

# Technical Assistance Consultant's Report

## Final Report: Part 1 (Conducting Due Diligence)

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Project No. 43576-012  
August 2012

### SRI LANKA: Clean Energy and Network Efficiency Improvement Project

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For Ministry of Power and Energy  
Ceylon Electricity Board

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**Asian Development Bank**



## **TA 7837-SRI - Clean Energy & Network Efficiency Improvement Part 1: Conducting Due Diligence**



**Deloitte.**

Final Report

**August 2012**

## Final Report

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# 1 Glossary

## 1.1 Abbreviations

Abbreviation	Description
ADB	Asian Development Bank
ADF	Asian Development Fund
AP	Affected Persons
BoI	Board of Investment
C&P	Consultation and Participation
CDM	Clean Development Mechanism
CEA	Central Environmental Authority
CEB	Ceylon Electricity Board
CER	Certified Emission Reductions
Ckt-km	Circuit kilometer
COBP	Country Operations Business Plan
CoP	Code of Practice
CPS	Country Partnership Strategy
DGM	Deputy General Manager
DMF	Design and Monitoring Framework
DoF	Department of Forestry
DP	Displaced Persons
DS	District Secretary
DSD	District Secretaries Division
DSM	Demand Side Management
EA	Executing Agency
EARF	Environmental Assessment and Review Framework
EIA	Environmental Impact Assessment
EIRR	Economic Internal Rate of Return
EMP	Environmental Management Plan
FBU	Functional Business Unit
FGD	Focus Group Discussion
FIRR	Financial Internal Rate of Return
GACAP	Governance and Anticorruption Action Plan
GAP	Gender Action Plan
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GoSL	Government of Sri Lanka
GRC	Grievance Redressal Committee
GRM	Grievance Redress Mechanism
GSS	Grid Sub Station

GWh	Giga Watt Hour
ha	Hectare (=10,000 m <sup>2</sup> )
HDI	Human Development Index
HPI	Human Poverty Index
HPP	Hydropower Plant
IA	Implementing Agency
ICB	International Competitive Bidding
IDC	Interest During Construction
IEE	Initial Environmental Examination
IPP	Independent Power Producers
kV	Kilo Volt
LA	Local Authority
LAA	Land Acquisition Act
LAR	Land Acquisition and Resettlement
LARC	Land Acquisition and Resettlement Committee
LECO	Lanka Electricity Company (Pvt) Ltd
LIBOR	London Interbank Offered Rate
LKR	Sri Lankan Rupee
MLLD	Ministry of Land and Land Development
MoENR	Ministry of Environment & Natural Resources
MoFP	Ministry of Finance and Planning
MoPE	Ministry of Power and Energy
MSL	Mean Sea Level
MW	Mega Watt
NCB	National Competitive Bidding
NCRE	Non-Conventional Renewable Energy
NEA	National Environmental Act
NEPS	National Energy Policy and Strategies
NGO	Non-Governmental Organisation
NIRP	National Involuntary Resettlement Policy
NWSDB	National Water Supply and Drainage Board
O&M	Operations and Maintenance
PAA	Project Approving Agency
PAI	Project Administration Instructions
PAM	Project Administration Manual
PFI	Participating Financial Institution
PIU	Project Implementation Unit
PPMS	Project Performance and Monitoring System
PPP	Public Private Partnership
PPTA	Project Preparatory Technical Assistance
PSA	Poverty and Social Analysis
PUCSL	Public Utilities Commission of Sri Lanka
QCBS	Quality and Cost Based Selection
RDA	Road Development Authority

RE	Rural Electrification; also Renewable Energy
RERED	Renewable Energy for Rural Economic Development Project
RMA	Resource Management Associates (Pvt) Ltd
RoW	Right-of-Way
RP	Resettlement Plan
RPC	Reactive Power Compensation
SCADA	Supervisory Control and Data Acquisition
SLSEA	Sri Lanka Sustainable Energy Authority
SPP	Small Power Producer
TA	Technical Assistance
TDE	Transmission Design and Environment Branch
TL	Transmission Line
ToR	Terms of Reference
USD	United States Dollar
WACC	Weighted Average Cost of Capital

## 1.2 Currency Conversion

The Sri Lankan currency is the Rupee (LKR). The exchange rate as of April 2012 (date of finalization of cost estimates) was approximately USD 1.00 = LKR 126.2.



## 2 Introduction

### 2.1 Appointment

International consulting services to assist the Asian Development Bank (ADB) with **TA 7837-SRI - Clean Energy & Network Efficiency Improvement Part 1: Conducting Due Diligence** was provided by Deloitte Touche Tohamatsu India Private Limited (DTTIPL) under Contract N° 100296-S41781. DTTIPL was assisted by national consultants Resource Management Associates (Pvt) Ltd (RMA), Sri Lanka.

The Executing Agency (EA) was the Ministry of Power & Energy (MoPE) and the Implementing Agency (IA) was Ceylon Electricity Board (CEB).

The TA (Technical Assistance) Contract for consulting services was signed on 05 December 2011 and consultancy services by DTTIPL commenced on 12 December 2011. The Project is scheduled to be submitted for Loan Approval in September 2012. The TA Contract is scheduled to be completed on 07 August 2012.

### 2.2 Project Objectives

Sri Lanka's power sector struggles to meet the growing demand for electricity at sufficiently low cost and acceptable reliability. The share of thermal energy in the power generation mix has increased dramatically from 6% in 1995 to 59% in 2011. In addition to the oil-fired thermal generation that makes electricity expensive due to high fuel prices, coal based generation has been added. The current transmission system is weak to meet the growing demand in certain regions. Substantial investments are required to strengthen the transmission network and to improve its reliability. Currently about 12% of households, primarily in the rural areas, do not have access to electricity. Despite the Government's intensive investment program to expand the rural distribution network, many poor households still remain unconnected. In particular, according to the available data, the electrification ratio in the northern and eastern provinces is the lowest among all Sri Lanka provinces and is well below the average national electrification ratio of 88% in 2010. There is also an urgent need to develop clean energy and indigenous renewable energy sources, undertake loss reduction efforts, and improve the network efficiency.

Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces. ADB's focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka.

The project will support Sri Lanka's national and sector priorities stated in the country's 10-Year Development Framework of 2006 that focuses on infrastructure development to accelerate economic growth and narrow regional disparities and the National Energy Policy and Strategies (NEPS), a ten year plan for the energy sector, that envisions sustainable development of energy resources, conversion facilities and delivery systems to enable access to and use of energy services by the entire population, and the safe, reliable delivery of such energy services at a competitive price. Subsequently, the government has reviewed and updated the development strategies and targets in 2010 that aim to (i) increase supply capacity of the system to 3470 MW by 2012 and 6367 MW by 2020; (ii) increase share in grid energy supply from nonconventional renewable energy sources from 4.1% in 2007 to 10% by 2016, and 20% by 2020; (iii) increase the percentage of households connected to the grid from 88% in 2010 to 100% by 2012; (iv) reduce the total technical and commercial losses of the transmission and distribution network

from 14.6% in 2009 to 12.0% by 2015; and (v) achieve energy savings of 4.3% in 2012, 6.4% in 2016, and 8.7% in 2020 from a potential consumption level through energy conservation.

The project is consistent with ADB's Sri Lanka Country Partnership Strategy (CPS)<sup>1</sup> that focuses on (i) funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources and to achieve energy-efficiency and reliability improvements through strengthening the transmission network, (ii) greater access to electricity by improving connectivity for the poor, and (iii) mitigating climate change through financing individual clean energy projects, including solar rooftop projects. The project will further support sustainable development of the power sector of Sri Lanka in line with the national and sector priorities, ADB's CPS and complement activities of other major development partners in the power sector of Sri Lanka. The Project will also expand ADB interventions in the power sector initiated by the Clean Energy and Access Improvement Project<sup>2</sup> that was designed to support sector reforms following approval of the Sri Lanka Electricity Act in March 2009. Implementation and compliance with key reform covenants relating to the reform roadmap established under the previous project will be closely monitored during the project. The project will also address post-conflict electricity needs of the population, improve relevant infrastructure in the conflict affected areas of the Northern and Eastern provinces that has been severely affected by the conflict, and directly contribute to the development of these provinces.

The project will include the following components: (i) transmission system strengthening to further improve its energy efficiency, reliability and enable wind power evacuation in the Northern, Central and Western provinces; (ii) distribution system improvement to expand access for electricity in the Eastern Province; and (iii) solar rooftop project to develop renewable energy.

A detailed overview of Sri Lanka's Power Sector and Sri Lanka's renewable sector is provided in Annex 2 and Annex 4 respectively.

## 2.3 Project Milestones

Key milestones were as follows:

- Kick-Off Meeting on 12 December 2011
- Submission of Inception Report on 19 January 2012
- ADB Fact-Finding Mission 27 Feb – 06 March 2012
- Submission of Mid-Term (Interim) Report on 23 March 2012
- ADB Mission 14 – 23 May 2012

This draft Final Report sets out the background and scope of work for the TA, summarizes the scope of the proposed resultant implementation project and incorporates all of the key information prepared during the TA.

## 2.4 Terms of Reference

The Terms of Reference for the project are reproduced in Annex 1. The scope of work includes transmission, distribution and renewable energy components. Studies on technical feasibility and issues,

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<sup>1</sup> ADB.2010. *Country Partnership Strategy for Sri Lanka 2011-2013*. Manila.

<sup>2</sup> ADB. 2009. *Report and Recommendation of the President to the Board of Directors on Proposed Loans, Grant, Administration of Grant, and Technical Assistance Grant to the Democratic Socialist Republic of Sri Lanka for the Clean Energy and Access Improvement Project*. Manila.

economic and financial analysis, environmental and social safeguard components and support for renewable energy development.

## 2.5 Project Team

CEB appointed counterpart staff from the Transmission Planning Branch and the Distribution Region 2 Planning Branch to assist DTTIPL & RMA in the project formulation: The contribution from these staff was most appreciated.

The following key personnel and project team were involved during the assignment:

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Mr. Shotaro Sasaki	Environmental Specialist, SAEN

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Mr. Upali Daranagama	Additional Secretary

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Ms Ayomi Tilekeratne	DGM (Transmission and Generation Planning)
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## 2.6 Acknowledgements

The DTTIPL together with RMA is grateful to MoPE, CEB and SLSEA management and officers for extending all possible cooperation and in providing all necessary information and support resources and facilitating visits to the project areas and other CEB and SLSEA facilities.

## 3 Project Overview

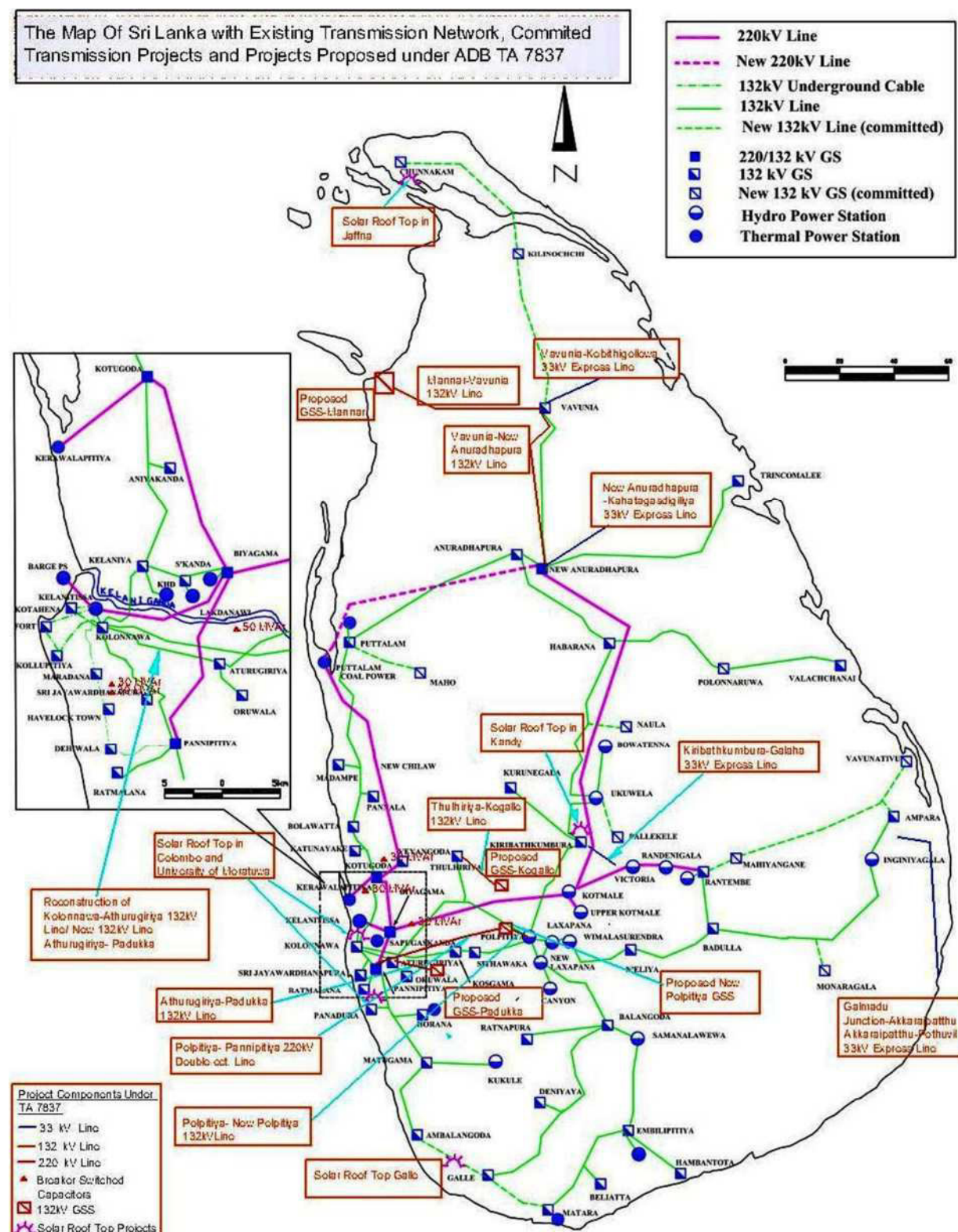
### 3.1 Project Description

The transmission projects are mainly targeted at system strengthening and also evacuation of clean power planned in Mannar area in Northern Province. System strengthening connected with Polpitiya - Pannipitiya transmission lines and power stations will enhance the capacity of transmitting hydro power Laxapana Complex towards load centers in the Western Province. The addition of Padukka - Kolonnawa transmission line would enhance on the reliability of transmission to towns in the Western province. Distribution components of the project have been designed to address the limitations of power distribution and allow expanded coverage of the Northern, North Central, Central and Eastern Provinces, and to enhance the quality of power supplied to mainly rural areas, some of which are presently served with a poor quality supply.

The Project, as scoped under TA № 7387-SRI *Clean Energy and Network Efficiency Improvement Part 1* will include the following components:

- A. Transmission system strengthening and network efficiency improvement
- B. Distribution system strengthening and network efficiency improvement; and
- C. Solar roof top pilot project

## 3.2 Project Components



**Figure 1: Project Components**

The key components of the proposed Project include the following



### 3.2.1 Transmission infrastructure strengthening in Northern Province

#### *Transmission System Strengthening in Mannar region*

- The project is located in the Northern Province. The project components include the following:
- Augmentation of Vavuniya grid substation with 2x132kV double busbar transmission line bays
- Construction of Mannar grid substation with 1x31.5 MVA, 132/33 kV transformers, 132 kV single busbar arrangement including bus section, 33 kV single busbar arrangement including bus section, 4x132 kV single busbar transmission line bays, 1x132 kV single busbar transformer bays, 4x33 kV feeder bays, 1x33 kV transformer bays
- Construction of 55 km, double circuit, Zebra, 132 kV transmission line from New Anuradhapura to Vavuniya (the construction of transmission line would be undertaken with 220 kV tower configuration for upgrading to 220 kV in the future)
- Construction of 70km, double circuit, Zebra, 132kV transmission line from Vavuniya to Mannar (the construction of transmission line would be undertaken with 220 kV tower configuration for upgrading to 220 kV in the future)
- SLSEA has identified 260 MW of wind potential in the Mannar region and studies are underway to determine the exact potential which can be harnessed based on the environmental assessment and ground level data collection. The proposed transmission line from Mannar to Vavuniya and Vavuniya - New Anuradhapura would be capable of evacuating upto 200 MW of wind power from the region. The existing 6 MW of peak demand in the Mannar region is fed through a Lynx double circuit 33 kV line on RC poles from Vavuniya to Mannar, a distance of 100 km. The demand for electricity of the area is likely to show an exponential growth due to the on-going rehabilitation of the displaced population and additional commercial and industrial activities over the next five years. Considering the above and obvious inability to meet the future demand, the substation of 132 kV /33 kV is required to improve the voltage profile in the area.
- Both Mannar – Vavuniya and Anuradhapura – Vavuniya transmission lines are proposed to be constructed with 220 kV tower configuration but charged at 132 kV. These are strategic links which can be used for meeting the future load requirements in areas north of Vavuniya and around Mannar region, which too are in a process of post-conflict recovery. The incremental cost for the construction of 220 kV tower configuration would be met by Government of Sri Lanka. A detailed note on construction of Mannar – Vavuniya – Anuradhapura Transmission Line is provided in Annex 3.

### 3.2.2 Transmission & Distribution network energy efficiency improvement

The project comprises of following sub-components

#### *New Polpitiya Power Transmission Development*

The project is located in Central Province and comprises,

- Construction of New Polpitiya grid substation with 2x250MVA 220/132kV transformers, 220kV double busbar arrangement including bus coupler, 132kV single busbar arrangement including bus section, 2x220kV double busbar transformer bays, 4x220kV double busbar transmission line bays, 2x132kV single busbar transformer bays and 2x132kV single busbar transmission line bays, provision for 2x220kV double busbar transmission line bays to connect New-Polpitiya- New Galle 220kV transmission line
- Augmentation of Pannipitiya grid substation with 2x220kV double busbar transmission line bays

- Construction of 10km, double circuit, 2xZebra, 132kV transmission line from Polpitiya to New Polpitiya,
- Construction of New Polpitiya - Pannipitiya, 2xZebra, 220kV, 58.5km, double circuit transmission line through Padukka

The hydropower plants, grouped into two cascades or “complexes”, in Sri Lanka are located in the central hills the Laxapana complex and the Mahaweli Complex with capacity of around 1000 MW. The major load centre is the Western province, centered on the city of Colombo. The existing four circuits of the two 132kV transmission lines from the Polpitiya hydropower station to Kolonnawa Grid Substation in the eastern border of the Colombo city transmit bulk power generated from Laxapana Hydropower Complex to the major load centers in and around Colombo. However, due to the limitations in the current carrying capacity of these lines, severe overloading is experienced in the day time when the Laxapana Hydropower plants are in operation. Furthermore, these lines are more than 40 years old. Therefore, there is an urgent requirement to update/replace all four circuits to facilitate enhanced power evacuation between Polpitiya and Kolonnawa to ensure that full output of the hydropower plants is delivered to the load centre without constraints and excessive losses. Similarly, Kotmale is the key hydropower plant in the Mahaweli complex and the Kotmale grid substation receives the output of many power plants in the complex. The Kotmale - Biyagama 220kV transmission line is one of the most important lines to carry bulk power generated from hydropower stations in Mahaweli Complex in Central Province to the major load centers in Colombo. The 220 kV Kotmale-Biyagama line passes through lightning prone areas and tripping of this transmission line due to lightning has caused total system blackouts in the past.

The proposed New Polpitiya - Pannipitiya 220kV transmission line would improve the system reliability as it provides (i) a higher capacity interconnection between the Laxapana complex and the load centre, effectively replacing the older lines, and (ii) an alternative route to the Kotmale-Biyagama 220kV transmission line, to deliver hydropower to the load centers in the Western province. The proposed transmission development reduces the transmission losses. Apart from the above, development of the New Polpitiya grid substation will facilitate extension of the 220kV transmission system to the Southern Province at a future date, which resolves most of the under voltage problems and line overloading problems in the Southern transmission network.

#### *Padukka Power Transmission Development*

Padukka is located in the eastern sector of the Western Province and the proposed system comprises of:

- Construction of Padukka Grid Substation with 2x250 MVA, 220/132/33 kV double busbar including bus coupler, 132kV single busbar including bus section, 33kV single busbar arrangement including bus section, with 4x220kV double busbar transmission line bays, 2x220kV double busbar transformer bays, 2x132kV single busbar transformer bays, 2x132kV single busbar transmission line bays, 4x33 kV feeder bays, 2x33kV S/B T/F bays, Provision for 2x220kV double busbar transmission line bays to connect Kirindiwela-Padukka 220kV transmission line and 100MVar capacitor banks at 132kV busbar
- Construction of 10 km, double circuit, 2xZebra, 132kV transmission line from Athurugiriya to Padukka
- Construction of 15 km, double circuit, 2xZebra, 132kV transmission line from Athurugiriya to Kolonnawa

Kolonnawa Switching Station is a 132kV station which serves major loads in Colombo area. Requirement of a new switching station at Padukka has been identified together with New Polpitiya-Pannipitiya 220kV transmission line in the Long Term Transmission Development Plan 2011-2020, to feed the Kolonnawa Switching Station. CEB has proposed to construct the Padukka Switching Station under the new 220kV line from New Polpitiya to Pannipitiya. Subsequently, considering the load growth in the towns to east of



Colombo suburbs, it has been decided to serve 33 kV outgoing feeders too, from Padukka. Thus, in this documentation, Padukka would be classified as a grid substation. A 132kV double circuit twin zebra line is proposed from the Padukka GS (proposed) to Kolonnawa switching station (existing) via Athurugiriya GS (existing) to transmit power generated at Laxapana hydropower complex to Kolonnawa Switching Station. Apart from transmission system strengthening, The proposed grid substation at Padukka will also improve the voltage profile of the 33 kV distribution systems and reduce distribution losses, and therefore improves the quality of supply in and around Padukka, Panagoda, Talagala, Labugama, Handapangoda and Pahathgama areas.

### ***Kegalle Power Transmission Development***

The project is located in the Central Province and comprises of

- Construction of Kegalle grid substation with 2x31.5 MVA, 132/33 kV transformers, 132kV single busbar arrangement including bus section, 33kV single busbar arrangement including bus section, 2x132 kV single busbar transmission line bays, 2x132kV single busbar transformer bays, 8x33 kV feeder bays, 2x33kV transformer bays
- Augmentation of Thulhiriya grid substation with 2x132 kV single busbar transmissionline bays
- Installation of 15 MVAR (3x5 MVAR) capacitor banks including 33kV BSC bays at Kegalle 33kV Bus Bar to control load PF
- Construction of 22.5 km, double circuit, Zebra, 132kV transmission line from Thulhiriya to Kegalle

To meet load growth demand in areas around Kegalle, Mawanella, Polgahawela and Rambukkana areas and thereby to relieve loading of Thulhiriya and Kiribathkumbura Grid Substations, it is proposed to construct a new grid substation at Kegalle. The proposed grid substation will also improve the voltage profile of 33 kV distribution system and reduce distribution losses thus improving the quality of supply in and around these areas. This new grid substation is proposed to connect to the national power system by constructing a 14km 2circuit, Zebra, 132kV transmission line from Thulhiriya grid substation.

### ***Reactive power management***

The projects are located in Western Province and comprises of:

- 50MVAR at Biyagama 33kV busbar (10x5MVAR inclu. BSC bays)
- 50MVAR at Sapugaskanda 33kV busbar (10x5MVAR inclu. BSC bays)
- 30MVAR at Kolonnawa-new 33kV busbar (6x5MVAR inclu. BSC bays)
- 30MVAR at Kolonnawa-old 33kV busbar (6x5MVAR inclu. BSC bays)

According to present distribution feeding arrangements most of the major loads in and around Colombo and Gampaha are fed from grid substations in Biyagama, Sapugaskanda, Veyangoda, Kolonnawa. Proposed installation of capacitors will improve the voltage profile of the 33 kV distribution systems and thereby improve the quality of supply in the areas. Since reactive power requirement is supplied at the load centre it contributes to the reduction of system losses

## **3.2.3 MV Network Energy Efficiency Improvement**

### ***Vavunia – Kebithigollewa 33kV Distribution Line and Gantry***

The project is located in Northern Province and comprises of

- Construction of a 23 km 33 kV Double Circuit Lynx Tower Line From Vavunia GSS to Kebithigollewa

- 33 kV 2 section SBB Gantry at Kebithigollewa

The project aims to improve MV Network efficiency and provide system capacity to cater for load growth in the North Province which is forecast to grow at an average of 7% over a ten year planning period. Construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. The estimated energy savings per month is 45 MWh. Around 18,000 consumers would benefit from this project

#### *Anuradhapura-Kahatagasdigiliya 33 kV Distribution Line & Gantry*

The project is located in North Central Province and comprises of:

- Construction of a 31 km 33 kV Double Circuit Lynx Tower Line from New Anuradhapura GSS to Kahatagasdigiliya
- 33 kV 2 section SBB Gantry at Kahatagasdigiliya

The project aims to improve MV Network efficiency and provide system capacity to cater for load growth in the North Central Province (NCP) is forecast at an average 7% over a ten year planning period. Electrification ratio (2010) for NCP is 82% and energy losses in the MV system are 1.7%. The construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. The energy saved per month is around 23 MWh and around 12,500 consumers would benefit from this project.

#### *Kiribathkumbura - Galaha 33 kV Distribution Line & Gantry*

The project is located in Central Province and comprises of:

- Construction of a 15 km 33 kV Double Circuit Lynx Tower Line from Kiribathkumbura GSS to Galaha
- 33 kV 3 section DBB Gantry at Galaha

The load growth in the Central Province (CP) is forecast at an average 6% over a ten year planning period. Electrification ratio (2010) for CP is 91% and energy losses in the MV system are 2.4%. Construction of the express line will provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. This proposed line will also help in evacuating power generated from Mul Oya mini hydro power station (5 MW) now under construction. The commissioning of this station will also help in further improving the voltage of this gantry. The energy saved per month is 648 MWh. Beneficiaries from this proposal is 14,000 consumers

#### *Akkaraipaththu - Galmadu Junction-Pothuvil 33 kV Distribution Line*

The project is located in Eastern Province and comprises of:

- Construction of 60 km 33 kV Double Circuit Lynx Tower Line from Galmadu Junction to Pothuvil via Akkaraipaththu
- 33 kV 2 section SBB Gantries at Akkaraipaththu and Pothuvil

The load growth in the Eastern Province (EP) is forecast at an average 9.5% over a ten year planning period. Electrification ratio (2010) for EP is 71% and energy losses in the MV system are 4.2%. Construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. For the Galmadu junction - Pothuvil line section, energy saved per month is 510 MWh

and beneficiaries from this proposal are 35,130 consumers. For the Akkaraipaththu - Pothuvil line section, the energy saved per month in this section is 522 MWh and beneficiaries from this proposal are 46,617 consumers.

### 3.2.4 Solar Rooftop Pilot Project

**Solar Roof-Top Project:** Development of 1 MW of solar rooftop pilot project on a Public Private Partnership (PPP) basis. 200 kW of capacity would be developed on public buildings/ universities on a PPP mode and remaining capacity would be developed on private buildings. A credit line of USD 1.5 million for private developers through Government of Sri Lanka and equal to the proposed USD 1.5 million grant from Asian Clean Energy Fund would be provided. The universities identified for the purpose of developing solar rooftop pilot projects include four key universities namely University of Moratuwa (Colombo, Western Province), University of Peradeniya (Kandy, Central Province), University of Jaffna (Jaffna, Northern Province) and University of Ruhuna (Galle, Southern Province). For the private developers, around 3 sites would be selected in and around cities of Colombo, Kandy and Jaffna.

The pilot project would serve as a benchmark for future replication and will address the following barriers for developing solar power in Sri Lanka

- Reducing the high capital cost through a bidding framework
- encourage private sector participation to create an ecosystem for self-replication
- contribute to increase in renewable power generation
- overcome any policy and regulatory barriers during the implementation

Apart from the benefit of clean energy source and hence reduction of Green House Gas Emission as a result of the implementation of solar rooftop project, there are certain additional benefits of developing rooftop based solar power generation in context of Sri Lanka.

- (a) avoided use of land which is required for ground mounted solar projects;
- (b) avoided cost of transmission and distribution losses since the injection is near the load centre only;
- (c) avoided cost of transmission infrastructure which may be required for solar park
- (d) unlock value of rooftop space for commercial exploitation in future

A detailed concept note on solar rooftop pilot project concept is provided in Annex 5. In order to implement the pilot project and also undertake the development of renewable resources in Sri Lanka in a planned fashion, there is a requirement for institutional capacity building of SLSEA and CEB. The detailed note on same is provided in Annex 6.

## 3.3 Project Costs

The project cost is estimated at USD 200 Million, including physical and price contingencies, financing charges during implementation, taxes & duties. The government will finance taxes and duties, financing charges relating to onlending to CEB, incremental costs (counterpart staff for project management and construction supervision, land acquisition, environmental and social mitigation), and distribution improvement component. In addition, Government will also bear the additional cost of USD 10.83 Million on account of installation of 220 kV transmission towers for the 132 kV New Anuradhapura - Vavuniya – Mannar transmission line. The investment plan is summarized in the following table.

**Table 1: Project Cost Estimates**

<b>A. Base Cost<sup>a</sup></b>	<b>(USD Million)</b>
1 Transmission infrastructure strengthening in the Northern province**	48.69
2 Transmission and distribution network energy efficiency improvement	118.28
3 Solar Rooftop Power Generation	2.79
<b>Subtotal A</b>	<b>169.76</b>
B Contingencies <sup>b</sup>	13.79
C Financing Charges During Implementation <sup>c</sup>	16.45
<b>Total (A+B+C)</b>	<b>200.00</b>

<sup>a</sup> In Q1 2012 prices.

<sup>b</sup> Physical contingencies computed at 4% of base cost. Price contingencies computed using ADB's forecasts of international and domestic inflation. Price contingencies computed at 0.5% on foreign exchange costs and 7.0% on local currency costs.

<sup>c</sup> Interest during implementation has been computed at the five year forward Libor rate plus a spread of 60 basis points and an onlending margin of 7.16% for OCR loan components, and at a base rate of 1.0% with an onlending margin of 7.16% for ADF loan components. Commitment charges for an OCR loan have been computed at 0.15% per year to be charged on the undisbursed loan amount.

**\*\* Government of Sri Lanka to fund the additional cost of constructing 220 kV towers for 132 kV Anuradhapura – Vavuniya - Mannar Transmission Line (USD 10.83 Million)**

Source: Ceylon Electricity Board and Consultants estimates

The detailed cost estimates by expenditure category, financier, outputs/ components and by year are provided in Annex 7.

The base costs for transmission and distribution components have been finalized based on the CEB's estimates. The base cost of solar rooftop component has been estimated based on the global benchmark data and primary survey of the local solar market.

The following tables provides the base cost estimates for the various components

**Table 2: Base Cost Estimates for the transmission and distribution projects**

<b>Project Component</b>	<b>Base Cost (USD Million)</b>
<b>A Transmission infrastructure strengthening in the Northern province</b>	
<b>T1 Mannar Power Transmission Development</b>	
Augmentation of Vavuniya GSS	0.53
Construction of Mannar GSS	5.94
Construction of New Anuradhapura to Vavuniya TL*	9.09
Construction of Vavuniya to Mannar TL*	14.60
Subtotal (A)	30.16
<b>T2 New Polpitiya Power Transmission Development</b>	
Construction of New Polpitiya GSS	12.89
Augmentation of Pannipitiya GSS	1.05
Construction of New Polpitiya - Pannipitiya TL through Padukka	24.28

Project Component		Base Cost (USD Million)
	Construction of Polpitiya- New Polpitiya TL	2.91
	Total Base Cost (T2)	41.13
T3	Padukka Power Transmission Development	
	Construction of Padukka Grid Substation	13.77
	Construction of Athurugiriya - Padukka TL	2.91
	Construction of Athurugiriya - Kolonnawa TL	4.37
	Total Base Cost (T3)	21.05
T4	Kegalle Power Transmission Development	
	Construction of Kegalle GSS	7.17
	Installation of 15 MVar (3x5 MVar) capacitor banks	0.56
	Augmentation of Thulhiriya grid substation	0.50
	Construction of Thulhiriya - Kegalle TL	4.49
	Total Base Cost (T4)	12.72
T5	Reactive power management	
	50 Mvar at Biyagama 33 kV Bus Bar	1.86
	50 Mvar at Sapugaskanda 33 kV Bus Bar	1.86
	30 Mvar at Kolonnawa-new 33 kV Bus Bar	1.11
	30 Mvar at Kolonnawa-old 33 kV Bus Bar	1.11
	Total Base Cost (T5)	5.94
<b>B</b>	<b>MV Network Energy Efficiency Improvement</b>	
D1	Vavuniya-Kebithigollewa Distribution Line	
	Vavuniya GSS - Kebithigollewa Distribution Line	2.44
	Kebithigollewa Gantry	0.22
	Total Base Cost (D1)	2.66
D2	Anuradhapura-Kahatagasdigiliya Distribution Line	
	Anuradhapura GSS - Kahatagasdigiliya Gantry Distribution Line	3.29
	Kebithigollewa Gantry	0.22
	Total Base Cost (D2)	3.51
D3	Kiribathkumbura-Galaha gantry Distribution Line	
	Kiribathkumbura GSS - Galaha gantry Distribution Line	1.59
	Galaha Gantry	0.35
	Total Base Cost (D3)	1.94

Project Component	Base Cost (USD Million)
D4 Galmadu Junction-Akkaraipatthu – Pothuvil Distribution Line	
Galmadu Junction - Akkaraipatthu Distribution Line	1.91
Akkaraipatthu Gantry	0.22
Akkaraipatthu - Pothuvil Distribution Line	4.46
Pothuvil Gantry	0.22
Total Base Cost (D4)	6.81
Subtotal (B)	95.76
<b>C Solar Rooftop Generation Pilot Project</b>	
Rooftop	2.79
Subtotal (C)	2.79
Total (A+B+C)	128.71
Administrative Cost	-
Tax and Duties	-
<b>Contingencies</b>	
Physical	-
Price	0.21
Financing Charges During Implementation	2.58
<b>Total Project Base Cost</b>	<b>131.50</b>

**Table 3: Cost Estimates for the 1 MW solar rooftop pilot project**

Description	Amount (USD Million)
Modules	1.47
Inverter	0.67
Civil Works	0.19
Transportation	0.03
Other Costs (Design, Metering)	0.33
Contingencies	0.21
<b>Total Cost</b>	<b>2.90</b>
Project Consultancy	0.10
<b>Grand Total</b>	<b>3.00</b>

### 3.4 Financial & Economic Analysis

The financial analysis of the proposed sub-projects was carried out in accordance with ADB's *Financial Management and Analysis of Projects*<sup>3</sup>. All financial costs and benefits have been expressed in constant 2012 price levels. Cost streams used for the purposes of estimation of the financial internal rate of return (FIRR) reflect the costs incurred in delivering the estimated benefits. The financial benefits to the CEB in terms of additional sales to consumers arising from increased transmission line and substation capacity, increased distribution substation capacity, improved network reliability and new customer connections, and from the reduction in average cost of sales accruing through network loss reduction was assessed.

The weighted average cost of capital (WACC) to CEB was calculated for each subproject and for the overall Project. The financial viability was assessed by comparing WACC to FIRR at the subproject level and for the aggregated Project. The sensitivity of the FIRR to adverse movements in the underlying assumptions was analyzed.

Financial viability was examined by comparing the incremental costs and benefits on a “with investment” and “without investment” basis. The average incremental generation costs were determined based on CEB's Apr 2011 Long Term Generation Expansion Plan, and average incremental transmission costs were added to derive total costs of supply to transmission subprojects. To this, estimated distribution average incremental costs were added to give total costs of supply to distribution subprojects. A 25-year period was used for subproject evaluation.

Subproject FIRRs are shown in Table 4. The overall FIRR to CEB is 10.99%. In general, transmission and distribution subproject FIRRs exceed subproject WACC.

**Table 4: FIRR Results**

	<b>Sub project</b>	<b>FIRR</b>
A	<b>Transmission infrastructure strengthening in the Northern province</b>	
T1	Mannar Power Transmission Development	9.26%
B	<b>Transmission and distribution network energy efficiency improvement</b>	
T2	New Polpitiya Power Transmission Development	7.71%
T3	Padukka Power Transmission Development	14.98%
T4	Kegalle Power Transmission Development	15.32%
T5	Reactive Power Management	6.93%
	<b>MV Network Energy Efficiency Improvement</b>	
D1	Vavyunia-Kebithigollewa Distribution Line and Gantry	14.14%
D2	Anuradhapura-Kahatagasdigiya Distribution Line and Gantry	3.38%
D3	Kiribathkumbura-Galaha gantry Distribution Line and Gantry	9.21%
D4	Galmadu Junction-Akkraipatthu – Pothuvil Distribution Line and Gentries	19.06%
	<b>Total Transmission and Distribution</b>	<b>10.99%</b>
C	Solar Rooftop	<b>10.68%</b>
	<b>Overall</b>	<b>10.99%</b>

The detailed financial analysis is provided in Annex 9.

The economic analysis was undertaken to determine the economic viability of project components. The analysis aims at

<sup>3</sup> ADB. 2005. *Financial Management and Analysis of Projects*. Manila

- Verifying electricity demand and supply projections
- Review of the least cost approach to system and project planning in Sri Lanka
- Undertaking cost benefit analysis of the proposed transmission and distribution loan components

Economic benefits accrue from incremental electricity consumption, the displacement of more expensive sources of energy and from a reduction in short-term supply interruptions. The incremental costs and benefits of subprojects were estimated by comparing “with project” and “without project” scenarios.

Transmission and distribution subprojects were analyzed separately as well as on aggregated basis for the Project. A 25-year period was used for evaluation. The detailed cost benefit calculations show that overall the Project is expected to deliver significant economic benefits, as summarized in Table 5, with an estimated aggregate EIRR of 12.16% which is above the hurdle rate of 12%.

**Table 5: EIRR Results**

Sub project		EIRR
<b>A</b>	<b>Transmission infrastructure strengthening in the Northern province</b>	
T1	Mannar Power Transmission Development	9.85%
<b>B</b>	<b>Transmission and distribution network energy efficiency improvement</b>	
T2	New Polpitiya Power Transmission Development	8.84%
T3	Padukka Power Transmission Development	16.60%
T4	Kegalle Power Transmission Development	16.83%
T5	Reactive Power Management	8.33%
	<b><i>MV Network Energy Efficiency Improvement</i></b>	
D1	Vavyunia-Kebithigollewa Distribution Line and Gantry	16.16%
D2	Anuradhapura-Kahatagasdigiliya Distribution Line and Gantry	4.65%
D3	Kiribathkumbura-Galaha gantry Distribution Line and Gantry	10.10%
D4	Galmadu Junction-Akkaraipatthu – Pothuvil Distribution Line and Gantries	21.60%
	<b>Total Transmission and Distribution</b>	<b>12.16%</b>
C	Solar Rooftop	<b>11.72%</b>
	<b>Grand Total</b>	<b>12.16%</b>

The EIRR of most subprojects is near the benchmark of 12%, while the estimated EIRR of the aggregate project is 12.16%. Some specific subprojects have EIRR below the benchmark 12%. These subprojects will not affect the future economic performance of the project owing to the following reasons. (i) Mannar power transmission development: The economic evaluation is based on reducing the losses on the existing 33 kV feeder into Mannar district, and serving the existing and future customers with a reliable power supply. Mannar is a post-conflict development region, since the end of the civil conflict in 2009. Furthermore, Mannar has been identified as a region with a high potential for wind based power generation, and ADB is currently assisting GOSL with a TA to assess the wind resource potential in Mannar, in preparation for a feasibility study. The Mannar power transmission development will most likely serve wind power to the load centers outside Mannar district, the economic benefit of which has not been included in the economic evaluation (ii) New Polpitiya Power Transmission Development: This line marks the development of the 220 kV link from the 660 MW Laxapana hydropower cascade to the load centres in the western sector of the country, replacing the 40-year old 132 kV lines. There is additional hydropower potential being developed in this area. The 35 MW Broadlands project is scheduled for commissioning by 2014, and few other minihydro power plants too would be connected. Therefore, the



economic benefits of the line would only increase from the benefits conservatively estimated in the analysis. (iii) Reactive power management: The reactive power management equipment have a direct bearing on power quality in terms of managing the voltage profile in the transmission system. The economic evaluation has only considered the benefits by way of reduced transmission losses, because the voltage profile improvements were not assigned an economic value in the analysis. (iv) Anuradhapura-Kahatagasdigiliya Distribution Line and Gantry: This MV line is an express feeder to Kahatagasdigiliya, and its main contribution is to improve the quality of supply to customers in Kahatagasdigiliya area. The improved quality of supply has not been assigned an economic value in the analysis. As the line is an express feeder, no significant additional consumption is expected to occur owing to the line, and hence the evaluated EIRR is lower. The detailed economic analysis is provided in Annex 10.

### 3.5 Project Implementation

Based on the following anticipated loan processing sequence, project implementation is expected to commence in December 2012:

- Loan negotiations in July 2012
- Government budget inclusion in August 2012
- ADB Board approval in September 2012
- Loan signing in November 2012
- Loan effectiveness in December 2012

The overall project implementation plan is shown in Figure 2.

The transmission project implementation would be over a 4-year period with annual disbursements of 5%, 25%, 50% and 20% of total project cost each year, starting from year 2013. The Distribution project implementation period would be 3 years, with disbursements of 20%, 70% and 10% of total project cost each year, starting from year 2013. The implementation period for the solar rooftop project would be two years, starting from mid – 2013.

It is proposed that the project implementation shall be completed by December 2016, and loan closing will be by June 2017. The implementation plan is shown in Figure 2.

**Figure 2: Implementation Schedule**

Description	2012		2013				2014				2015				2016				2017	
	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2
<b>Project Formulation</b>																				
Loan Preparation and Signing																				
Loan Effectiveness																				
<b>Implementation</b>																				
<b>Transmission infrastructure strengthening</b>																				
<b>Activity: Construction of Transmission Lines &amp; Grid Substations</b>																				
Tendering and Award																				
Preparatory works and Mobilization																				
Civil works, supply and erection of Equipments																				
Testing and Commissioning																				
<b>Activity: MV Network Energy Efficiency Improvement</b>																				
Tendering and Award																				
Preparatory works and Mobilization																				
Civil works, supply and erection of Equipments																				
Testing and Commissioning																				
<b>Activity: Solar Rooftop Pilot Project</b>																				
Appointment of Project Management Consultant																				
Tendering and Award																				
Supply and Installation																				
Testing and Commissioning																				
<b>Management Activities</b>																				
Procurement Plan Activities																				
<b>Reviews</b>																				
<b>Project Completion Report</b>																				

### 3.6 Project Procurement

Procurement of works, goods, and services will be carried out in accordance with the latest version of ADB's *Procurement Guidelines*. ADB will allow advance contracting and local currency cost financing. International competitive bidding (ICB) procedures will be used for procurement packages for 220 kV and 132 kV transmission lines, 132/33 kV grid substations, supply of distribution equipment and materials and solar roof top equipment and materials.

The SLSEA will recruit individual consultants to provide technical and procurement support for implementation of the grant related to the solar roof top project activities under SLSEA's responsibility. The consultants will be recruited using the latest version of ADB's *Guidelines on Use of Consultants* for engagement of national consultants. The consulting firm or consortium of firms will be engaged using the Quality- and Cost-Based Selection (QCBS) method.

The following table provides an indicative list of all procurement (goods, works and consulting services) over the life of the project.

**Table 6: List of Packages**

General Description				Estimated Value (USD Million)	Estimated Number of Contracts	Procurement Method	Domestic Preference Applicable	Comments
<b>Package 1-</b>	<b>Mannar</b>	<b>Power</b>	<b>Development</b>	<b>30.16</b>	<b>2</b>	<b>ICB</b>	<b>Y</b>	
Construction of grid substation and transmission lines on turnkey basis. <sup>4</sup>								
<b>Lot A-</b>				6.47		ICB	Y	
i. Augmentation of Vavuniya grid substation with 2x132kV double busbar transmission line bays								
ii. Construction of Mannar grid substation with 1x31.5 MVA, 132/33 kV transformers, 132kV single busbar arrangement including bus section, 33kV single busbar arrangement including bus section, 4x132 kV single busbar transmission line bays, 1x132kV single busbar transformer bays, 4x33 kV feeder bays, 1x33kV transformer bays								
<b>Lot B-</b>				23.69		ICB	Y	
i. Construction of 55km, double circuit, Zebra, 132kV transmission line from New Anuradhapura to Vavuniya								
ii. Construction of 70km, double								

<sup>4</sup> Excludes additional cost of USD 10.83 Millions for the construction of 220 kV Tower Configuration for New Anuradhapura – Vavuniya – Mannar Transmission Line to be funded by Government of Sri Lanka

General Description	Estimated Value (USD Million)	Estimated Number of Contracts	Procurement Method	Domestic Preference Applicable	Comments
circuit, Zebra, 132kV transmission line from Vavuniya to Mannar					
Transmission and distribution network energy efficiency improvement					
<b>Package 2 - Kegalle Power Transmission Development</b>	<b>12.72</b>	<b>2</b>	<b>ICB</b>	<b>Y</b>	
<b>Lot A1-</b>	8.23		ICB	Y	
i. Construction of Kegalle grid substation with 2x31.5 MVA, 132/33 kV transformers, 132kV single busbar arrangement including bus section, 33kV single busbar arrangement including bus section, 2x132 kV single busbar transmission line bays, 2x132kV single busbar transformer bays, 8x33 kV feeder bays, 2x33kV transformer bays					
ii. Installation of 15 MVar (3x5 MVar) capacitor banks including 33kV BSC bays at Kegalle 33kV Bus Bar to control load PF					
iii. Augmentation of Thulhiriya grid substation with 2x132 kV single busbar transmission line bays					
<b>Lot B-</b>	4.49				
i. Construction of 22.5 km, double circuit, Zebra, 132kV transmission line from Thulhiriya to Kegalle					
<b>Package 3 - Reactive Power Management</b>	<b>5.94</b>	<b>1</b>	<b>ICB</b>	<b>Y</b>	
i. 50MVar at Biyagama 33kV busbar (10x5MVar inclu. BSC bays)	1.86		ICB	Y	
ii. 50MVar at Sapugaskanda 33kV busbar (10x5MVar inclu. BSC bays)	1.86				
iii. 30MVar at Kolonnawa-new 33kV busbar (6x5MVar inclu. BSC bays)	1.11				
iv. 30MVar at Kolonnawa-old 33kV busbar (6x5MVar inclu. BSC bays)	1.11				
<b>Package 4 - New Polpitiya Power Transmission Development</b>	<b>37.17</b>	<b>2</b>	<b>ICB</b>	<b>Y</b>	
Construction of grid substation and transmission lines on turnkey basis.					
<b>Lot A-</b>	12.89		ICB	Y	
i. Construction of New Polpitiya grid					

General Description	Estimated Value (USD Million)	Estimated Number of Contracts	Procurement Method	Domestic Preference Applicable	Comments
substation with 2x250MVA 220/132kV transformers, 220kV double busbar arrangement including bus coupler, 132kV single busbar arrangement including bus section, 2x220kV double busbar transformer bays, 4x220kV double busbar transmission line bays, 2x132kV single busbar transformer bays and 2x132kV single busbar transmission line bays, Provision for 2x220kV double busbar transmission line bays to connect New-Polpitiya- New Galle 220kV transmission line					
<b>Lot B-</b>	24.28		ICB	Y	
i. Construction of New Polpitiya - Pannipitiya, 2xZebra, 220kV, 58.5km, double circuit transmission line through Padukka					
<b>Package 5 - Padukka Power Transmission Development &amp; parts of New Polpitiya Power Transmission Development</b>	<b>25.01</b>	<b>2</b>	<b>ICB</b>	<b>Y</b>	
Construction of grid substation and transmission lines on turnkey basis.					
<b>Lot A-</b>			ICB	Y	
i. Augmentation of Pannipitiya grid substation with 2x220kV double busbar transmission line bays	1.05				
ii. Construction of Padukka Grid Substation with 2x250 MVA, 220/132/33 kV double busbar including bus coupler, 132kV single busbar including bus section, 33kV single busbar arrangement including bus section, with 4x220kV double busbar transmission line bays, 2x220kV double busbar transformer bays, 2x132kV single busbar transformer bays, 2x132kV single busbar transmission line bays, 4x33 kV feeder bays, 2x33kV S/B T/F bays, Provision for 2x220kV double busbar transmission line	13.77				

General Description	Estimated Value (USD Million)	Estimated Number of Contracts	Procurement Method	Domestic Preference Applicable	Comments
bays to connect Kirindiwela-Padukka 220kV transmission line and 100MVar capacitor banks at 132kV busbar					
<b>Lot B-</b>			ICB	Y	
i. Construction of 10km, double circuit, 2xZebra, 132kV transmission line from Polpitiya to New Polpitiya	2.91				
ii. Construction of 10 km, double circuit, 2xZebra, 132kV transmission-line from Athurugiriya to Padukka	2.91				
iii. Construction of 15 km, double circuit, 2xZebra, 132kV transmission line from Athurugiriya to Kolonnawa	4.37				
<b>Package 6 - MV Network Energy Efficiency Improvement –Part I</b>	<b>6.17</b>	<b>2</b>	<b>ICB</b>	<b>Y</b>	
<b>LOT A -</b>	2.66				
i) Vavuniya-to-Kebithigollewa 23 km, 33 kV tower line and 33 kV gantry at Kebithigollewa	3.51				
<b>LOT B -</b>					
i) New Anuradhapura-to-Kahatagasdigiliya 31 km, 33 kV tower line and 33 kV gantry at Kahatagasdigiliya					
<b>Package 7 - MV Network Energy Efficiency Improvement – Part II</b>	<b>8.75</b>	<b>3</b>	<b>ICB</b>	<b>Y</b>	
<b>LOT A -</b>	1.94				
i) Kiribathkumbura-to-Galaha 15 km, 33 kV tower line and 33 kV gantry at Galaha					
<b>LOT B -</b>	2.13				
i) Galmadu Junction to Akkaraipatthu, 18 km 33 kV tower line and 33 kV gantry at Akkaraipatthu					
<b>LOT C -</b>	4.68				
i) Akkaraipatthu to Pothuvil, 42 km 33 kV tower line and 33 kV gantry at Pothuvil					
<b>C. Solar Roof Top<sup>5</sup></b>	<b>2.79</b>				

<sup>5</sup> Includes Grant of USD 1.5 Million

General Description	Estimated Value (USD Million)	Estimated Number of Contracts	Procurement Method	Domestic Preference Applicable	Comments
Government Universities in Colombo, Jaffna, Kandy, Galle	0.58	4	NCB	Y	
Other Locations in and around Colombo, Jaffna, Kandy	2.21	9			

## 3.7 Project Management Arrangements

### 3.7.1 Project Implementation Organizations - Roles and Responsibilities

Project Implementation Organisations	Management Roles and Responsibilities
<b>Executing Agency-</b> Ministry of Power and Energy	Provision of counterpart staff, operational support and budget for project activities Monitoring and evaluation of project activities and outputs including periodic review Dissemination and evaluation of project activities and outputs including periodic review
<b>Implementing Agencies-Ceylon Electricity Board</b>	Provision of counterpart staff Implementing activities under the components efficiently and effectively Quality assurance of project outputs Providing various reports to ADB
<b>Implementing Agencies-Sustainability Energy Authority</b>	Provision of counterpart staff Implementing activities under the components efficiently and effectively Quality assurance of project outputs Providing various reports to ADB
<b>Project Steering Committee</b>	Will be chaired by the Secretary, Ministry of Power and Energy. Will include representatives from the Ministry of Finance and Planning (External Resources Department, Department of National Planning, National Budget Department, Foreign Aid and Budget Monitoring Department, and Treasury Operations Department), Ministry of Power and Energy, Public Utilities Commission, Ceylon Electricity Board and Sri Lanka Sustainable Energy Authority (members)
<b>Auditor General Department</b>	Will Undertake project financial account audits
<b>Contractors</b>	Will undertake actual implementation of contracts for equipment, civil works and services
<b>Asian Development Bank</b>	Will undertake project reviews and facilitate implementation

### 3.7.2 Key Persons Involved in Implementation

#### Executing Agency

Ministry of Power and Energy    Mr M.M.C. Ferdinando, Secretary  
 Telephone: +94 11 2574917  
 Email address: secrepen@sltnet.lk  
 Office address: 72 Ananada Kumaraswamy Mawatha, Colombo 07, Sri Lanka

#### ADB

Energy Division,                      Mr Yongping Zhai, Director  
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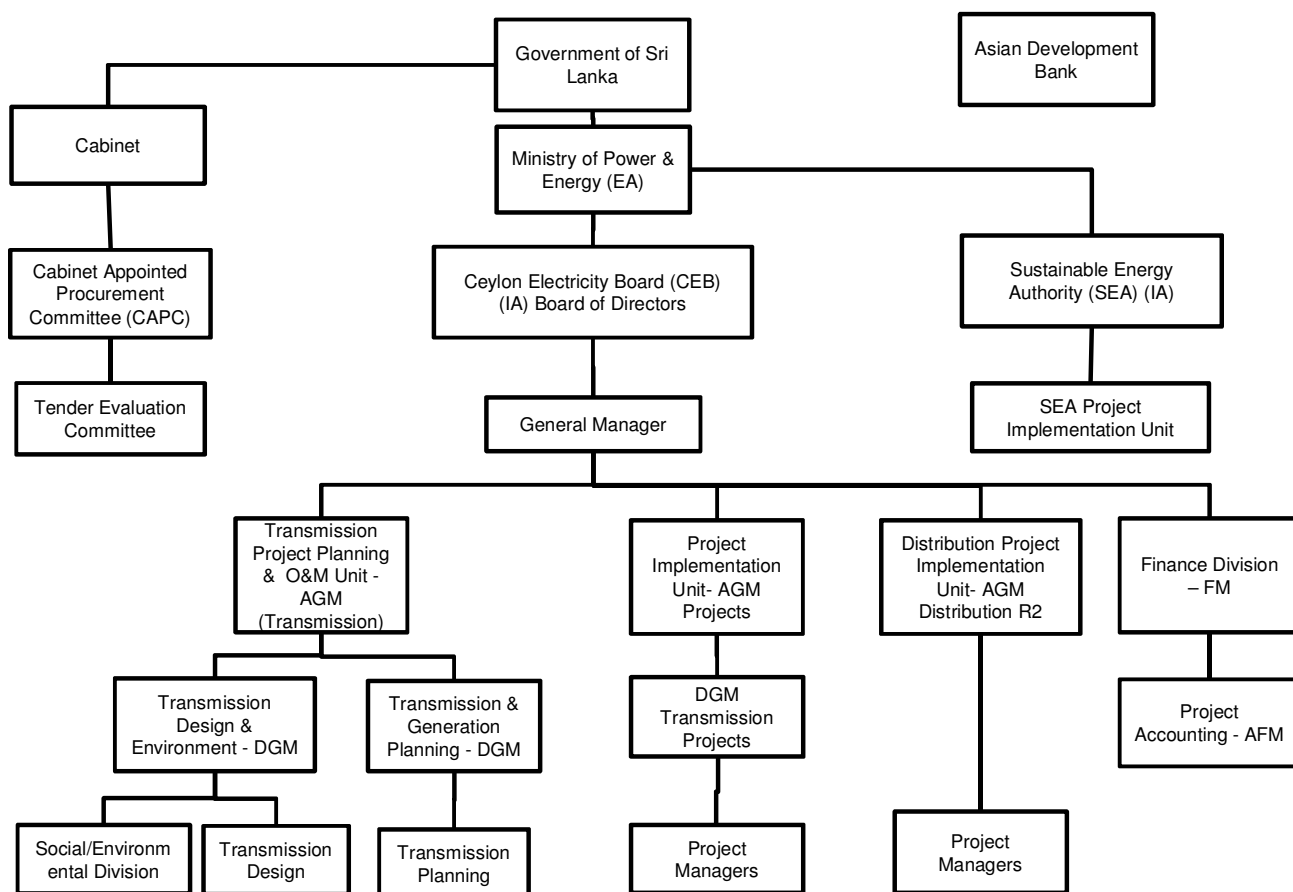
### 3.7.3 Project Organisation Structure

The Ministry of Power and Energy (MoPE) will be the Executing Agency (EA). Ceylon Electricity Board (CEB) will be the Implementing Agency (IA) for transmission strengthening and distribution system improvement components. SLSEA shall be implementing agency for the component of solar roof top implementation.

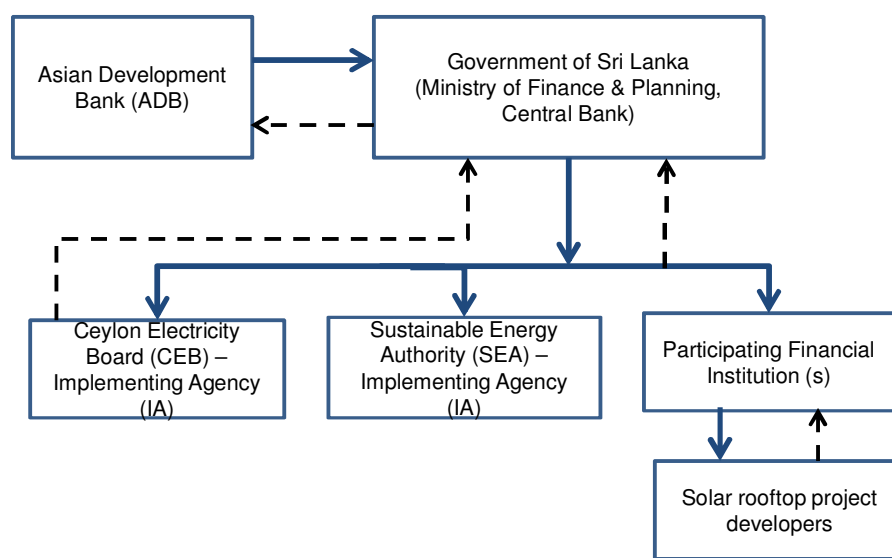
A Steering Committee, established for the project and chaired by the Secretary of the MoPE, will meet quarterly to review the overall progress of the project.

Project implementation units (PIUs) including experienced staff and headed by senior officers will be set up in CEB/SLSEA to undertake day-to-day project implementation activities. Full-time project managers with qualified staff will be appointed to supervise subprojects under each component. The PIUs will be responsible for overall project implementation, including procurement, accounting, quality assurance, social and environmental issues and coordination with concerned agencies. PIUs will also coordinate closely with the procurement committee, which will be appointed by the cabinet or MoPE depending on the size of contracts. The overall project implementation structure is given in Figure below:



**Figure 3 Project Implementation Structure**

### 3.7.4 Fund Flow Diagram

**Figure 4: Fund Flow Diagram**

## 3.8 Project Safeguards

### 3.8.1 Environment

An Initial Environmental Examination (IEE) and Environmental Management Plan (EMP) have been prepared for each subproject. The IAs will monitor, audit, and report to ADB twice a year on the implementation of the EMPs for each of their respective subprojects. Each EA will verify that all associated facilities do not involve Involuntary Settlement. Projects will be constructed and commissioned in compliance with the laws and regulations of Sri Lanka. The social and environmental management cell within CEB will assist in promoting environmentally responsible implementation of contracts and will monitor the implementation of mitigation measures. The mitigation measures will be incorporated into the contractor's contract document.

### 3.8.2 Involuntary Resettlement

The objective of safeguards is to avoid adverse impacts of projects on the environment and affected persons (AP) and to prevent, minimize, mitigate or compensate adverse impacts, where these are considered to be temporary and of reversible nature. Implementation of project safeguard plans is guided by Loan Covenants and other approved safeguard planning instruments. The project will have a Resettlement Plan (RP) to address and provide details on the nature and scale of land acquisition and resettlement required for the project, though this has been identified as minor and insignificant in nature. A loan condition of the project will be to ensure that the Resettlement Plan is completely implemented, prior to the commencement of civil work activities. CEB will be the entity responsible for ensuring this. The CEB's Environmental Unit will be responsible for updating and finalizing the resettlement plan, followed by disclosure to the local people. CEB will, in advance of project disbursement, allocate the land acquisition and resettlement budget and costs in their overall annual budget, as identified in the RP. All affected and displaced people will be identified by the CEB through its PIU and the Environmental Unit. Disbursement of compensation and assistance will be carried out in accordance to the eligibility and entitlement matrix in the Resettlement Plan (RP). The detailed implementation arrangements are given in the RP.

## 3.9 ADB Documents

### 3.9.1 Annex 8: Project Description

### 3.9.2 Annex 9: Financial Analysis

### 3.9.3 Annex 10: Economic Analysis

### 3.9.4 Annex 11: CEB's Past Financial Performance & Projections

### 3.9.5 Annex 12: Summary Poverty Reduction and Social Strategy

### 3.9.6 Annex 13: Resettlement Plan

### 3.9.7 Annex 14: Summary of Initial Environment Examination Report

### 3.9.8 Annex 15: IEE - Power Transmission Development Component

### 3.9.9 Annex 16: IEE –Distribution System Improvement Component

**3.9.10 Annex 17: EDD: Solar Rooftop Power Generation Pilot Program**

**3.9.11 Annex 18: Environmental Assessment & summary of Initial Environmental Examination**

## 4 Annex

## A 1. Annex 1: Terms of Reference (TOR)

### TA 7837-SRI: Clean Energy and Network Efficiency Improvement Part 1: Conducting Due Diligence

- 1 The project preparatory technical assistance (PPTA) will require 34 person-months of consulting services (15 international and 19 national) for conducting technical, economic, financial, poverty and social, and safeguard due diligence for an ensuing project. An international consulting firm or consortium of firms will form a consultant team with expertise in the areas of (i) transmission engineering, (ii) distribution engineering with experience in mid-voltage (33 and 11 kV) lines, (iii) renewable energy, specifically wind and solar; (iv) financial and economic analysis, (v) social safeguard development, and (vi) environmental assessment. The team leader will be an international expert in transmission engineering. The consultants' outline terms of reference will include, but not necessarily be limited to, the following tasks.

#### 1. Transmission Specialist/Team Leader (international, 4 person-months)

- 2 An international transmission specialist, as a team leader, will be responsible for the overall quality and implementation of the TA assignment, providing the required support for the executing agency/implementing agency (the EA/IA) and reporting to ADB's project officer. With input from national transmission specialist and other consultant team members, the international transmission specialist and team leader will prepare overall sector assessment including the role of the transmission system, review transmission line route surveys and finalize relevant detailed project designs, including technical specification of the proposed transmission sub-stations and lines, their cost estimates and procurement packages in consultation with EA/IA staff. He will also formulate overall procurement plan for a project and conduct procurement capacity assessment of an implementing agency. In particular, the tasks of the transmission specialist and team leader will include, but not be limited to, the following:
  - (i) As team leader, coordinate with other team members to develop a detailed work plan and implementation schedule, work with the EA/IA to oversee the consulting team, and compile, edit, and ensure the quality of reports to be issued under the TA;
  - (ii) Prepare the scope, capital and operating cost estimates, implementation schedule showing anticipated progress of work and expenditures, contracting, and implementation arrangements, and combine and formulate suitable procurement packages for all components;
  - (iii) Identify key sector and policy issues the ensuing project could support including suitable areas for capacity building, etc.;
  - (iv) Prepare a final project report consisting of information needed for ADB to bring the investment proposal for its Board consideration;
  - (v) Prepare/update a design and monitoring framework for the ensuing loan project according to ADB standards, clearly identifying impacts, outcomes, outputs, inputs, and activities and milestones, and set up monitoring indicators for implementation and post evaluation, including collecting necessary baseline data and establishing target indicators for the ensuing project to enable impact evaluation after project completion;
  - (vi) Estimate Green House Gas Reduction, where feasible, for appropriate components of the project in line with best international practice and ADB endorsed methodology;
  - (vii) Review the status of ongoing and past transmission projects in Sri Lanka and assess technical issues, outcomes, and lessons;
  - (viii) Review the results of route surveys carried out by EA/IA staff;
  - (ix) Finalize the least-cost design for line routes and the cost estimates for the relevant transmission infrastructure of the ensuing project, taking into account the financing plan available;

- (x) Based on available information, analyze a system stability issue due to connection of wind and solar power to the grid, prepare relevant recommendations for consideration by the EA/IA, and ensure that the transmission infrastructure design addresses this issue accordingly; and
- (xi) Develop an investment plan for the proposed transmission infrastructure in the project areas.

**2. Transmission Specialist (national, 4 person-months)**

- 3 The national transmission specialist will support and assist the international transmission specialist and team leader with the tasks described in para. 2 above.

**3. Distribution Specialist (international, 2 person-months)**

- 4 An international distribution specialist, with assistance of the national distribution specialist, will review route surveys and finalize relevant detailed project designs, their cost estimates and procurement packages in consultation with EA/IA staff. The specialists will carry out, but not be limited to, the following tasks:
  - (i) Conduct/review the results of route surveys carried out by EA/IA staff;
  - (ii) Finalize the least-cost design for line routes and the cost estimates for a relevant component of the ensuing project, taking into account the financing plan available;
  - (iii) Conduct load flow studies to optimally sizing the wire and develop an investment plan for upgrading/reinforcing/reconducting mid-voltage (33 and 11 kV) lines in the project area;
  - (iv) Review/propose reactive power management options through installation of 33 kV/11 kV capacitor banks;
  - (v) Prepare a procurement plan for the component; and
  - (vi) Prepare a detailed component implementation schedule showing anticipated progress of work and expenditures.

**4. Distribution Specialist (National, 3 person months)**

- 5 The national distribution specialist will support and assist the international distribution specialist with the tasks described in para. 4 above.

**5. Renewable Energy Specialist (international, 2 person-months)**

- 6 The renewable energy specialist, with assistance of the national specialist, will conduct engineering and management reviews for development of wind and solar power in the project areas based on study of the ongoing efforts and other countries' best practices. The experts will formulate and finalize a proposal for financing under the ensuing project in consultation with EA/IA. The specialist will carry out, but not be limited to, the following tasks:
  - (i) Review the status of ongoing and past wind and solar projects, and assess technical issues, outcomes, and lessons;
  - (ii) Based on review of the ongoing projects, priorities, available wind and solar data, and international best practices, formulate a proposal for financing, including technology option and design;
  - (iii) Prepare/review a wind park master plan;
  - (iv) Explore potential of the proposed solar power park and of a possible market for rooftop solar power generation through PPP;
  - (v) Finalize cost estimates for the potential wind and solar parks to be supported by the ensuing project, taking into account viability and sustainability of the proposed technical design;
  - (vi) Prepare relevant detailed implementation schedule and investment plan for the component; and

- (vii) Assess capacity of the EA/IA to implement/manage the relevant wind and solar generation interventions to be supported by the ensuing loan project, and, if the capacity is inadequate, propose measures and plans for capacity building and project implementation support.

## **6. Renewable Energy Specialist (National, 2 person months)**

- 7 The national renewable energy specialist will support and assist the international renewable specialist with the tasks described in para. 6 above.

## **7. Power Economist (international, 2 person-months)**

- 8 In accordance with ADB's *Guidelines for the Economic Analysis of Projects*, the international power economist, with assistance of the national power economist, will undertake economic analysis of the proposed investment project and assess its economic viability. Working in collaboration with the financial analysts to ensure the use of consistent approach and assumptions across the financial and economic analyses, the power economists will carry out, but not be limited to, the following tasks:
  - (i) Provide the economic rationale for the project including an analysis of alternatives;
  - (ii) Assess economic feasibility of various investment components;
  - (iii) Estimate the economic capital and operating costs, and carry out least-cost, viability, and beneficiary analysis of the proposed project, including sensitivity analysis;
  - (iv) Conduct economic benefit-cost analysis to confirm the overall viability of the proposed project in terms of economic internal rates of return;
  - (v) In consultation with the social development specialist, incorporate poverty reduction impacts in accordance with ADS's Handbook on Integrating Poverty Impact Assessment in the Economic Analysis of Projects;
  - (vi) Assess various stakeholders' willingness to pay and ability to pay for expected various services under the proposed project;
  - (vii) Estimate the poverty reduction impact ratio (PIR) according to ADB's relevant guidelines and requirements;
  - (viii) Assess economic and sustainability issues and carry out distribution, sensitivity and risk analyses;
  - (ix) Evaluate the proposed project's direct and indirect environmental impacts, and carry out economic analysis of these impacts in terms of net present value and internal rates of return in accordance with ADS's *Handbook on Economic Evaluation of Environmental Impacts*; and
  - (x) Specify indicators to monitor benefits from the ensuing loan project, establish procedures and provide cost estimates for benefit monitoring and evaluation in terms of the ADB's Guidelines for Benefit Monitoring and Evaluation (1992).

## **8. Power Economist (National, 2 person months)**

- 9 The national power economist will support and assist the international power economist with the tasks described in para. 8 above.

## **9. Financial Analyst(international, 1 person-month)**

- 10 In accordance with ADS's Guidelines for the Financial Analysis and Management of Projects (2005), the Financial Management Assessment Questionnaire (2005), and the Financial Due Diligence Methodology Note (2009), the international financial analyst will undertake financial analysis of the proposed investment components and assess the financial performance and the financial management capabilities of the executing/implementing agencies, with assistance of the national financial analyst. Working in collaboration with the power economists to ensure the use of consistent

approach and assumptions across the financial and economic analyses, the financial analysts will carry out, but not be limited to, the following tasks:

- (i) Prepare a project cost table and a financing plan for the investment components, including proposed ADB lending and appropriate counterpart funds for local currency and expenditures;
- (ii) Carry out a financial analysis of the proposed investment components by building a financial forecasting model that will create future year projections comprising CEB income statements, balance sheets, cash-flow statements and key financial ratios. The model should include 3-year historic data and projections for at least 10 years. Key risks should be identified and sensitivity modeled. Actions that will be needed to ensure project sustainability, typically agreement to required future tariff levels and financial ratios, should be identified as potential "assurances and/or covenants".
- (iii) Carry out a financial evaluation of the proposed investment components over the construction and operating periods by calculating the financial internal rate of return and comparing it with a weighted average cost of capital in accordance with the ADB's Guidelines;
- (iv) Identify risks to project revenues and costs, conduct relevant sensitivity analysis, and identify potential risk mitigation strategies and approaches;
- (v) Undertake a financial management assessment of the proposed executing/implementing agencies, including a review of corporate planning and budgetary control, financial management accounting and reporting, internal control and audit systems, and data processing, to identify any financial issues that could affect project implementation and/or sustainable operations of project investments and suggest mitigation strategies;
- (vi) Study the proposed Project's financial impact on the executing/implementing agencies and options for sharing the financial burden, recommend measures for improving their financial performance, suggest appropriate financial covenants to monitor the Project's financial performance, and recommend ways to improve their corporate governance in light of ADB's policy on governance; and
- (vii) Design the project's fund flow and disbursement mechanism, and where applicable, review lending and on-lending arrangements in consultation with the executing/implementing agencies and the government on the financing terms.

#### **10. Financial Analyst (National, 2 person months)**

- 11 The national financial analyst will support and assist the international financial analyst with the tasks described in para. 10 above.

#### **11. Environmental Specialist (international, 2 person-months)**

- 12 The environmental specialists shall be familiar and knowledgeable about Sri Lanka's environmental framework and approval requirements related to environmental clearances for power sector investment projects. The environmental specialists shall have experience in preparing Environmental Impact Assessment and Initial Environmental Examinations (IEEs) of projects financed by international financial institutions, specifically ADB and the World Bank. In accordance with relevant guidelines and policies for environmental assessment, the international environmental specialist, with assistance of the national environmental specialist, will undertake, but not be limited to, the following tasks:
  - (i) Review of institutional capacity of the proposed executing and implementing agencies to prepare and implement environmental impact assessment (EIA) reports for the project components and the required Environmental Management Plan to determine mitigation measures in the design, construction, and maintenance phases of the project components and national regulatory requirements in accordance with the ADB's Safeguard Policy Statement (2009);
  - (ii) Review laws, regulations and policies of Sri Lanka on environment;



- (iii) Prepare Rapid Environmental Assessment Checklist and determine environmental category for each project component;
- (iv) Prepare project descriptions and a summary of environmental issues identified for each project component to support the determination of the project environmental categorization;
- (v) Prepare Environmental Impact Assessments or Initial Environmental Examinations depending on the subproject categorization (environmental category A or B) assigned by ADB in accordance with the ADB's *Safeguard Policy Statement (2009)* for project components including analysis of potential impacts of associated wind and solar facilities;
- (vi) Document and organize public consultations, including local stakeholders, at least once in representative project sites. If any environment Category-A components are identified, carry out two public consultations (once during the early stages of an environmental impact assessment (EIA) field work, and once when the draft EIA report is available and before loan appraisal by ADB); and
- (vii) Prepare Environmental Management and Monitoring Plan (EMP and MP) for each project component and a combined EMP and MP for the entire project. The project component EMPs and the combined EMP shall include a cost estimate plan for implementation of the proposed mitigation measures.

## **12. Environmental Specialist (National, 3 person months)**

- 13 The national environmental specialist will support and assist the international environmental specialist with the tasks described in para. 12 above.

## **13. Social Development Specialist (international, 2 person-months)**

- 14 In accordance with all relevant policies, in particular with the relevant laws and policies of Sri Lanka and ADB's *Safeguard Policy Statement (2009)*, the tasks of the international social development specialist, with assistance of a national social development specialist, will include, but not be limited to, the following:
  - (i) Review the national legal policies on land acquisition and involuntary resettlement to verify adequacy and consistency with the ADB's *Safeguard Policy Statement (2009)* and if gaps are found, recommend measures to bridge the gap. Analyze and confirm the following aspects (at national and local levels) that will apply to land acquisition and resettlement in the project area: (a) laws and regulations, including local practices; (b) budgetary processes (tentative agreement from concerned authorities on provision of outlays necessary for land acquisition and resettlement); and (c) relevant administrative arrangement and requirements;
  - (ii) If the project components involve resettlement, prepare a resettlement plan (RP) with full stakeholder participation including participation of the executing and implementing agencies. RP should be implementable in the Sri Lankan context and still meet ADB policy requirements;
  - (iii) Determine the replacement costs of all categories of losses; and prepare an indicative budget for land acquisition and resettlement costs with specific sourcing and approval process;
  - (iv) Assess the need for an Indigenous Peoples Development Plan (IPDP) and carry out any further indigenous people-targeted surveys, as necessary;
  - (v) Prepare a socioeconomic analysis, including a poverty profile and characteristics and determinants of primary project beneficiaries in the target areas of the proposed investment components based on a review of existing studies, data, and development plans. The analysis will include a review of poverty by gender and ethnic minority and propose specific actions to benefit vulnerable indigenous peoples and minorities;

- (vi) Analyze access to electricity, affordability, consumption levels, and consumer satisfaction across socioeconomic groups in target project areas, assess the determinants and elasticity of the demand for power by different socioeconomic groups, categorize areas where electrification would have the largest growth and poverty reduction impacts given the underlying potential of those areas, and assess the implications on employment generation for poor;
- (vii) In consultation with the power economist and financial analyst, define groups that would benefit from the proposed investment components, prepare an estimate of the distribution of the project's financial and economic benefits, and summarize the likely net benefits for each group in accordance with ADB's *Handbook for Integrating Poverty Impact in Economic Analysis for Projects*. Given the available dataset, assess the direct, indirect, and distributional impacts of the project under different growth scenarios with and without the project, summarize the distributional impacts in a matrix, calculate the poverty impact ratio, and carry out appropriate risk and sensitivity analyses with respect to the poverty impact ratio;
- (viii) Prepare a gender needs analysis to identify specific energy needs and preferences of poor and vulnerable women in project areas, design activities/indicators/targets responding to these energy needs to ensure gender beneficial impacts, and develop participatory gender-inclusive strategies to maximize women's participation in project design, development and implementation;
- (ix) Assess and recommend ways to improve gender equity, prepare a Gender Action Plan (GAP), as needed;
- (x) Review land acquisition and relocation plans of project components that involve resettlement, and assess their conformity with ADB *Guidelines for Involuntary Resettlement*, including (a) time-bound arrangements, public consultation, public disclosure, relocation, compensation for affected inhabitants, and (b) costs related to relocation, compensation for land acquisition, and right-of-way;
- (xi) Review potential social and gender impacts of associated wind and solar facilities, and prepare relevant design recommendations as appropriate;
- (xii) Incorporate all mitigation measures into the cost estimates of the proposed components; and
- (xiii) Prepare the TOR for the NGO/consultant who will be in charge of the implementation of the RPs, IPDP and GAP if necessary.

#### **14. Social Development Specialist (National, 3 person months)**

- 15 The social development specialist will support and assist the international development specialist with the tasks described in para. 14 above.

## A 2. Annex 2: Sri Lanka Power Sector Overview

### 1 Structure

- Ceylon Electricity Board is a corporate body established for development and coordination of the Generation, Transmission and Distribution of Electrical Energy in Sri Lanka. It holds six separate licenses for these activities. The license for Generation Division caters to 66% of the power to the grid. The license for Transmission Division is exclusively for CEB by law.
- The Transmission Network consists of 55 grid substations (132/33 kV, 220/132/33 kV, 220/132 kV & 132 /11 kV) and 2,236 km of HV Lines (both 220 kV & 132 kV) approximately.
- The island is divided into four regions for power distribution, supply and sales, where each distribution division holds a license. These distribution licenses cover more than 97% of the geography of Sri Lanka. Lanka Electricity Company Ltd. (LECO), which is a subsidiary of CEB, covers the remaining areas catering to 478,500 customers. Electricity distribution network of CEB consists of MV lines (33 kV & 11 kV), primary substations (33 kV / 11 kV), Distribution Substations (33 kV/400 V & 11kV/400V), and LV lines (400V).

### 2 Role of key stakeholders

Sri Lanka's electricity industry is managed by the Ministry of Power & Energy. All electricity utilities remain under direct or indirect state ownership, whereas, there is significant private sector participation in power generation. By end 2011, the institutions listed in Table 1 are active in the electricity industry. Regulatory and facilitation agencies are described in Table 2.

**Table 1: Institutions in the energy supply industry**

Institution	Functions and other information
Government	
Ministry of Power and Energy (MOPE)	Energy policy, project implementation and monitoring, supervision of state-owned electricity utilities
Ministry of Petroleum and Petroleum Resource Development (MOPPRD)	Petroleum industry project implementation and monitoring, supervision of state-owned petroleum corporation, petroleum resource development and exploration
Electricity utilities	
Ceylon Electricity Board (CEB)	State-owned corporation, engaged in power generation (one license, 23 power plants), transmission (one license), and distribution (four licenses, about 4.5 million customers)
Lanka Electricity Company (Pvt) Ltd (LECO)	State-owned company, engaged in power distribution (one license, 450,000 customers) along western and southern coastal regions,
Independent Power Producers (IPPs)	
Ten thermal IPPs to grid, two thermal IPPs in Jaffna mini-grid	Each IPP an individual company, eight diesel power plants and two combined cycles on the main grid, two diesel power plants on the Jaffna mini-grid
About 100 small renewable energy IPPs (also known as Small Power Producers, SPPs)	Each SPP an individual company, small hydro (about 95), rice-husk (2), and waste-heat (1).
About 300 community small hydro-based distribution cooperatives	About 5000 households are served, in total
About 120,000 solar home systems	Serving an equal number of households

**Table 2: Regulatory and Facilitation Agencies**

Institution	Functions and other information
Sri Lanka Sustainable Energy Authority (SEA)	Policy, promotion and regulatory functions of (i) renewable energy (ii) energy efficiency, and (iii) energy planning, (iv) energy fund management
Public Utilities Commission of Sri Lanka (PUCSL)	Infrastructure regulatory commission presently empowered to regulate (i) electricity industry (ii) bunker and lubricating oil industries. In future, Petroleum Industry regulation is likely to be assigned to PUC

### 3 Policy, Legal and Regulatory Context

#### National Energy Policy

In year 2006, the Government announced the new “National Energy Policy and Strategies”, which outlined the policies, strategies and targets/institutional responsibilities. The policy was subsequently approved by Parliament. Key policy elements announced related to (a) Providing basic energy needs (b) Ensuring energy security (c) Promoting energy efficiency and conservation (d) Promoting indigenous resources (e) Adopting an appropriate pricing policy (f) Enhancing energy sector management capacity (g) Consumer protection and ensuring a level playing field (h) Enhancing the quality of energy services (i) Protection from adverse environmental impacts of energy facilities.

The policy is currently under review. Some of the relevant highlights of the Energy Policy include:

- **Non-conventional Renewable Energy:** Non-conventional Renewable Energy (NCRE) shall be the fourth energy resource in this diversification and security strategy. The Government will endeavor to reach a minimum level of 10% of electrical energy supplied to the grid to be from NCRE by a process of facilitation, including access to green funding such as CDM. The target year to reach this level of NCRE penetration is 2015. It has since been proposed to raise this target to 20% of generation by year 2020.
- **Network Losses:** Transmission and distribution energy losses (the sum of technical and commercial losses) in the electricity sub-sector will be gradually brought down to a maximum of 13.5% of net generation by end 2009. A subsequent extension of the target transmission and distribution losses to 12% by 2015 has since been announced.

#### Legal and Regulatory Background

The Electricity Reform Act 2002 (EA 02) was enacted in December 2002 to regulate and restructure the electricity industry in Sri Lanka. In the same year, the Public Utilities Commission Act 2002 was also enacted, pursuant to which the Public Utilities Commission of Sri Lanka (PUCSL) was established in July 2003. Several provisions of the EA 02 were implemented when the Government of Sri Lanka (GoSL) initiated review of the on-going power sector reforms in the country. The review process endorsed the establishment of PUCSL to regulate the sector, however also recommended modifications of the industry structure. Accordingly, the Sri Lanka Electricity Bill and the Ceylon Electricity Board (CEB) Amendment Bill were prepared and put up for discussions. However, the Supreme Court of Sri Lanka articulated several concerns in operationalizing the draft bills. Consequently, GoSL decided to develop a new power sector reforms process within the existing Industry framework.

With the above in view, the Electricity Reform Act of 2002 was repealed and the Sri Lanka Electricity Act 2009 (EA 09) was certified on 8th April 2009 with the following key provisions:

- Establishment of legislative framework to empower PUCSL to regulate the Power Sector, including CEB.
- A licensing regime would be established where CEB and other operators are required to obtain a licenses from PUCSL to generate, transmit, distribute and supply electricity.
- PUCSL will determine tariffs, following tariff filing and a public hearing process.
- The CEB will remain as a public corporation and will be issued with multiple licenses for generation, transmission, distribution and supply of electricity. However licensing condition would necessitate respective licensed functions of the CEB to be 'ring fenced'. This would allow separation of accounts and facilitate effective performance monitoring.
- Functional Business Units (FBUs) would be established within the CEB to handle respective licensed functions. Internal power trading system would be established to facilitate power trading among the FBUs.
- PUCSL will be responsible to safeguard interests of the consumers, investors, policy makers and all operators of the power industry.

The enactment of the EA 09 has necessitated the development and implementation of several topics, crucial for fully achieving the objectives of this Act:

- Robust regulations, rules and procedures to institutionalize the envisaged regulatory processes. While PUCSL has already initiated action in this regard, these will have to be aligned to the requirement of the new Act. These include (i) Licensing requirement and procedures; (ii) Framework and methodology for tariff determination by various licensees; (iii) Laying of overall Standards of overall Performance and efficient use of electricity; (iv) Consumer Grievance and Complaint Redressal Mechanism; (v) Dispute Resolution Mechanism etc.
- Lay out the plan of action to meet the targets specified in the National Energy Policy of the Sri Lanka i.e. phasing out of subsidy, rural electrification targets etc;
- Coordination mechanism between the Ministry of Power and Energy and PUCSL, and CEB will have to be developed as there are several tasks under the Act that need to be coordinated jointly among these entities;
- Realignment of the Ceylon Electricity Board (CEB) business processes and systems to respond to the new regulatory requirement. This will involve an As-is analysis, understanding of gaps and requirement and addressing of gaps and new requirement;
- Improve mechanisms for participation of stakeholders in the regulatory process. Wider stakeholder participation and informed consumer advocacy is essential for effective regulation;
- Develop institutional capacities (through focused training program, case studies and exercises, hands on training workshops etc) of the above entities and handholding to respond to the new regulatory requirement including development of adequate systems. Regulator's information requirements to improve the quality of its monitoring of the companies operational and financial condition is impeded by the inability of the existing regulatory information systems to provide the data necessary to make good regulatory policy;
- Clear reporting and monitoring structures;
- Address the problems of energy access and rural supply. A single entity alone cannot address this problem and meet the goals laid down in the energy policy for grid and off-grid electrification;

- Set quality of service standards, especially for cases where this still falls well below the acceptance levels. Increased development and urbanization is pressing the need for good quality and reliable supply. The regulations framed by the PUCSL must incorporate incentives for improvement of supply and the data environment.

### Progress with Regulatory Reforms

Licenses have been issued, in 2009, to the Transmission Licensees (CEB), and five Distribution Licensees (four of which are held by CEB and the other by LECO).

PUCSL has established the Tariff Methodology and a road map for tariff reforms and rebalancing. Two tariff filings have been conducted and tariff determinations have been announced in January 2011 and July 2011. However, it is indicated that the tariffs are not keeping with the increasing fuel prices and other costs, and the scheduled tariff announcement for January 2012 has not been made as yet. Accordingly, the expected movement of the electricity industry towards a break-even position with regard to finances, targeted for year 2015 is unlikely to materialize, while most of the elements of the tariff methodology remains un-implemented both by the licensees (especially CEB) and PUCSL. These include reforms to the tariff structure as planned and approved in 2011, removal of anomalies and cross-subsidies, and the definition of a direct subsidy to the low-income electricity customers.

Other regulatory interventions on customer service (commercial quality), supply quality (technical quality), codes, plans, etc. are in progress but the degree and speed of implementation is observed to be slow.

## 4 Generation

With a cascade of six power plants totaling 660 MW, Mahaweli River Complex is the largest hydroelectric scheme in Sri Lanka, built over 1970-1990. The Kelani Complex (built 1950-1983) comprises a cascade of five power plants with a total capacity of 335 MW. Smaller capacity additions to these power plants and new medium-scale (10-50 MW) run-of-river power plants remain to be implemented on both the cascades. Small thermal capacities have been in operation since 1962, but since about year 1990, the demand growth has been largely met with oil-fired thermal generating plants. Table 3 provides a summary of power plants and their ownership. Oil fired thermal power plants provide an increasingly large portion of electricity generated in the country. Fuels used for electricity generation are coal, residual oil, furnace oil, auto diesel and naphtha. CEB presently has one combined cycle power plant that can be operated either on naphtha or auto diesel, and gas turbine plants operating on auto diesel. All CEB's diesel power plants operate on residual oil. There are ten independent power producers who have entered into 10 to 20 year contracts with the CEB to build, own and operate power plants. These power plants also use diesel, furnace oil or residual oil. They have a total contracted capacity of 838 MW. However, to meet the requirements of isolated locations, including the city of Jaffna, CEB has contracted two diesel power plants with a total capacity of 45 MW.

**Table 3: Power Plants in Sri Lanka (Status by end 2011)**

Power Plant Type	Capacity (MW)	Expected Annual Avg. Energy (GWh)
<b>CEB Owned Plants</b>		
<b>Major hydro</b>	<b>1185</b>	<b>4465</b>
<b>Small hydroelectric plants</b>	<b>20</b>	<b>-</b>
Thermal power plants	509	
Wind	3	
<b>Total CEB Power Plants</b>	<b>1717</b>	

<b>Independent Power Producers<sup>6</sup></b>		
IPP Thermal	858	5490
Hydroelectric SPPs	183	-
Biomass	11	-
Solar	1	
Wind	30	
<b>Total private power plants</b>	<b>1083</b>	
<b>Total system generating capacity</b>	<b>2737</b>	

IPP=Independent Power Producer, SPP = Small Power Producer (<10 MW)

(Source: Summarized from CEB Long-term Plan 2008, amended to reflect subsequent additions)

### Small power plants and non-conventional renewable energy

- **Hydro:** Currently small hydropower plants are developed as grid connected private power plants feeding the grid on a commercial basis. There are 87 small hydroelectric power plants connected to the grid (all privately owned) with an aggregate capacity of about 183 MW. Over 300 micro hydropower plants (typically less than 20kW) are also used to provide basic electricity needs of remote communities with no involvement of the grid or CEB. About 50 off-grid micro hydropower plants (typically less than 100 kW) are still in use by tea/rubber estates to provide power to estate factories and bungalows.
- **Wind Power:** In 1999, CEB set up the first-ever wind power generation plant of 3MW capacity in Hambantota, as a pilot project<sup>7</sup>. Presently, CEB has issued nine contracts to private investors to develop 90 MW of wind power generating capacity. Out of this, 33 MW of capacity is now operational, all in the Puttalam District in the North Western Province.
- **Solar Energy:** Solar photovoltaic (PV) systems are being used in Sri Lanka for small-scale applications in remote regions, including supply of basic electricity needs in rural households. It is estimated that close to 110,000 solar home systems were in use by end 2008<sup>8</sup>. More recently in 2011, two grid connected solar PV arrays were commissioned, each with a capacity of 500 kW.
- **Dendro Power:** Generation of electricity using biomass grown in dedicated plantations (referred to as 'dendro power') is considered to be a promising future power option for Sri Lanka. Thermal energy from woody biomass harvested from plantations of fast growing tree species could be used to power a conventional steam power plant or gasifier-based diesel or gas turbine plants. The first-ever commercial dendro power plant of 1 MW was commissioned in 2004, but it is not presently in operation.
- **Power generation from waste:** Rice husk is used in two power plants, with a total capacity of 11 MW.
- **Net metering:** The "net" metering facility is available to all electricity customers, first introduced in 2009. The customer is free to use any renewable energy<sup>9</sup> source, based on the availability and

<sup>6</sup> excluding the two power plants on short-term contracts serving the mini-grid in the northern Jaffna peninsula.

<sup>7</sup> ESD project of The World Bank

<sup>8</sup> By mid-2007, solar PV systems in operation for household use were estimated to be 130,000, and some reductions are expected owing to rapid expansion of the grid.

<sup>9</sup> including waste heat recovery



affordability. The capacity limit is the contract demand, subject to a maximum of 42 kVA<sup>10</sup>. In any given month, the customer will be billed for the net purchase from the grid. Any surplus exports are credited to the bill, to be used at any time, in any month in the future. Credits can be carried through until the end of the net metering contract (10 years).

### Power Plants under Construction

Upper Kotmale hydroelectric project of 150MW capacity is now under construction and planned to be completed in 2012. The second stage of the first coal-fired power plant of 600 MW is now under construction, and it is expected to be operational by year 2013, making the total capacity to be 900 MW. About 25 small hydroelectric power plants (less than 10 MW each, but in general, in the 1-3 MW range) are under construction, and it is expected that the small hydroelectric capacity (presently about 180 MW) would reach 250 MW by end 2015. CEB has only 3 MW of wind power generation, whereas additional 30 MW installed wind power generation is owned by 3 IPPs having 10MW each.

### Energy mix in power generation, past and the future

Until mid-1990s, the largest share of electricity generation was from hydropower. With most of the major hydroelectric potential now developed, non-hydro sources would have to meet the growing demand for electricity. In 2009, only 42% of the total electricity demand was met by the hydroelectric power plants (both large and small), compared with 94% in 1995. The renewable energy share in electricity generation will further decline as the growing demand is to be met with thermal generation. The national energy policy declares that 10% of electricity generation (in energy terms) will be with Non-conventional Renewable Energy (NCRE) sources by year 2015 (in year 2008, 4.4% was met with NCRE), which will help to retain the renewable energy share to a certain degree, as seen in Table 4.

**Table 4: Gross Generation to the Grid (2010)**

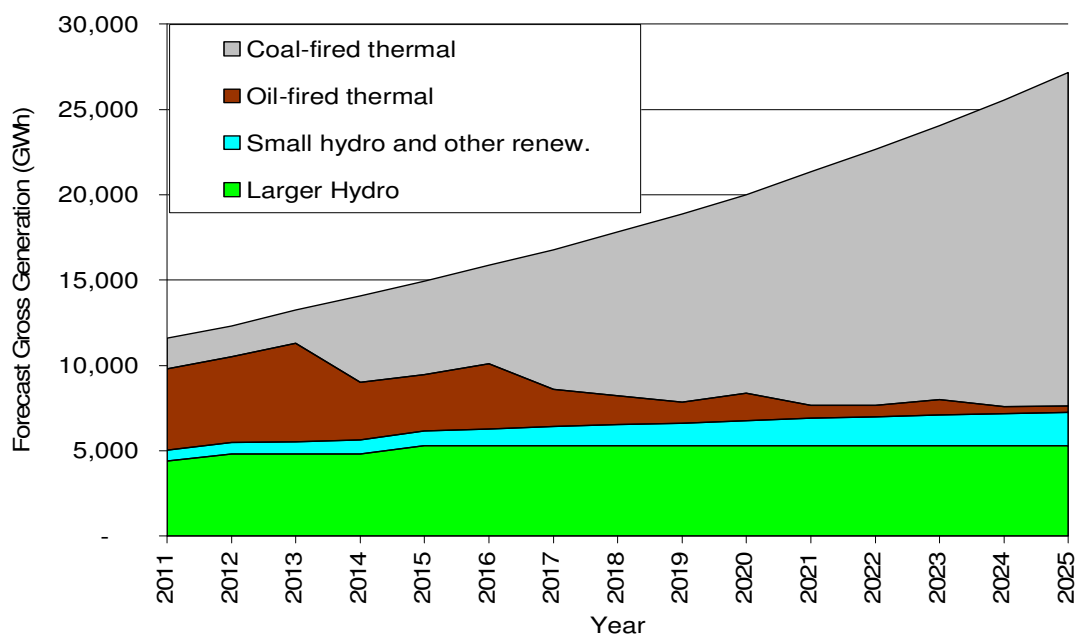
Gross Generation	GWh	Share
Large Hydro	4,988	46.5%
Oil-fired Thermal	5,008	46.7%
Small Renewables	732	6.8%
<b>Total</b>	<b>10,728</b>	<b>100.0%</b>
Share of renewable energy in the national grid	5,720	53.3%

The forecast energy mix is shown in Figure 1, which meets with the national policy of developing non-conventional renewable energy facilities to the extent of 10% of generation to the grid. The forecast energy mix is expected to cause a reduction in the cost of electricity generation from thermal sources in real terms, as shown in Figure 2.

**Figure 1: Hydro, Thermal and Small Renewable Energy Share: Planned**

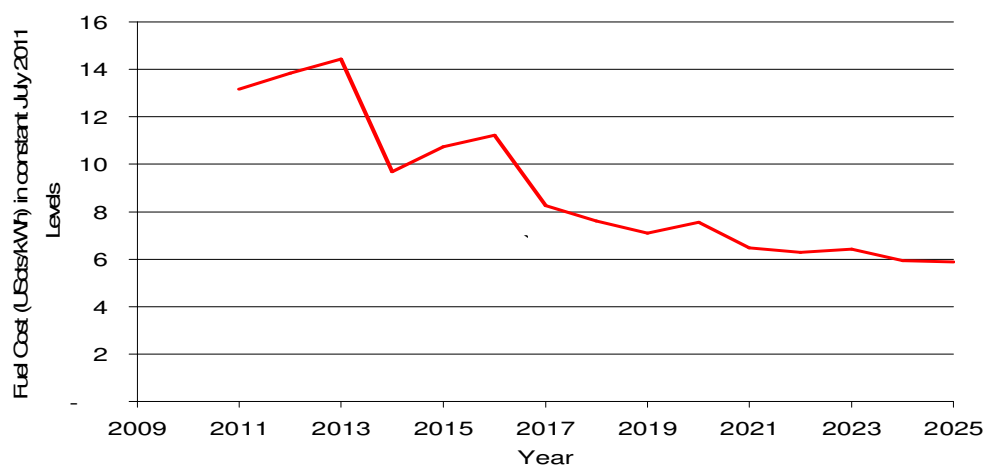
<sup>10</sup> Corresponds to a three-phase, 60 Ampere supply, which is the highest rating for a retail supply. It has been proposed to increase the capacity limit to the customer's contract demand.





Note: This reflects the NCRE scenario meets the national policy target of 10% by 2015, and retains approximately the 10% share into the future

**Figure 2: Forecast Cost of Thermal Generation**



Basis: July 2011 fuel prices in Sri Lanka in financial terms for power generation, equivalent to the following prices

Diesel	131.5	USD/bbl
FO 180 cSt	91.1	USD/bbl
FO 380 cSt	86.0	USD/bbl
Naphtha	77.8	USD/bbl
Coal	150.0	USD/MT
Biomass (grown)	108.0	USD/MT

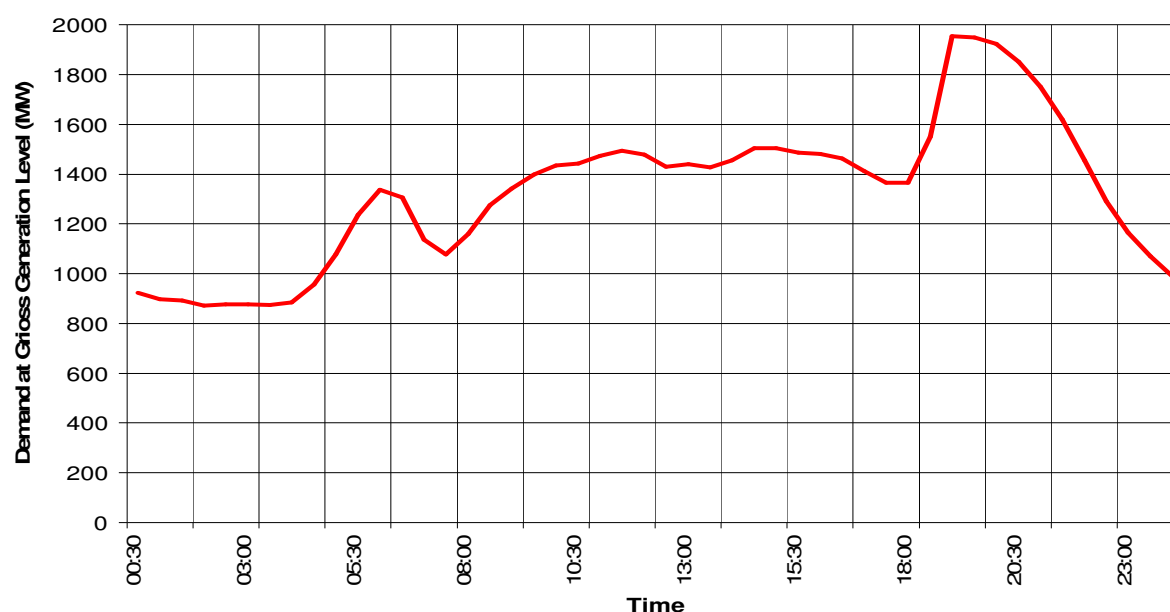
### Peak Demand and Load Profile

Peak demand in 2010 was 1,954 MW<sup>11</sup>. This demand was fully met with no load shedding, planned or unplanned. The last planned load shedding in Sri Lanka was on 15<sup>th</sup> May 2002, which ended a long period of capacity shortages that required load shedding from mid-2001. The reasons for capacity shortages over 2001-2002 are many, chief of which is the delay in implementing the long-term generation expansion plan owing to political indecision. These problems, however, have now been resolved to a great extent with several power plants under construction, while medium term thermal IPPs presently provide the capacity at a higher cost than the long-term least-cost options. Additionally, the first coal-fired generating capacity of 300 MW was commissioned in March 2011.

Sri Lanka displays a load profile with a relatively high evening peak caused largely by lighting for household use. The apparent load factor in the system shows a gradual increase, because of the energy contribution from embedded generation, whose capacity contribution is not included in the peak demand assessments. Figure 6 shows the apparent load profile of the system on the peak day of 2010, while Table 5 shows the assessed system load factor, with and without embedded generation.

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<sup>11</sup> measured at the generation bus bar, at gross generation level. Contribution from embedded generation, which are largely small hydroelectric power plants, is not included, but is estimated to be about 100 MW coincident with the reported peak.

**Figure 5: System Load Profile**

Date of the profile: 17 March 2010, the date on which the maximum demand of centrally dispatched power plants occurred, profile not adjusted for embedded generation.

**Table 5: The System Peak Demand and the Improving Load Factor**

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
System Peak Demand (MW) excl. embedded gen	1,405	1,444	1,422	1,516	1,563	1,748	1,893	1,842	1,922	1,868	1,955
Gross Generation To CEB Grid (GWh)											
Including embedded gen.	6,713	6,537	6,831	7,703	7,868	8,844	9,443	9,845	9,987	9,962	10,784
Excluding embedded gen.	6,666	6,469	6,724	7,578	7,658	8,562	9,095	9,498	9,549	9,410	10,052
System Load Factor											
Including embedded gen.	54.6%	51.7%	54.8%	58.0%	57.4%	57.8%	56.9%	61.0%	59.3%	60.9%	63.0%
Excluding embedded gen.	54.2%	51.1%	54.0%	57.1%	55.9%	55.9%	54.8%	58.9%	56.7%	57.5%	58.7%

## 5 Transmission

CEB owns and operates the entire electricity transmission network at 220 kV, 132 kV and most of the two sub-transmission networks of 33kV and 11kV. Some 11 kV lines are owned and operated by LECO. Electricity generated at power plants is stepped up to one of the two transmission voltages and transmitted to receiving stations around the country. The receiving stations for the load centers in the western part of the country are at Kolonnawa and Biyagama. There are about 55 Grid Substations, where the power received at 220 kV or 132 kV is stepped down from the transmission voltages to the sub-transmission level (33 kV) to be distributed over a large local area.

**Table 6: Transmission Facilities of CEB Licensees**

Parameter	Unit	Overhead or underground	Value
Number of 220 kV Grid Substations	Nos		7
Number of 132 kV Grid Substations	Nos		48
Length of 220 kV transmission lines	Ckt-km	Overhead	484
Length of 132 kV transmission lines	Ckt-km	Overhead	1711
	Ckt-km	Underground	41
Length of 33 kV distribution lines	Ckt-km	Overhead	24,370
	Ckt-km	Underground	58

## 6 Distribution, Customers and Sales

CEB distributes electricity to 89% of the customers while LECO supplies the balance. CEB's network of 400 V/230 V distribution lines (overhead & underground) stretches over 104,153 route km. LECO, established in 1983, purchases electricity from CEB and distributes among retail and bulk customers in their designated areas, between Galle and Negombo along the Western coastal belt. There were 4.95 million electricity customers served by the national grid (both CEB and LECO) by end 2010. Household customers were the largest group (88%). Commercial customers (all public buildings, offices and shops) were a further 10%. Industrial customers accounted for 1%. The details of customers and sales to each customer class are given in Table 7 and Table 8.

**Table 7: CEB and LECO Customers (2010)**

	CEB	LECO	Total
Households	3,958,829	404,495	4,363,324
Religious	26,763	2,287	29,050
Industrial	45,059	3,402	48,461
Commercial	449,733	64,559	514,292
Others	1	2,930	2,931
<b>Total</b>	<b>4,480,385</b>	<b>477,673</b>	<b>4,958,058</b>

Source: CEB Statistical Digest, 2010

**Table 8: CEB and LECO Sales (All figures in GWh)**

Customer Class	2004	2005	2006	2007	2008	2009	2010
Households	2,594	2,859	3,056	3,178	3,230	3,363	3,641
Religious	45	49	51	50	49	51	55
Industry	2,530	2,686	2,901	2,911	2,910	2,765	3,141
Commercial	1,323	1,465	1,633	1,864	2,028	2,059	2,224
Street Lighting	106	141	125	136	133	133	130
<b>Total Sales</b>	<b>6,599</b>	<b>7,201</b>	<b>7,766</b>	<b>8,139</b>	<b>8,350</b>	<b>8,372</b>	<b>9,191</b>
Sales growth	7.1%	9.1%	7.9%	4.8%	2.6%	0.3%	9.8%

Source: Sri Lanka Energy Balance 2010, and CEB Statistical Digest 2010.

The total energy losses were estimated to be 14.2% in 2009. For year 2010, CEB reported a total loss of 12.97% for its transmission and distribution network. LECO reported a network loss of 6.4%. The total

actual Sri Lanka T&D loss for 2010 is estimated to be 13.3% of net generation. This is lower than the 14.0% target established by PUCSL.

### **Progress with Access to Electricity**

- **Grid Connected Supply:** Proposed rural electrification schemes are surveyed and analyzed, and packaged into projects and presented for financing. A total of seven such “projects” have been implemented by CEB that has catalyzed the rapid electrification rates, now reaching about 81% of all households<sup>12</sup>. This rapid expansion has been made possible largely owing to concessionary financing from various agencies, particularly from the Asian Development Bank (ADB), and more recently from the Governments of Kuwait, Sweden, China and India. These investments are provided by the Government as additional equity to CEB, and CEB is not required to pay back the investments to the Government.
- **Off-grid supply:** Since 2002, a parallel program to provide remote and rural households with off-grid services was established with the support of the World Bank and by end 2008, such micro-hydro (community), solar PV (household modules) and wind generating systems (community) are estimated to have served 2% of the households.
- **Future Investments on Rural Electrification:** The ten year plan<sup>13</sup> explains the Government’s strategy for rural electrification reflecting the following targets: “Investments will be made on grid extensions as well as to establish off-grid energy services, to ensure access is available to 96% of households by 2016. Measures will be implemented to support connection costs of households that already have access”.
- The Government has since revised the target to be 100% electrification by year 2012, which may include some percentage of households to be served with off-grid supply, in addition to the estimated 2% already served with off-grid systems. The indicative assessment of the current level of electrification (i.e. households with an active electricity account) is about 88%.

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<sup>12</sup> The reporting of electrification ratio follows different definitions. CEB adds all household customers and a share of commercial customers who conduct small businesses, to calculate the number of electrified households. However, in CEB’s accounts, there is a high share of zero-reading household accounts. When adjusted, the actual ratio will be lower than the figure reported by CEB.

<sup>13</sup> Ten year horizon development framework (2006-2016), Discussion Paper, Department of National Planning, Colombo, Jan 2007.

### A 3. Annex 3: Mannar–Vavuniya–Anuradhapura Transmission Line


























The Mannar region in Sri Lanka holds a lot of potential for the wind capacity development. As per SLSEA's estimate (Renewable Energy Resource Development Plan 1/2012), the estimated wind potential in the region is around 260 MW. The identified wind development zone lies in a highly eco-sensitive area surrounded by a Ramsar Convention site and a marine sanctuary. The actual wind potential which can be harnessed can only be accurately determined after undertaking a detailed environmental assessment and land-use assessments.

The Mannar region is also witnessing high demand growth as a result of resettlement and rehabilitation of displaced population. This is likely to see further boost with the development of commercial complexes (hotels, resorts, etc) as well as industries in near future. The current demand in the region is around 6 MW in the Mannar region. As per CEB's transmission plan (2011), the demand is likely to be 17.6 MW by 2014.

The Mannar region is currently fed by a Lynx double circuit 33 kV line with RC poles from Vavuniya to Mannar, a distance of approximately 100 km. The present system is not sufficient to meet the growing demand in the region.

As per the latest CEB Transmission Plan which was approved by the CEB Board in April 2012, the following transmission system has been proposed which would address the requirement of wind power evacuation as well as demand growth in the Mannar region:

- Augmentation of Vavuniya grid substation with 2x132kV double busbar transmission line bays
- Construction of Mannar grid substation with 1x31.5 MVA, 132/33 kV transformer, 132kV single busbar arrangement including a bus section, 33kV single busbar arrangement including a bus section, 4x132 kV single busbar transmission line bays, 1x132kV single busbar transformer bays, 4x33 kV feeder bays, 1x33kV transformer bays
- Construction of 55km, double circuit, Zebra, 132kV transmission line from New Anuradhapura to Vavuniya
- Construction of 70km, double circuit, Zebra, 132kV transmission line from Vavuniya to Mannar
- The proposed transmission system can evacuate around 180 MW of wind generation capacity and with 40 MVAR shunt capacitor compensation, this power transfer capacity can go up to 210 MW. Considering the current estimates of potential, the proposed configuration is satisfactory.
- Analysis on the selection of voltage level and other options for evacuation of 200 MW power on various aspects is shown in table below:

Interconnection of Mannar GSS to Vavuniya GSS	Interconnection of wind collection GSS on island to Mannar GSS	Transmission Capacity (MW)	Transmission Losses	Environmental Issues	Voltage drop at tail end	Voltage rise at sending end during minimum wind	Cost Implication
Mannar-Vavuniya 220kV line- Double Circuit-Overhead-Zebra	220 kV Double circuit- Overhead-Zebra	~400					
Mannar Vavuniya 132kV line- Double Circuit-Overhead-Panther	132 kV Double Circuit-Overhead-Panther	~200					
Mannar Vavuniya 132kV line- Double Circuit-Overhead-Zebra	132 kV Double Circuit-Overhead-Zebra	~200					
Mannar-Vavuniya 220kV line- Double Circuit-Overhead Zebra-Charging at 132kV	132 kV Double Circuit-Overhead-Zebra	~200					
Mannar Vavuniya 132kV line- Double Circuit-Overhead-Zebra	132 kV Underground cable	~200					




 Low Impact   
  Medium Impact   
  High Impact

Table above indicates that the best option for power evacuation from Mannar Region is 132 kV double circuit overhead transmission line from Mannar to Vavuniya, which is having medium impact across selected parameters.

In order to address the long term wind power generation evacuation requirement in the region, there are two options which can be considered while going ahead with the currently proposed 132 kV Mannar – Vavuniya – Anuradhapura transmission line.

#### *Modification of the same structure to enhance the capacity by 100%*

The same structure of 132 kV Zebra can be modified to 220 kV to evacuate higher generation (capacity can be enhanced at least by 100%) and the work can be carried out without interrupting the commercial operations (using live line technology). This technology has been used internationally and would provide an economical solution as compared to constructing a 220 kV line immediately.

#### *Considering alternate transmission route to northern part of Mannar*

Apart from the technical solution possible, an alternate 132 kV transmission line can be routed to the northern part (Kilinochichi or Jaffna) to carry additional wind power generation in future, in case the need for the same arises.

The above two options would be similar to replacing the proposed 132 kV line with a 220 kV at present but will be more economically viable.

Since the overall potential of wind power in Mannar Region is limited to 260 MW (as per SLSEA's draft Renewable Energy Resource Development Plan, Jan 2012)<sup>14</sup> and the same needs to be validated through ground data measurements as well as undertaking environmental studies in the region to identify the actual exploitable wind potential. Considering this scenario, the proposed 132 kV system would be sufficient to meet the requirements

<sup>14</sup> As per Wind Resources in the Mannar Region, May 2011, the total identified potential in Mannar region was 360 MW.

### *Absorption of Wind Energy*

The 220kV option is suited only if we anticipate immediate capacity addition up to order of 400-500MW. The capability of the transmission and distribution system to absorb the infirm wind power generation has been provided below:

The absorption of wind energy is presented from two aspects: (i) dispatchability, and associated economics, (ii) spinning reserve requirements

### *Dispatchability and economics*

Sri Lanka generating system already has the following non-dispatchable, must-run generating capacity: Small hydro: about 200 MW, wind: 40 MW.

In addition, dozens of small hydro power plants and a few more wind power plants are under construction. Meanwhile, baseload power plants and other hydropower plants will also be built to enable Sri Lanka to achieve the most economical long-term generation costs. By year 2020, the Sri Lanka power system would comprise power plants with specific operational characteristics as summarized in the table below.

Type of Power Plant	Generating Capacity (MW)	Operational Feature	Minimum operating capacity (MW)
Coal-fired thermal	1905	Must-run at minimum loading level (40%), dispatchable thereafter	762
Oil-fired thermal	873	Full dispatchable owing to smaller unit sizes, except in the three combined cycle plants, which may not be committed for operation during normal operations	none
Large hydropower (above 10 MW)	1332	Run-of river plants are baseload, must-run	200
Small Power Producers (all of which are renewable energy based, each less than 10 MW, includes presently committed wind power plants of 90 MW)	650	Must-run, non-dispatchable	650 (assuming 100% power plant and resource availability, but the forecast system demand is already net of this capacity)
Total non-dispatchable, must-run capacity excluding wind power development in Mannar			962
Forecast minimum demand on the system (at 3-4 am )			999

Note: The proposed wind power development in Mannar is not included in any of the above capacity figures

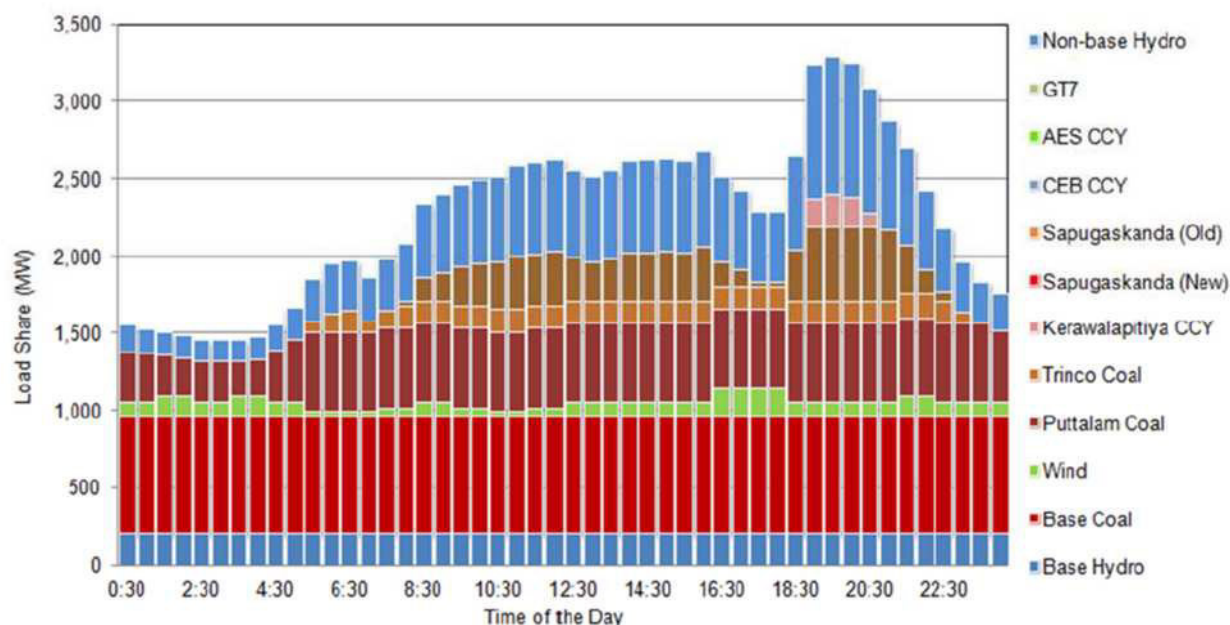
Therefore, by year 2020, with existing commitments including 90 MW of wind power plants as SPPs, the minimum demand and the total non-dispatchable generation are nearly equal.

When wind power in Mannar or other non-dispatchable, must-run power plants are added further to the above, then at certain times of the day and seasons, such power plants would require to be unloaded to ensure that the generation in the power system is equal to the customer demand at all times.



A simulation was conducted by developing a dispatch model for the Sri Lanka power system, to examine how much of wind power can be absorbed into the system, beyond the present commitment for 90 MW from SPPs. Hourly demand data for a recent year were forecast to the year 2020 situation, assuming the same growth rates as in the CEB demand forecast. The load profile was assumed to remain unchanged. It should be noted that CEB's published data on demand excludes contribution from embedded generation. This assumption was continued into this analysis as well. Wind velocity data in Mannar in 10 minute intervals and a typical power curve of a wind power plant was used to develop the actual capacity of the wind power injection from Mannar.

Figure below shows the dispatches on a typical day in year 2020. This information is given only for illustration, as the wind availability and dispatch varies from day to day, which has been modeled in this study at 10 minute intervals.



In order to identify the amount of energy likely to spill if large scale wind power plants are developed in addition to the committed power plants listed in the earlier table, a new wind power plant with a variable capacity (from 100MW to 500MW) is added to the merit order expecting the same to be dispatched just after the must-run hydro power plants and the base capacity of the coal power plants.

When the model was run for different capacities of the large scale wind power plant in Mannar (which is representative of the Mannar wind development work being analyzed here), the resultant 'spillages' were observed, as summarized in Table below.

Wind generation capacity in Mannar	Generation from the wind power plant (GWh)	Wind energy "spilled" (GWh)	Energy "spilled" as % of total potential
100MW	340.4	0.1	0.0%
200MW	676.5	4.4	0.6%
300MW	966.1	55.2	5.4%
400MW	1177.9	183.9	13.5%
500MW	1330.7	371.5	21.8%

Note: This wind capacity is in addition to the capacity of about 90 MW already committed under SPP guidelines, which are must-run, non-dispatchable.

Accordingly, the most likely development in Mannar by year 2020 requires to be limited to about 200 MW, to ensure that wind power plants are not unloaded, unnecessarily wasting the resource. If development is conducted at an accelerated pace, then the investors would have to be paid a tariff higher than the minimum possible, to make-up for the “spilled” energy.

### *Spinning Reserve*

By year 2020, Sri Lanka’s generation will consist of an estimated varying generation sources as follows:

- Run-of-river hydro, medium scale (must-run, dispatchable): 200 MW
- Small hydro (must-run, non-dispatchable, varying moderately): 550 MW
- Wind power (must-run , non-dispatchable, embedded), varying rapidly): 90 MW
- Mannar wind development (must-run, dispatchable) 200 MW (proposed)

Accordingly, the spinning reserve to be maintained to account for rapidly varying sources would be about 290 MW, in addition to the spinning reserve required to account for plant outages and demand variations. This additional spinning reserve will be about 8% of the peak demand, and 30% of the off-peak demand. Such large spinning reserve would certainly entail a significant increase in system operating costs.

## A 4. Annex 4:Sri Lanka Renewable Sector Overview

On-grid wind and solar power generation are relatively new sub sectors in Sri Lanka and are going through a period of learning. This review attempts to trace and understand the issues faced by the industries and the government in the initial period of commercialization of these two technologies and to document the lessons learnt in this process. It is expected that both government and the industry would be able to gain from this information in steering the planned commercialization of wind and solar power generation in Mannar and Hambantota regions respectively.

The review has largely been carried out based on secondary information and few primary interviews with key stakeholders. Information gathered from these sources was supplemented with our own knowledge and experience in the renewable energy scene in Sri Lanka.

### 1 Policy Targets & Strategies

#### Historical Development

In 1997, Sri Lanka took the first step in addressing the issue of developing small to medium– scale renewable energy-based power generating facilities, by allowing the private sector to invest in grid-connected power plants less than 10 MW in size. As conventional large hydro also belongs to the renewable energy category, this new application is referred to as *New Renewable Energy (NRE)* sources.

Grid-connected electricity generating facilities with an installed capacity of less than 10 MW, and owned/operated by private companies, are presently considered by CEB as Small Power Plants (SPPs). These SPPs are embedded power plants, because they are connected at medium voltage levels (mostly 33 kV) in the CEB grid, unlike the larger power plants, which are connected at higher voltage levels. Furthermore, embedded power plants in Sri Lanka, being small and dependent on the availability of renewable energy, which is sometimes unpredictable, are not dispatched.

CEB purchases electricity from SPPs on the basis of a standardized non-negotiable Small Power Purchase Agreement (SPPA). The SPPA is offered only to embedded power plants of which the primary source is either a renewable source, or for power plants using waste heat or using combined heat and power technology. The contract specifies the conditions, current prices and pricing policy on which electricity will be purchased by the CEB. The first SPPA was signed in 1997. Investor confidence in Sri Lanka is so far seen mainly in the development of small hydro, while investors have shown some interest to develop biomass and wind power plants, but with little success. The policy incentives that build-up investor confidence and minimizes delays in the development of grid-connected renewable energy projects, are the following:

- There is no solicitation process; all projects are on a first-come, first-served basis.
- Selection of the site, and project development, equipment selection, entirely decided by the developer
- SPP agreement is standardized, non-negotiable (hence avoids lengthy negotiations)
- Pricing formula is standardized, and uniformly applied to all SPPs
- Incentives by way of competitive interest rates through the Renewable Energy for Rural Economic Development (RERED) project.

By the end of 2006, there were 60 NRE-based power plants connected to the grid with an aggregate capacity of 109 MW. These power plants supplied 346 GWh to the grid, which amounts to 3.7% of the gross annual generation. Thus, embedded generation is still a small share of system generation.

## New Policies and Strategies on NRE

In the April 2006 policy document, the promotion of indigenous resources is linked with renewable energy development, because Sri Lanka has not yet discovered any non-renewable sources of energy. The Energy Policy and Strategies of Sri Lanka (April 2006) specified a target of reaching 10% of grid energy from Non-conventional Renewable Energy (NRE) by year 2015. The Department of National Planning's Mahinda Chintana Vision for the Future, 2010 has provided revised estimates for the renewable energy. It is estimated that by 2020, about 20% of electricity supply shall be generated by the renewable energy while 10% target would be achieved by 2016. For this purpose, sufficient investment will be made on development of renewable energy sector with wind, dendro, solar and mini hydro power plants. Thus the scenario of diminishing contributions from renewable energy to the national grid, as explained earlier, will be arrested by this new policy initiative.

The price offered for SPP agreements have been lower in the pre-2002 period, and lead to complaints from developers of all the three leading technologies: small hydro, biomass and wind power. As the price offered is linked to oil prices, through the calculation of avoided fuel costs to CEB, the price offered has since exceeded 5.5 US cents/kWh, which is considered to be adequate to make most of the small hydroelectric power projects viable. This has created a renewed enthusiasm on the development of small hydroelectric capacity under the SPP agreements.

The prices offered, however, are inadequate to make the other renewable energy technologies viable. The technologies that are adequately mature and competitive to be commercially successful are biomass (Dendro) technology and wind power generation, both for grid connected applications. After an extensive study and a consultative process on the pricing of NRE under the RERED project, a technology-specific three-tier tariff was developed for small hydro, wind and biomass based power plants<sup>15</sup>. Other incentives listed in the previous section remain. Thus, a favorable policy climate exists in Sri Lanka for the private sector to invest on NRE development.

## 2 Institutional Framework

In October 2007 Ministry of Power & Energy (M/P&E) established an institution called "Sri Lanka Sustainable Energy Authority" enacting the Sri Lanka Sustainable Energy Authority Act No. 35 of 2007 of the Parliament of the Democratic Socialist Republic of Sri Lanka. The SLSEA was established to serve as an apex institution to drive Sri Lanka towards a new level of sustainability in energy generation and usage, through increasing indigenous energy and improving energy efficiency within the country. With the enactment of the Act, all renewable energy resources of the country were vested with the Republic of Sri Lanka. This piece of legislation defines the Sri Lanka Sustainable Energy Authority (SLSEA) as the custodian of the renewable resources thus vested with the Republic. Apart from her statutory obligations, SLSEA will function as the facilitator of implementation of projects using NRE sources. Powers and duties vested with SLSEA include identification, conservation and management of all renewable energy resources, developing conducive environment for encouraging and promoting investments on renewable energy and to administer renewable energy development projects.

## 3 Financing Support

The Government of Sri Lanka, with the assistance of the World Bank and the Global Environment Facility (GEF) established the Renewable Energy for Rural Economic Development (RERED) Project, which aims to expand the commercial provision and utilization of renewable energy resources, with a focus on improving the quality of life and economic development in rural areas by providing access to electricity

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<sup>15</sup> Sri Lanka Sustainable Energy Authority ([www.energy.gov.lk](http://www.energy.gov.lk)) website

generated from such resources. The RERED Project is the follow-up to the successful Energy Services Delivery (ESD) Project that was implemented during 1997-2002. The RERED Project was funded by a US\$75 million line of credit from the International Development Agency (IDA) of The World Bank and a US\$8 million grant from the GEF. IDA provided an additional US\$40 million line of credit for RERED Additional Financing. The program has concluded in 2011.

Loans for individual investments (sub-projects) are disbursed through Participating Credit Institutions (PCI), who makes their independent credit assessments while ensuring that sub-projects are financially viable, environmentally sound, meet required engineering standards and are economically justifiable. The executing agency of the RERED Project is the Administrative Unit (AU) set up within the Development Finance Corporation of Ceylon (DFCC) Bank. Major development objectives of the project are:

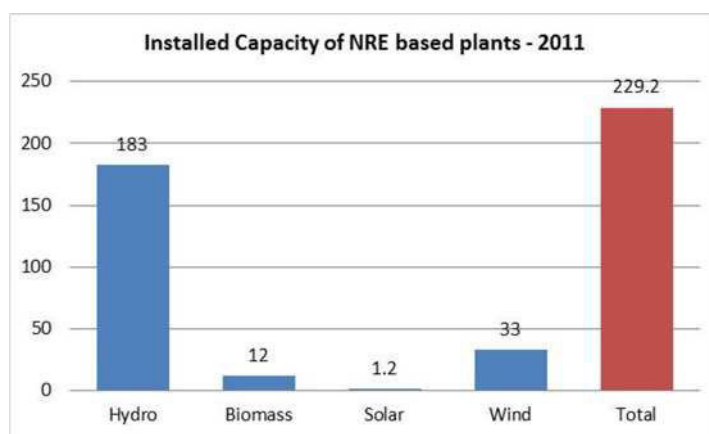
- Provision of off-grid electricity services to invigorate the rural economy, empower the poor and improve their standard of living
- Setting up of grid-connected investment projects to encourage competition in the power sector, provide capacity addition and diversity, and achieve greater sector efficiency and transparency.

RERED Project played a major role in financing renewable energy projects in Sri Lanka and has financed 135 MW of grid-connected electricity generation capacity

#### 4 Present Status of NRE Projects

Through a process of facilitation of private investments in addition to CEB's capacities, by August 2011, Sri Lanka had renewable energy power plants (each less than 10 MW) of a total capacity of 229 MW (Figure 1). This includes three wind power plants (30MW total capacity) and a biomass power plant (10MW) using rice husk. In addition, CEB has 3 MW of wind power capacity. By end 2010, electricity generation from new renewable energy sources stood at 6.83% of the total generation, mainly due to the contribution by the small hydro projects. The renewable energy portfolio formulated by SLSEA envisages bringing a total capacity of 460 MW operational by 2015.

**Figure 1 - Installed capacity of NRE-based power plants – August 2011**



#### 5 Wind Energy Development

##### Wind Resources in Sri Lanka

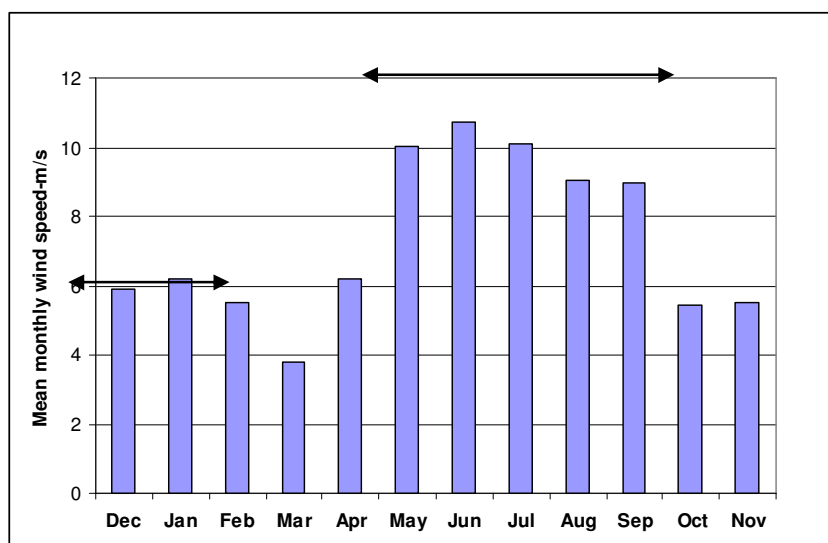
Sri Lanka's wind climate is primarily determined by the Asian Monsoon system, which is part of the General Circulation over Asia. Monsoon winds are driven by the seasonal changes in the pressure systems caused by differential heating and cooling of the earth's surface. These seasonal changes are

related to the movement (apparent) of the Sun to the northern and southern hemispheres. Due to warming of the Asian landmass during summer in the northern hemisphere, the Inter Tropical Convergence Zone (ITCZ)<sup>16</sup> moves towards higher latitudes as far as 30 degrees over north-west India. The surface airflow (*Trade winds*), which moves towards the convergence zone, bears a south-easterly direction in the southern hemisphere and veers to become south-westerly after crossing the equator. During this period, South Asia and most Southeast Asian countries experience what is known as the *South-West (SW) Monsoon*.

During the northern winter, a region of strong high pressure develops over the northern part of Asian continent at latitudes of about 40°-60° due to prevalence of low temperature. The resulting outflow of air masses spread towards the south and southeast over the Korean peninsula, China and Japan converging with the north-easterlies from the Pacific Ocean (pacific trades). The two air currents merge on their way towards the southwest and form the *North-East (NE) Monsoon*.

The SW Monsoon lasts from the middle of May till early October while the NE Monsoon lasts from December to February (Figure 2). SW Monsoon is the stronger of the two Monsoons and is felt along the entire western coast of Sri Lanka as well as inland areas in the dry zone and some mountainous regions.

**Figure 2 - Yearly wind pattern recorded in Mampuri, Puttlam**



### Historic Development

Potential for deploying modern wind technology for large-scale electricity generation was realized in Sri Lanka in mid-eighties and resource assessment studies were initiated in the southern part of Sri Lanka. First-ever systematic study on wind resources was launched by CEB in 1988 with financial and technical assistance from the Government of the Netherlands. The study covered an area of about 1500km<sup>2</sup> in the southern lowlands extending up to south-eastern coast line. Moderate winds with annual average wind speeds in the range 5.5 - 6.0 m/s were found along the coastline but the potential was seen to decrease rapidly towards inland areas. Based on the findings of this study CEB launched a 3MW pilot wind project primarily for study and demonstration purposes.

<sup>16</sup> ITCZ is a zone of low pressure where trade winds from both hemispheres converge.

CEB launched the second wind resource study in 2000 in the Puttlam-Kalpitiya region with financial and technical assistance from the United Nations Development Programme<sup>17</sup>. Results of this study have shown that strong wind potential with annual average wind speed of 7-7.5 m/s (at 60m height) exists along the coastal belt in the Kalpitiya peninsula.

Some limited studies carried out in Ambewela (altitude 2200m) have shown strong SW winds sweeping across the high plains reaching monthly average values as high as 14m/s but confined only to the SW monsoon season of May-October. Rest of the time, monthly average wind speeds remain less than 4m/s.

In 2003, National Renewable Energy Laboratory (NREL) in the US prepared the National Wind Atlas of Sri Lanka<sup>18</sup> that depicts the spatial distribution of wind resource in the country (Annexure 2). This became a useful tool to both the government and private developers in the selection of sites for commercial wind development.

### **Growth of Wind Power Industry**

In 2003 CEB solicited proposals to add 20MW of wind capacity to the CEB grid on Build, Own & Operate (BOO) basis. Even though this initiative failed to attract investments due to some stringent conditions imposed on the project proponents, it triggered interest in commercial wind development in Sri Lanka. Nevertheless, wind energy based electricity generation remained financially unviable at the then prevailing renewable energy tariff<sup>19</sup>. Situation worsened further when wind turbine prices started to increase due to rising worldwide demand since 2003. Therefore, Interest in wind power development remained dormant in Sri Lanka. In order to broaden the renewable energy supply base beyond small hydro, a technology-specific tariff was proposed in the energy policy prepared in 2006.

Policies and strategies adopted in the new energy policy had an impact on the development of non-hydro NRE sources such as wind and biomass. In particular, the technology-specific tariff was a major incentive that attracted private wind developers. Its main attraction was the front-loaded three-tier tariff that provided sufficient revenue within the first seven years to cope with the relatively high investment cost of wind projects (as compared with small hydropower) and provide for a reasonable return on the equity.

Applications for wind power projects increased dramatically after the introduction of technology-specific tariff. Almost all the proposed project sites were located in the Puttlam region particularly along the coastal belt. National wind atlas has rated this region as having “good” wind potential. At present, four wind power plants with combined capacity of 30 MW are in operation in the Puttlam region. It is hard to get credible information about the actual capital cost of these projects which the developers claim as more than USD 2000 per kW. Evidently, all the power plants are operating with a plant factor above 30%. According to SLSEA, energy permits have been issued to another 10 projects with total capacity of 100 MW. These are under various stages of development.

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<sup>17</sup> Wind Resource Assessment and Project Preparation is a sub-project of the overall project of the Ministry of Power and Energy on “Capacity Building in Renewable Energy and Energy Efficiency”. The project was funded by the United Nations Development Program and the Government of Sri Lanka. Its development objective is to expand the use of indigenous, sustainable energy resources through private sector and to increase energy efficiency in the commercial and industrial sectors.

<sup>18</sup> Preparation of the National Wind Atlas was funded by the United States Agency for International Development (USAID) within the framework of “South Asian Regional Initiative in Energy”

<sup>19</sup> This tariff was attractive only to small hydropower plants that were built at relatively low capital costs



## Review of Constraints in Project Development

As is to be expected with all pioneering efforts, wind power projects in Sri Lanka experienced numerous development constraints. Review of constraints on wind project development is based on an interview with the developer of the first commercial wind power project in Sri Lanka. Information gathered from this interview was supplemented with our own experience in wind project development in Sri Lanka. These are discussed below under the respective headings.

### Lack of Long-term Wind Data

By far the most crucial issue relating to wind energy development in Sri Lanka was the lack of long-term wind data of the quality required for feasibility studies on large wind projects. Meteorology Department in Sri Lanka is recording wind data on routine basis at limited number of stations spread across the country. At some stations, the existing wind and solar database spans over 50 years. However, the use of such data for large-scale projects is constrained by following reasons:

- Data recording interval at these stations is 3 hours during day-time and larger at night time, which is too large for wind energy studies.
- Absence of wind direction data in numerical form.
- Lack of records on instrument and station history – instrument replacement, re-positioning of instruments, changes in the surrounding landscape and so on.
- Too low height of wind measurement – typically 3 m to 6 m.
- Overall station exposure to wind flow is far from satisfactory in most stations.

Even though CEB had collected wind data of better quality in their wind resource assessment studies, there was no continuity in any of the studies. There were also concerns that wind masts used in local wind measurement projects did not conform to the relevant international standards. Hence, conducting a bankable feasibility study in early wind projects was a major challenge for the consultants. This was overcome to some extent by resorting to the use of global databases and wind climate modeling techniques within specified levels of uncertainties.

In order to address this issue SLSEA established a network of permanent wind masts to serve as reference stations for future wind energy studies. Wind data is collected on these 40m-high wind masts at 10-minute interval using sensors installed at three levels.

### Project Approval Process

Most renewable energy developers consider the project approval process currently in operation in Sri Lanka as one of the most difficult phases of the project development process. The process also lacks a central agency to coordinate the many government institutions participating in the approval process. Although central coordination is one of the facilitating roles of SLSEA, the process is not streamlined to address the key issues being faced by developers.

At the time when wind power development started (around 2007), the project approval process in existence was entirely small hydro-oriented and this caused serious difficulties for the pioneering wind projects as line agencies had no exposure to the issues related to wind projects<sup>20</sup>. Absence of a central coordination agency and the general lack of objectivity in review of project proposals by respective line agencies are two major constraints in the renewable energy project development process in Sri Lanka.

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<sup>20</sup> In one instance, a developer had been directed to obtain approval from the Irrigation Department for his wind project



### High Capital Cost

Since early eighties, the capital cost of wind power projects had been steadily declining worldwide mainly due to:

- Learning curve effect (learning curve during technology development)
- Scale economies of total project size (the larger the project size, the lower the specific project cost - \$/kW)
- Scale economies in manufacture (the larger the number of units per order, the lower the unit cost)
- Scale economies of unit size (the larger the individual machine, the lower its unit cost)

However, according to a US study<sup>21</sup> capital costs of wind projects have taken an upward trend since about 2003 due to several reasons that include increasing material prices and rapidly growing demand for wind equipment in the world market. This indeed had a major impact on the cost of Sri Lanka wind projects that were taking off around this period.

### Land Acquisition

Land that is occupied by the foundation and substation of a typical modern wind turbine is normally about 30mx30m in area. However, during the time of wind turbine installation and major repairs, temporary access is needed to a bigger land area around the turbine footing. Also the noise levels specified in the National Environment Act No. 47 of 1980 refer to a maximum noise level of 60dB at the power plant boundary. To comply with both these requirements developer need to have access to an area of about 0.5 – 0.7 ha which is about 5 - 7 times the land actually occupied by the wind turbine. In addition to these requirements, land is also needed for buildings and constructing access roads.

Outright purchase of land on this scale constitutes a major challenge for wind developers particularly in areas where agriculture remains the main livelihood of the local population. Moreover, rural land owners also consider this as an intrusion into their social and cultural environment often resulting in conflicts between developers and the local population. Bringing land owners as shareholders of the project might be an answer to this problem if the annual dividends could compensate for the loss of agricultural revenue. It remains to be seen how urban businesses would react to such a suggestion.

## 6 Solar Energy Development

### Solar Resources in Sri Lanka

Total land area of Sri Lanka lies within the equatorial belt, a region where substantial solar energy resources exist throughout much of the year. The extent of solar resources in Sri Lanka has been estimated in the past based on studies of daily total direct sunshine hours recorded at a number of weather and agricultural stations throughout the country. The results of this study shows that the distribution of annual solar resources varies from 4.2 to 5.6 kWh/m<sup>2</sup>/day across the country, with the lowest values occurring in the hill country in the south-central region. The results also showed that the country does not experience sharp seasonal changes in solar resources.

According to the solar resource map prepared by NREL<sup>22</sup>, the annual average solar radiation varies from 4.5 to 6.0 kWh/ m<sup>2</sup>/day across the country. The study shows that ample resources exist throughout the

<sup>21</sup> Biennial Review of the Cost of Wind Power – Northwest Power and Conservation Council, July 2006

<sup>22</sup> In 2003, the National Renewable Energy Laboratory (NREL) in the US prepared a solar resource map for Sri Lanka within the framework of South Asia Regional Initiative-Energy (SARI-E) funded by USAID

year for virtually all locations in Sri Lanka for PV applications, such as solar home systems and remote power applications. The variability in global horizontal solar resources is relatively small across most of the country, despite the impact of terrain characteristics on cloud formation. The resource generally varies spatially at most 20% to 30% during any given season. The highest resources are in the northern and southern regions, and the lowest resources are in the interior hill country.

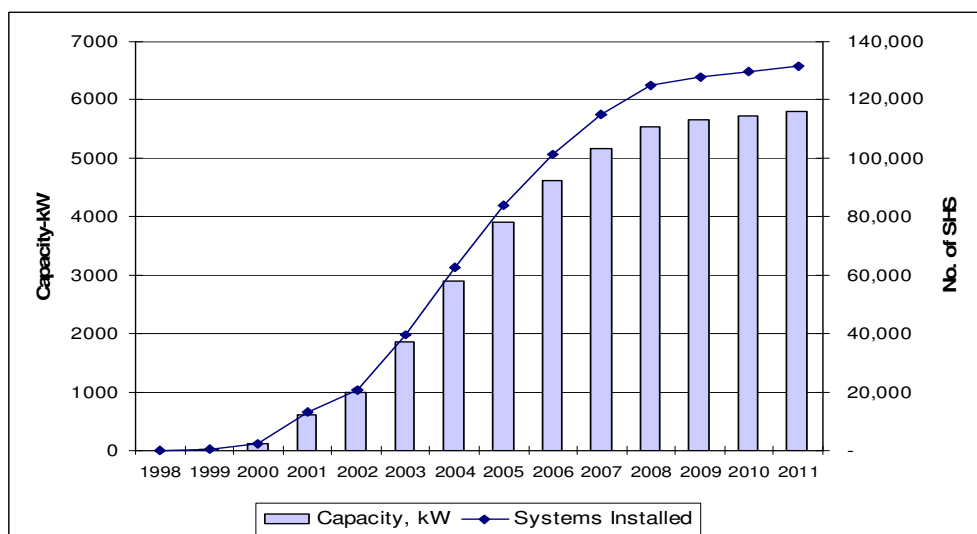
### Historic Development

Solar PV technology was introduced to Sri Lanka by CEB in early eighties as an off-grid electricity supply option in remote areas. Even though CEB interventions helped to demonstrate the technical viability of Solar PV systems (also called Solar Home Systems-SHS) for off-grid applications, they did not create a vibrant SHS industry. Seemingly, slow market uptake was due to the high capital cost of the system that was targeted at the relatively poor rural customers. Specific cost of a SHS in eighties was about USD 15-20 per peak Watt.

### Commercialisation of Solar PV Technology

Commercial scale deployment of SHS gathered momentum only in mid-nineties through the interventions brought about by the ESD project of the World Bank and continued later through the RERED project. Besides providing soft financing, ESD/RERED project also created a system of numerous support services and market linkages to enable rural customers to access SHS. In addition to the grants made available from GEF, the government of Sri Lanka also provided up to LKR10,000 (~USD 77) subsidy for Solar Home Systems (SHS). Overall impact of these interventions has been a dramatic growth of the SHS market particularly during the 2002-2005 periods (Figure 3). Since then, the SHS capacity growth rate had been declining perhaps due to the removal of RERED subsidies<sup>23</sup> and increasing grid-based electrification in Sri Lanka (~ 90% of Sri Lankan homes).

**Figure 3 - Growth of off-grid solar home systems in Sri Lanka**



### On-grid Solar PV Systems

Deployment of On-grid solar PV in Sri Lanka was first implemented by Worldview Global Media Ltd. (WGML) which is a conglomerate initiated by the Worldview International Foundation (WIF), an International NGO with consultative status with the United Nations. The solar PV plant of WGML is part

<sup>23</sup> Detailed analysis of the solar industry in Sri Lanka can be found in the publication titled "Solar Industry Growth in Sri Lanka" by James R, Finucane 2005 and "Sri Lanka Solar Industry Market Survey" by ACNielsen Lanka (Pvt) Limited

of the highly conservationist environmentally friendly office complex. Installed capacity of the plant is 18kW<sub>p</sub> and is operating under SPPA arrangement of CEB. The project was funded by a grant from Norway.

Deployment of solar PV technology for on-grid power generation as SPPs received a further boost with the announcement of a “open” tariff category<sup>24</sup> that could be applied to solar-based electricity as well. This was followed by several applications for setting up large solar PV power plants, but it remains to be seen how many of them would materialize in reality. At the moment the capacity of privately operated solar PV plants is 141 kW that includes 123 kW of solar PV capacity installed in a hotel in Anuradhapura.

### **Solar Energy Park**

Under the direction of the Ministry of Power and Energy (MoPE) solar energy development in the southern region was started in year 2009 focusing on demonstrating the commercial use of solar PV for on-grid power generation. This demonstration solar PV power plant is sited in Hambantota. The project has been financed with grant aid provided by the government of Japan (phase 1) and the government of Korea (phase 2). Under phase 1, a solar PV power plant of installed capacity 737kW<sub>p</sub> was installed at a cost of LKR 1024 Million. Phase 2 project consists of a power plant of capacity 500 kW<sub>p</sub> built at a cost of LKR 627 million (LKR 513 million provided by the Korean government and LKR 114 million of counterpart funds from the Sri Lanka government).

The project aims at creating the energy park concept where SEA would acquire required land and develop the infrastructure and invite private sector to invest in solar PV plants. The concept has created considerable interest among the investors and has now attracted 21 projects for 145MW<sub>p</sub> of capacity, exceeding the available land area of 20ha. Efforts are underway to acquire 240 ha in the same geographical area to cater to this demand.

## **7 Net Metering Scheme for Small Renewables**

In addition to the SPP program, the Government made a policy decision in year 2008 to allow any electricity customer who generates electricity using a renewable energy source to connect his facility to the distribution network. Unlike in the SPP program, these customer-owned facilities are expected to be of small capacity, and hence they would be allowed to be connected through the existing electricity connection of the customer’s premises.

In this mode of operation there will be no payment for the electricity exported by the customer to the grid. Any exports will be set-off against the customer’s own electricity consumption. In other words, the grid would act as an energy bank, accepting customer’s energy surpluses and returning the energy back to the customer on demand.

The customer’s electricity purchase from the distribution network and the electricity exported by the customer to the distribution network shall both be measured. The customer shall be billed only for the net amount of energy purchased from the Distribution Licensee. Accordingly, the scheme is referred to as the “Net Energy Metering Program”. The installed capacity of such generating facilities should be less than customer’s contract demand and is subject to maximum installed capacity of 42 kVA.

### **Plants in Operation**

Nikini Automation Systems, which is a company that is providing solutions to a variety of industrial automation needs, is among the pioneering companies in Sri Lanka which actively promoted grid-connected solar PV systems.

<sup>24</sup> Any other renewable energy technology (electricity produced based on SPPA) that does not have a declared tariff would be offered a flat tariff of LKR 20.70/kWh, for 20 years

At present, the largest grid-connected solar PV system (125kW<sub>p</sub>) installed by Nikini is in Ulagalla Resorts in Anuradhapura which has been built as an eco-friendly hotel. Nikini claims to have sold several smaller systems to household and commercial customers with an aggregate capacity of 75kW<sub>p</sub> in addition to 25kW<sub>p</sub> solar PV plant on company's own office building which is operated on net metering mode.

## 8 Solar Roof Top Projects

There is no specific policy by the Government to promote the use of solar roof top generation in the country. While the Net Energy Metering Program allows the private parties/ households to get the solar roof top units installed, the prohibitive cost deters the wider use of the technology apart from few commercial establishments.

A Public Private Participation (PPP) model can be considered for solar roof top projects. For instance, Government Buildings could be used for installing the units while the same could be developed and maintained by the private parties which are selected through some competitive process. There are similar instances from elsewhere in Asia of a PPP model for solar roof top. The advantages of PPP model based on competitive bidding are several:

- A pilot project could be developed for speedier roll out of technology
- Competitive bidding can bring down the cost
- Government's involvement would guarantee replication across the country
- Private participation will bring efficiencies
- There is possibility of getting grant funding from multi-lateral agencies for promotion of these new technologies

The roll out of PPP model would require certain capacity building for SLSEA to manage and run the process.

## 9 Some Strategies for Wind and Solar Development

Experience with the development of initial wind projects has shown that providing a commercially attractive tariff alone was not sufficient to create a dynamic wind power industry. Based on the review of project development constraints in the previous section and taking into consideration our wider experience in the field, we propose that future wind & solar power development be carried out following a *park concept*.

This concept essentially means that, as against the present method of allowing developers to select their own project sites, SLSEA will select resource-rich (wind and solar) regions in the country and map out & develop specific sites for project development according to a long-term master plan. The long-term master plan will consider (a) technically and economically feasible wind / solar power penetration scenario over the selected planning horizon based on CEB's generation plan and system operational considerations and (b) socio-economic and environmental sensitivity of the selected project sites. Ideally, the master plan should look at a 20-year time horizon and also cater to emerging technologies & applications as well, e.g. hydrogen production for use in fuel-cells, solar-powered charging of electric cars, etc.

Some preliminary activities of such a master plan to be carried out at government's own expense (to be recovered later through the tariff) in respect of selected project areas are:

- Formulation of a scheme for acquisition of land parcels to site wind turbines through a process of extensive stakeholder consultation

- Carrying out on-site wind monitoring in conformity to the applicable international standards
- Carrying out geo-technical studies in each project site
- Carrying out site specific initial environmental examination (IEE)
- Designing a detailed road development plan for the selected region conforming to the requirements of transporting wind equipment
- Designing a network of power transmission lines and sub-stations to transmit power from all the identified sites

It is proposed that development & implementation of the master plan be entrusted to SLSEA with additional powers if necessary. Once a site is developed, SLSEA will offer it to prospective developers through a competitive bidding process. The framework for developing the competitive bidding guidelines, process and necessary documentation needs to be undertaken by the coordinating agency, SLSEA in this case.

There is also a need for coordinating the efforts with other agencies, for instance, road and transmission line construction can be undertaken only after the assurance of the development of indicated capacities and aligning the timelines for these developments.

## A 5. Annex 5: Solar Roof Top Pilot Concept Note

### 1 Background

The proposed 2012 Clean Energy and Network Efficiency Improvement Project will include developing a solar rooftop power generation pilot of about 1 mega-watt (MW) capacity on a public-private partnership (PPP) basis. The project will aim to encourage development of a private sector market for solar rooftop power generation, contribute to increase in renewable power generation, encourage wide use of solar rooftop applications, and serve as a benchmark for replication. The pilot will address the following barriers for developing solar power in Sri Lanka:

- (i) excessive capital costs through use of a competitive bidding framework;
- (ii) general lack of awareness of the capabilities of solar photo-voltaic (PV) systems through a demonstration effect and use of net metering systems;
- (iii) need to dedicate large amounts of scarce land for solar power generation in Sri Lanka; and
- (iv) lack of opportunities for universities and research institutes to undertake research in emerging areas of renewable technologies.

Currently, net-metering with free energy banking facility is available to all electricity customers in Sri Lanka, provided the primary source is renewable. About 50 small rooftop solar PV systems are already in operation on net-metered basis along with two ground mounted solar projects of 500 kW and 737 kW capacity built through bilateral grants. The small rooftop solar PV systems presently operational on net metering basis have overcome the tariff barrier by effectively ignoring the economics, basing the investment on other benefits as perceived by such investors. Sri Lanka has no feed-in tariff for solar PV and the two ground mounted PV projects have thus used the non-cost reflective special tariff offered for technologies announced for projects signed up over a limited period in 2011. In the absence of a cost-reflective feed-in tariff, the only avenue for solar power project development in the current policy and regulatory regime is through existing net-metering regulations.

The key considerations of the Ministry of Power and Energy (MOPE), the executing agency, are that the proposed pilot project should not: (i) cause any financial burden on customers or utilities, and (ii) cause any economic burden on the government, including the requirement for subsidies to be given.

### 2 Brief description of the pilot

The pilot will include options for installing the rooftop systems on public buildings/universities on a PPP basis (i.e., installation, operation and maintenance handled by the private sector). In addition, the project will also help to facilitate a sustainable private sector participation in solar rooftop project development by involving private entities (hotels, private factories, commercial entities, etc.). The project will also have a component to provide project implementation and monitoring consultancy support to the Sustainable Energy Authority (SEA) in its role as the implementation agency for the duration of the project implementation.

The projects on the public buildings/universities will be developed on a PPP mode through allocation of an investment grant portion by the government for installing solar rooftop power generation on selected university buildings. The financing of private sector solar rooftop projects will be undertaken by providing credit to eligible private developers from a credit line as part of the project loan. The proposed pilot solar systems are expected to be bided out to the private sector for designing, developing, installation and commissioning that may help to bring down capital costs to a reasonable level. The scope can include a maintenance contract for period of 10 years. National Competitive Bidding (NCB) procedures would be adopted for the selection of service providers. SEA will be supported by project management consulting services to ensure effective implementation and monitoring of the pilot project and contribute to capacity building in SEA. It is proposed to finance these consulting services (one national consultant for 24 person-months) from the grant proceeds.

The government buildings identified for the purpose of developing solar rooftop power generation pilot subprojects include the four key universities, including those with engineering faculties, namely University of Moratuwa (Colombo, Western province), University of Peradeniya (Kandy, Central province), University of Jaffna (Jaffna, Northern province) and University of Ruhuna (Galle, Southern province). The expected capacity to be developed at each of these locations would be around 50 kW. The subprojects would be based on the net metering concept. The subprojects in universities of Moratuwa and Peradeniya may be extended for solar power research.

The subprojects proposed to be developed by the private developers would be selected on the basis of transparent selection criteria but would be restricted to the locations in and around the cities of Colombo, Kandy and Jaffna. Around 3 sites would be selected in each of the identified geographical locations.

### 3 Cost estimate and financing plan

The cost estimates for the pilot solar rooftop project are based on market analysis and information available from service providers in Sri Lanka and international price benchmarks for the equipment in South Asian market and presented in Table 1 below.

**Table 7: Cost Estimates for 1 MW solar rooftop**

Description	Amount (USD '000 per MW)	Share of Total
Modules	1,470	50.7%
Inverter	670	23.1%
Balance of System		
Civil Works	190	6.6%
Transportation	30	1.0%
Other Costs (Design, Metering)	330	11.4%
Contingencies	210	7.2%
<b>Total</b>	<b>2,900</b>	<b>100.0%</b>

The total financing available for the pilot project is USD 3 million, comprising of USD 1.5 million as a grant and additional USD 1.5 million as counterpart funding by the government to be provided from the ADF loan proceeds. Based on the cost estimates, a total capacity of 1 MW can be developed under the pilot, provided a competitive bidding process is followed which will bring down the capital cost. Out of the total amount of the proposed financing, USD 100,000 from the grant proceeds would be allocated for the project implementation and monitoring support to SEA. The financing plan is provided in Table 2 below.

**Table 2: Financing Plan**

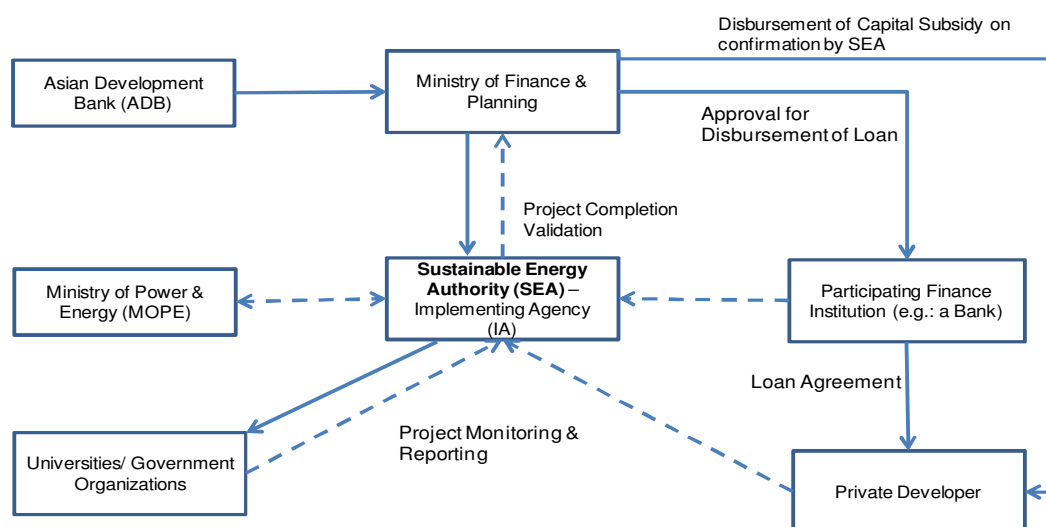
Description	USD Thousand			
	Total	Government Institutes	Private Sector Subprojects	Project Implementation support
CEF Grant	1,500	580	820	100
ADB Loan	1,500		1,500	



<b>Total</b>	<b>3,000</b>	<b>580</b>	<b>2,320</b>	<b>100</b>
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Based on cost estimates, the total cost for PPP-based subprojects for the universities (4 x 50 kW) would be USD 580,000 to be funded completely from the grant. Around 800 kW will be developed through private sector participation. The remaining amount from the grant component (USD 820,000) would be provided to the private sector as a capital subsidy on completion of relevant subprojects and verification of the same by SEA based on actual installed capacity that has been made operational. The proposed capital subsidy to the private sector will be used as an incentive for the private sector to undertake the solar rooftop sub-projects and cover a portion of the incremental cost (gap between grid supply and the cost of solar PV generation). The disbursement of the capital subsidy will be done strictly after verification of actual installed capacity, which is made operational, by SEA. The capital subsidy will be disbursed by the Ministry of Finance and Planning from a relevant grant account upon recommendation of SEA. The credit line of USD 1,500,000 to the private sector would be provided from the ADF loan, which has concessionary interest rates.

The credit facility will be channeled then from a dedicated account of the Ministry of Finance and Planning (MOFP) established in the Central Bank to an account in a participating financial institution(s) that will check repayment capacity of the developer according to its internal procedures and provide a loan to the developer. The same one or two participating financial institutions to be involved in a similar credit line implementation under the micro-hydro rehabilitation and repowering pilot of the ADB's Sustainable Power Sector Support Project maybe selected for administration of the proposed credit line. The following Figure indicates implementation arrangements for the solar rooftop power generation pilot.



#### 4 Benefits

The anticipated impact of the pilot will be increase in clean energy investments, deployment of solar power technologies with strong demonstration effects in a greater scale, and lowering barriers to solar power applications in Sri Lanka. The anticipated outcome of the pilot will be sustainable and cleaner power supply, reduction in greenhouse gas (GHG) emissions, economic benefits from utilization of renewable energy sources, and developed private sector market for solar rooftop power generation.

#### 5 Terms of Reference for Implementation and Monitoring Support for Solar

A national project management and monitoring specialist will provide support to the SEA in developing and monitoring the implementation of the solar rooftop power generation pilot. The consultant will be



engaged on an individual basis for 24 person-months for the entire expected pilot duration following ADB procedures. The consultant will assist SEA in administering the pilot, undertaking technical and financial assessment of the proposed sub-projects, monitoring and verification of equipment installation by project developers and plant operators. The tasks of the project management and monitoring specialist will include but not be limited to the following:

- (i) Assess the scope of the proposed program to develop solar rooftop and other similar properties, the range of projects and project owners, and status of potential sites;
- (ii) Develop a management and reporting structure for SEA's role as the implementing agency, and descriptions/instructions required as reference material for the SEA's staff to ensure smooth operation of the approval, funding and monitoring mechanism;
- (iii) Assist SEA in undertaking technical and financial assessment of the proposed sub-projects;
- (iv) Prepare a financing monitoring framework for review of project implementation progress;
- (v) Assist SEA in regular monitoring and reporting for the subprojects under implementation;
- (vi) Assist SEA in verifying and validating the project completion results including installed capacity which is in actual operation; and
- (vii) Perform other activities which may be required.

## A 6. Annex 6: Institutional Capacity Building for Renewable Sector

The two key entities in the development of renewable sector in Sri Lanka are Sri Lanka Sustainable Energy Authority (SLSEA), Ceylon Electricity Board (CEB). We have assessed the current situation to identify the key gap areas in the institutional framework and capacity/ know for undertaking the present tasks and meeting the future requirements.

### 1 Key Focus Areas

In order to develop the renewable sector in Sri Lanka and impart the required impetus through technology innovation and commercial viability, there is a need to develop institutional capacity in the system. SLSEA and CEB are two key stakeholders in addition to MoPE in taking forward the development of renewable. The following key focus areas have been identified based on the as is system review and undertaking a gap analysis.

#### Technical Expertise for network studies

Sri Lankan power system is not very large and is still in growth phase of development. The recent and future trends in generation are directed towards a change in the fuel mix from hydro pre dominance to having reasonable coal based generation. In addition, there is a keen focus on development of renewable energy sector for wind, solar and biomass technologies with a target to have 15% share of energy from the renewable resource by 2020. All these developments pose challenges for the transmission system planning which is required to undertake detailed network studies to ensure absorption of the infirm power in the system while maintaining the minimum system security standards. These are relatively new challenges for system planners to address while very little historical understanding of issues exists within the country.

Hence, there is a need for adequate capacity building in the transmission planning department to develop broader understanding of issues. This could be addressed through a hands-on training for the planners, facilitating interactions with other countries where similar issues have been addressed.

#### Technical Expertise for resource assessment, planning and technology selection

##### Project Approval, Facilitation and Monitoring

SLSEA is mandated to perform the functions for project approval, facilitation and monitoring as per the SLSEA Act (No 35 of 2007). These functions require specific understanding of the various rules and regulations, a strong policy and procedures

#### Conducting bidding and evaluation of proposals

Based on our detailed assessment of the Sri Lankan power system and review of the existing processes and procedures, the following activities would be covered:

- Detailed study of system stability matters taking into consideration the addition of renewable sources in the system
- Support in preparation of feasibility studies and master plans for the proposed wind and solar power parks;
- Evaluation of PPP options and preparation of a business model for development of renewable resources including solar rooftop;
- Preparation of relevant competitive bidding documentation (bidding documents, a draft power purchasing agreement [PPA], etc.) for the proposed wind and solar parks to attract the private sector with the aim to obtain the lowest possible tariff and ensure that the private sector will bear a technology risk and will be interested in proper maintenance during the relevant project life;

- Conducting bidding and evaluation of proposals;
- PPA negotiation and deal structuring for the proposed wind and solar parks;
- Identify key areas for CEB to build technical capability for conducting the studies for renewable energy capacity additions to the system.

## 2 Themes for Capacity Building

The planned Capacity Building program addresses the needs of organizations expected to work with SLSEA in program implementation. Specifically, capacity building of the energy auditors and energy services companies certified by SLSEA will be a part of the capacity building initiative. In order to ensure a long-term capacity building initiative, the plan also includes collaboration with the utilities, planning and implementation agencies, institutions involved in training, etc.

- Understanding of past, current and future energy consumption in Maharashtra
- Planning of utility capacity development and tariff plans
- Database management
- Understanding of current and forthcoming regulatory processes
- Market research
- Technology assessment and testing procedures
- Financial analysis related to proposed program areas
- Market promotion, advertising and outreach
- Training in conducting and evaluating audits

## 3 SLSEA Gap Analysis

SLSEA has been established under the Sri Lanka Sustainable Energy Authority Act, No. 35 of 2007 and is required to perform various statutory functions like

- To develop renewable energy resources
- To declare energy development areas
- To implement energy efficiency measures and conservation programmes
- To promote energy security, reliability and cost effectiveness in energy delivery and information management

Based on the long term vision of SLSEA as outlined in the Act and the in short to medium term strategic objectives to be achieved, SLSEA needs to undertake certain specific initiatives outline below:

- Develop a comprehensive rolling Renewable Resource Master Plan for 10 years backed by detailed resource wise development plan
  - Resource Assessment Mapping
    - Macro level mapping for longer period of time - Long term plan and programme for macro-level mapping
    - Guidelines, standards & norms for minimum site data for renewable energy project development

- Technology assessment strategy
  - Mapping the stage of development of each RE technology including supply chain, technology capability and manufacturing capacity at the national level
  - Develop a database based on installed/ demonstration projects for mapping technology performance
- Understanding of current and forthcoming regulatory processes
  - Mapping the economic and financial rationale (into the future) of investing in RE technologies
  - Evaluate pros and cons for introduction of renewable purchase obligations and renewable energy certificates
- Wind Park Master Plan for the development of wind resources in the identified park sites in the country. This would include the existing developments in Putlam area and proposed park in Mannar region.
  - Resource assessment studies (already being conducted under a separate TA)
  - Environmental Impact Assessment studies
  - Bid process management, development of documents for bidding
- Solar Park Master Plan for the proposed Hambantota park site
- RE Project implementation
  - Development of a single window concept for faster execution of projects
  - Development and management of comprehensive database for the project monitoring
  - Web based tool for facilitating project development – project lifecycle mapping and step description
  - Identify training and capacity building programmes with technical institutions for RE technology
- Preparation for the implementation of Solar Roof Top Projects including
  - identification of potential sites
  - Coordination with other agencies
  - Development of a business model
  - Preparation of documents for selection criteria, implementation agreements with the developers, etc
  - Managing the bidding process
  - Implementation monitoring framework
- Financial analysis capabilities related to proposed programs
- Policy and Regulatory Advocacy
  - Market research capability
  - Interactions with international institutions, sharing of experiences from other countries

- Communication and outreach strategy

Based on the As-Is analysis of the functions of SLSEA as derived from the Act, we have categorized the existing institutional capacity to undertake various statutory functions as shown below:

(a) Renewable Energy Thrust

RE Resource Assessment	Moderate
RE Planning	Moderate
Project Approval	Low
Project Facilitation	Low
Project Monitoring	Low
Land Matters	High
Project Prospecting	Low
RE Facilities	Low
Rural Energy Services	Low
Technology & Solutions	Low

(b) Energy Management Thrust

Systems & Compliance	High
Monitoring & Verification	High
Energy Efficiency Services	Low
Efficient Technologies	Moderate
Outreach & Communication	Low
Capacity development	Low
Regional Operations	Low

(c) Policy & Planning Function

Economic Affairs	Low
Policy Formulation	Low

(d) Resource Mobilization Function

CDM Cell	Low
Investments	Low
Fund Mobilization	Low
Revenue	Low

## (e) Support Functions

Corporate Affairs	Medium
Enforcement	Low
Finance	Low
Procurement	Low
Office Infrastructure	Low
Logistics & Support services	Low

#### 4 Capacity Building needs of EA/IA for renewable energy development in Sri Lanka

The following areas have been identified for capacity enhancement:

- Preparation of a Renewable Resource Master Plan for Sri Lanka
- Development of wind park concept with specific focus on the requirements of Mannar wind park currently proposed
- Evaluate the options for development of solar resources (rooftop, PV based, Solar Thermal) including concept of solar park on lines of wind park

##### Technology and Resource Mapping

The SEA has undertaken some RE technology mapping which provides insight on the basic technologies which shall have high applicability in Sri Lanka the focus has so far been in the areas of small wind turbines. However, there is a need to carry out a comprehensive exercise based on its renewable energy resource base and the national energy needs assessment.

SEA has some capacity in renewable energy resource assessment especially in hydro and wind. There is still a need to carry out resource assessment in other areas like solar, biomass, MSW, geothermal, etc. The hydro maps are mostly complete, due to large number of operating projects and wind resource has been mapped in low resolution and needs to be substantiated by regions for investors to develop the projects.

The SEA has been trying to work with academic institutions like University of Moratuwa and develop educational and research facilities in the areas of various renewable energy technologies which could act as an advisor on complex technology issues. However, this is still to be materialized. It would be an excellent idea to develop centers of excellence in different Universities / national labs in Sri Lanka.

##### Project Monitoring and Development

The SEA has dedicated resource allocation unit in project monitoring and regulation expertise but is primarily focused on hydro, wind and biomass. This is headed by the Director (Economic Affairs). However, this division has not been able to perform as it is currently overloaded with regulation and allocation matters.

##### Other Technical aspects and role of Other Institutions

The key constraint in the scale up of the renewable energy development has been primarily to address the issues of renewable energy variability and the ability to maintain the grid stability. Both CEB and SEA have to address this aspect and there is a need to draw upon the experiences in other countries primarily from Europe, China, India and other countries which have high wind and solar deployment.

Although, there exists technical and regulatory standards and specifications for renewable energy sources to interconnect to the grid there is a need to consider, resource specific vagaries and their implications on the grid by considering the state-of-the-art information and technologies.

Also, there is a need for standardization in the process of laying down technological norms for installations of RE projects. The renewable energy sector is self-evolving but process can be guided to achieve the objective in an efficient and a well-defined manner.

There is also a need for CEB - the key stakeholder to start including high renewable energy availability areas/ sites/ zones as potential generation sites and start planning for development of infrastructure at these sites. There is also a need to have other agencies responsible for infrastructure like roads and railways to start planning for infrastructure for these sites as well.

Both the CEB and SEA need to have access to global technology databases which will assist them in the development of future policy and regulations. Currently, SEA closely follows studies carried out by EWA and other organizations. In-addition, there is a need to have national level symposiums, workshops etc. to create awareness and facilitate innovation from a local perspective.

### **Technology Absorption and Innovation**

SEA has taken some steps toward developing a manufacturing base in some technologies and has also provided incentives. Sri Lanka has already established a good hydro turbine manufacturer and a wind turbine manufacturer which received SEA support. Locally made machinery is paid around LKR 0.5-0.75 more per kWh. However, much remains to be done in other solar technologies and there is a need to undertake an assessment of the various renewable energy value chains and explore areas where local industry can play a role manufacture of RE components based on future potential.

The SEA is trying to woo foreign technology providers to come to Sri Lanka and invest (independently or as a JV) in renewable energy supply chain development. However, major player who would like to cater to the global market are reluctant to set-up their facilities here unless they find some niche application in Sri Lanka, more so because of limited local market.

Both CEB and SEA needs to come up with programs for demonstrating potential renewable energy technologies to address country specific barriers. They will need both financial and technical support to address this aspect. As of date they have a solar PV pilot project, a hydro demonstration centre which is under commissioning a wind pilot by CEB and now promoting a solar thermal with ADB. It is also important to involve the Government of Sri Lanka to address these aspects.

So far the SEA has only one R&D collaboration on wind turbine related issues there is a far greater need to explore the possibility of technical collaborations with global research firms working across other renewable energy technologies. This could also extent to CEB, who needs to consider power systems stability related issues and dispatch of variable power.

Both CEB and SEA need to build capacities by sending its professionals and RE practitioners in the country for training to institutions abroad with expertise in renewable energy development. SEA is unable participate as it lacks adequate staff and resources.

### **Regulatory and Commercial Aspects**

The financial parameters for renewable energy projects such as ROE, IRR etc. are still under negotiation by between the regulators and the private developers. The private developers expect 22% ROE, but Government thinks it must be 4%+AWDR. It is suggested that a training program is conducted for all stakeholders including the developers and financial institutions on innovative financing and how to address technology related risks.

The experiences of CEB on Wheeling and Banking (W & B) does not seem to be positive; this could be one of the key areas in terms of technical as well as regulatory aspects that can be taken up for capacity building involving key stakeholders.

CEB and other utilities lack funds to support the target of 20% of power from renewables to be supplied by 2020. Also, it is very unlikely to burden the consumer as they pay much higher than most developing country domestic consumers per kWh. The government has been imposing fuel surcharge based on international oil prices. Therefore there is need to have a fresh perspective on financing and electricity pricing.

Project developers are likely to face challenges in procuring finances from financial institutions with the end of RERED. Most the banks/financial institutions have the adequate capacity to appraise the projects in wind and hydro but are wary of handling other renewable energy technologies. Also, most of the financial institutions do not provide long-term loans to renewable energy project developers and the funding is mostly restricted to 5 to 8 years and this likely to front load the tariff reducing returns to the investors. It is proposed that advance training programs on business models in provided to all stakeholders, including regulators, CEB, SEA etc.

The current mechanism for the allotment of renewable energy projects is based on first come first serve basis, this leads to higher capital costs and higher tariffs. It is therefore essential to introduce a competitive bidding process involving private sector participation which will lead to a price discovery based on local economic and market conditions. It proposes that a capacity building exercise is carried on how to carry out a fair competitive bidding process in a few pilot projects.

## 5 CEB

Sri Lankan power system is not very large and is still in growth phase of development. The recent and future trends in generation are directed towards a change in the fuel mix from hydro pre dominance to having reasonable coal based generation. In addition, there is a keen focus on development of renewable energy sector for wind, solar and biomass technologies with a target to have 15% share of energy from the renewable resource by 2020. All these developments pose challenges for the transmission system planning which is required to undertake detailed network studies to ensure absorption of the infirm power in the system while maintaining the minimum system security standards. These are relatively new challenges for system planners to address while very little historical understanding of issues exists within the country.

Hence, there is a need for adequate capacity building in the transmission planning department to develop broader understanding of issues. This could be addressed through hands on training for the planners, facilitating interactions with other countries where similar issues have been addressed.



## **A 7. Annex 7: Project Cost Estimates by Categories**

**1: Detailed Cost Estimates by Expenditure Category**

Item	LKR Million			USD Million			
	Foreign Exchange	Local Currency	Total Cost	Foreign Exchange	Local Currency	Total Cost	% of Base Cost
<b>A. Investments</b> a/							
1. Civil works and erection	2,885.93	4,067.96	6,953.90	22.87	32.23	55.10	32.46%
2. Equipment	9,281.39	1,362.22	10,643.62	73.55	10.79	84.34	49.68%
3. Consultant							
a. Project management	-	12.62	12.62	-	0.10	0.10	0.06%
4. Taxes and duties	-	3,139.86	3,139.86	-	24.88	24.88	14.66%
<b>Sub Total (A)</b>	<b>12,167.33</b>	<b>8,582.67</b>	<b>20,750.00</b>	<b>96.41</b>	<b>68.01</b>	<b>164.42</b>	<b>96.85%</b>
<b>B. Other Costs</b>							
1. Land	-	-	-	-	-	-	0.00%
2. Environmental & Social Mitigation	-	502.57	502.57	-	3.98	3.98	2.34%
3. Project management and construction supervision	-	171.22	171.22	-	1.36	1.36	0.80%
<b>Sub Total (B)</b>	<b>-</b>	<b>673.79</b>	<b>673.79</b>	<b>-</b>	<b>5.34</b>	<b>5.34</b>	<b>3.15%</b>
<b>Total Base Cost</b>	<b>12,167.33</b>	<b>9,256.46</b>	<b>21,423.79</b>	<b>96.41</b>	<b>73.35</b>	<b>169.76</b>	<b>100.00%</b>
<b>C. Contingencies</b>							
1. Physical c/	475.89	20.85	496.74	3.77	0.17	3.94	2.32%
2. Price d/	186.30	1,057.21	1,243.51	1.48	8.38	9.85	5.80%
<b>Sub Total (C)</b>	<b>662.19</b>	<b>1,078.06</b>	<b>1,740.25</b>	<b>5.25</b>	<b>8.54</b>	<b>13.79</b>	<b>8.12%</b>
<b>D. Financing Charges During Implementation</b>							
1. Interest during construction e/	278.71	1,750.26	2,028.97	2.21	13.87	16.08	9.47%
2. Commitment Charges	46.89	-	46.89	0.37	-	0.37	0.22%
<b>Sub Total (D)</b>	<b>325.60</b>	<b>1,750.26</b>	<b>2,075.86</b>	<b>2.58</b>	<b>13.87</b>	<b>16.45</b>	<b>9.69%</b>
<b>Total Project Cost (A+B+C+D)</b>	<b>13,155.12</b>	<b>12,084.78</b>	<b>25,239.89</b>	<b>104.24</b>	<b>95.76</b>	<b>200.00</b>	<b>117.81%</b>

a/ In Apr 2012 Prices

b/ Internal CEB cost allocation capitalized to project account

c/ Computed at 4.0% of base costs

d/ Computed at 0.5% on foreign exchange costs and 7% on local currency costs

e/ Interest during implementation has been computed at the five year forward Libor rate plus a spread of 0.4% and an onlending margin of 6.9% for OCR loan components, and at a base rate of 1.0% with an onlending margin of 7.16% for ADF loan components

## 2: Detailed Cost Estimates by Financier

Item	USD Million Cost	ADB				Grant		Government/ CEB	
		OCR	% of cost category	ADF	% of cost category	Amount	% of cost category	Amount	% of cost category
<b>A. Investments</b>									
1. Civil works and erection	55.10	30.25	54.90%	14.02	25.45%	-	0.00%	10.83	19.65%
2. Equipment	84.34	67.63	80.19%	15.52	18.40%	1.19	1.41%	-	0.00%
3. Consultant									
a. Project management	0.10	-	0.00%		0.00%	0.10	100.00%	-	0.00%
4. Taxes and duties	24.88	-	0.00%		0.00%	-	0.00%	24.88	100.00%
<b>Sub Total (A)</b>	<b>164.42</b>	<b>97.88</b>	<b>59.53%</b>	<b>29.54</b>	<b>17.97%</b>	<b>1.29</b>	<b>0.78%</b>	<b>35.71</b>	<b>21.72%</b>
<b>B. Other Costs</b>									
1. Land	-	-	0.00%	-	0.00%		0.00%		0.00%
2. Environmental & Social Mitigation	3.98	-	0.00%	-	0.00%	-	0.00%	3.98	100.00%
3. Project management and construction supervision	1.36	-	0.00%	-	0.00%	-	0.00%	1.36	100.00%
<b>Sub Total (B)</b>	<b>5.34</b>	<b>-</b>	<b>0.00%</b>	<b>-</b>	<b>0.00%</b>	<b>-</b>	<b>0.00%</b>	<b>5.34</b>	<b>100.00%</b>
<b>Total Base Cost</b>	<b>169.76</b>	<b>97.88</b>	<b>57.66%</b>	<b>29.54</b>	<b>17.40%</b>	<b>1.29</b>	<b>0.76%</b>	<b>41.05</b>	<b>24.18%</b>
<b>C. Contingencies</b>									
1. Physical	3.94	-	0.00%	-	0.00%	-	0.00%	3.94	100.00%
2. Price	9.85	-	0.00%	-	0.00%	0.21	2.13%	9.64	97.87%
<b>Sub Total (C)</b>	<b>13.79</b>	<b>-</b>	<b>0.00%</b>	<b>-</b>	<b>0.00%</b>	<b>0.21</b>	<b>1.52%</b>	<b>13.58</b>	<b>98.48%</b>
<b>D. Financing Charges During Implementation</b>									
1. Interest during construction	16.08	1.75	10.89%	0.46	2.84%	-	0.00%	13.87	86.27%
2. Commitment Charges	0.37	0.37	100.00%	-	0.00%	-	0.00%	-	0.00%
<b>Sub Total (D)</b>	<b>16.45</b>	<b>2.12</b>	<b>12.90%</b>	<b>0.46</b>	<b>2.78%</b>	<b>-</b>	<b>0.00%</b>	<b>13.87</b>	<b>84.33%</b>
<b>Total Project Cost (A+B+C+D)</b>	<b>200.00</b>	<b>100.00</b>	<b>50.00%</b>	<b>30.00</b>	<b>15.00%</b>	<b>1.50</b>	<b>0.75%</b>	<b>68.50</b>	<b>34.25%</b>

**3: Detailed Cost Estimates by Outputs/ Components**

Item	Total Cost	USD Million					
		Component 1		Component 2		Component 3	
		Amount	% of cost category	ADF	Amount	% of cost category	Amount
<b>A. Investments</b>							
1. Civil works and erection	55.10	22.64	41.08%	32.25	58.52%	0.22	0.40%
2. Equipment	84.34	18.56	22.01%	63.30	75.06%	2.47	2.93%
3. Consultant							
a. Project management	0.10	-	0.00%	-	0.00%	0.10	100.00%
4. Taxes and duties	24.88	5.82	23.37%	19.06	76.63%	-	0.00%
<b>Sub Total (A)</b>	<b>164.42</b>	<b>47.02</b>	<b>28.59%</b>	<b>114.62</b>	<b>69.71%</b>	<b>2.79</b>	<b>1.70%</b>
<b>B. Other Costs</b>							
1. Land	-	-	0.00%	-	0.00%		0.00%
2. Environmental & Social Mitigation	3.98	1.32	33.06%	2.67	67.00%		0.00%
3. Project management and construction supervision	1.36	0.36	26.63%	0.99	73.13%		0.00%
<b>Sub Total (B)</b>	<b>5.34</b>	<b>1.68</b>	<b>31.42%</b>	<b>3.66</b>	<b>68.56%</b>		<b>0.00%</b>
<b>Total Base Cost</b>	<b>169.76</b>	<b>48.69</b>	<b>28.68%</b>	<b>118.28</b>	<b>69.67%</b>	<b>2.79</b>	<b>1.64%</b>
<b>C. Contingencies</b>							
1. Physical	3.94	1.26	31.97%	2.68	68.03%		0.00%
2. Price	9.85	2.62	26.60%	7.02	71.27%	0.21	2.13%
<b>Sub Total (C)</b>	<b>13.79</b>	<b>3.88</b>	<b>28.13%</b>	<b>9.70</b>	<b>70.34%</b>	<b>0.21</b>	<b>1.52%</b>
<b>D. Financing Charges During Implementation</b>							
1. Interest during construction	16.08	4.63	28.80%	11.45	71.21%	-	0.00%
2. Commitment Charges	0.37	0.10	27.25%	0.27	73.17%		0.00%
<b>Sub Total (D)</b>	<b>16.45</b>	<b>4.73</b>	<b>28.77%</b>	<b>11.72</b>	<b>71.25%</b>		<b>0.00%</b>
<b>Total Project Cost (A+B+C+D)</b>	<b>200.00</b>	<b>57.30</b>	<b>28.65%</b>	<b>139.70</b>	<b>69.85%</b>	<b>3.00</b>	<b>1.50%</b>

**4: Detailed Cost Estimates by Years**

		USD Million				
		Total Cost	Year 1	Year 2	Year 3	Year 4
A.	<b>Investments</b>					
	1. Civil works and erection	55.10	3.11	14.92	18.03	19.04
	2. Equipment	84.34	4.48	22.85	27.33	29.69
	3. Consultant					
	a. Project management	0.10	-	0.05	0.05	-
	4. Taxes and duties	24.88	1.34	6.51	7.89	9.15
	<b>Sub Total (A)</b>	<b>164.42</b>	<b>8.92</b>	<b>44.33</b>	<b>53.30</b>	<b>57.87</b>
B.	<b>Other Costs</b>					
	1. Land	-	-	-	-	-
	2. Environmental & Social Mitigation	3.98	0.22	1.07	1.29	1.40
	3. Project management and construction supervision	1.36	0.07	0.36	0.46	0.46
	<b>Sub Total (B)</b>	<b>5.34</b>	<b>0.29</b>	<b>1.43</b>	<b>1.76</b>	<b>1.86</b>
	<b>Total Base Cost</b>	<b>169.76</b>	<b>9.22</b>	<b>45.76</b>	<b>55.05</b>	<b>59.73</b>
C.	<b>Contingencies</b>					
	1. Physical	3.94	0.22	1.05	1.26	1.41
	2. Price	9.85	0.18	1.87	3.42	4.38
	<b>Sub Total (C)</b>	<b>13.79</b>	<b>0.40</b>	<b>2.92</b>	<b>4.68</b>	<b>5.79</b>
D.	<b>Financing Charges During Implementation</b>					
	1. Interest during construction	16.08	0.30	2.00	5.10	8.68
	2. Commitment Charges	0.37	0.15	0.12	0.08	0.03
	<b>Sub Total (D)</b>	<b>16.45</b>	<b>0.44</b>	<b>2.12</b>	<b>5.18</b>	<b>8.71</b>
	<b>Total Project Cost (A+B+C+D)</b>	<b>200.00</b>	<b>10.06</b>	<b>50.79</b>	<b>64.92</b>	<b>74.23</b>

## A 8. Annex 8: Project Description

The key components of the proposed Project include the following

### 1 Transmission infrastructure strengthening in the Northern province

This component will contribute to a reliable, adequate and affordable power supply for sustainable economic growth and poverty reduction in Northern Province. The strengthened transmission system will alleviate existing sub-standard voltage conditions in Mannar district of the Northern Province and will also facilitate the evacuation of wind power capacity upto 200 MW which could come up in the region.

#### 1.1 Transmission system strengthening in Mannar Region

The project is located in the Northern Province. The project components include the following:-

- Augmentation of Vavuniya grid substation with 2x132kV double busbar transmission line bays
- Construction of Mannar grid substation with 1x31.5 MVA, 132/33 kV transformers, 132kV single busbar arrangement including bus section, 33kV single busbar arrangement including bus section, 4x132 kV single busbar transmission line bays, 1x132kV single busbar transformer bays, 4x33 kV feeder bays, 1x33kV transformer bays
- Construction of 55km, double circuit, Zebra, 132kV transmission line from New Anuradhapura to Vavuniya (with 220 kV transmission tower configuration for upgradation to 220 kV line in future)
- Construction of 70km, double circuit, Zebra, 132kV transmission line from Vavuniya to Mannar

SLSEA has identified 260 MW of wind potential in the Mannar region and studies are underway to determine the exact potential which can be harnessed based on the environmental assessment and ground level data collection. The proposed 132 kV D/C transmission line from Mannar to Vavuniya and Strengthening of 132 kV Vavuniya - New Anuradhapura line is capable of evacuating upto 200 MW of wind power from the region. In addition, the existing 6 MW of peak demand in the Mannar region is fed by Lynx Double Circuit 33 kV lines with RC poles from Vavuniya to Mannar, a distance of 100 Kms. The projected demand of the area is likely to witness exponential growth due to rehabilitation of displaced population and additional commercial and industrial activities over the next five years. Considering the above and obviously inability to strengthen and meeting the future demand, the substation of 132 kV /33 kV is required to improve the voltage profile in the area. The Anuradhapura – Vavuniya transmission line is proposed to be constructed with 220 kV tower configuration but charged at 132 kV voltage. This is a strategic link which can be used for meeting the future load requirements in northern region. The incremental cost for the construction of 220 kV tower configuration would be met by Government of Sri Lanka.

### 2 Transmission and distribution network energy efficiency improvement

The project comprises of following sub-components

#### 2.1 New Polpitiya Power Transmission Development

The project is located in Central Province and comprises of

- Construction of New Polpitiya grid substation with 2x250MVA 220/132kV transformers, 220kV double busbar arrangement including bus coupler, 132kV single busbar arrangement including bus section, 2x220kV double busbar transformer bays, 4x220kV double busbar transmission line bays, 2x132kV single busbar transformer bays and 2x132kV single busbar transmission line bays, Provision for 2x220kV double busbar transmission line bays to connect New-Polpitiya- New Galle 220kV transmission line
- Augmentation of Pannipitiya grid substation with 2x220kV double busbar transmission line bays
- Construction of 10km, double circuit, 2xZebra, 132kV transmission line from Polpitiya to New Polpitiya,

- Construction of New Polpitiya - Pannipitiya, 2xZebra, 220kV, 58.5km, double circuit transmission line through Padukka

The hydropower plants, grouped into two cascades or “complexes”, in Sri Lanka are located in the central hills the Laxapana complex and the Mahaweli Complex with capacity of around 1000 MW. The major load centre is the Western province, centered on the city of Colombo. The existing four circuits of the two 132kV transmission lines from the Polpitiya hydropower station to Kolonnawa Grid Substation in the eastern border of the Colombo city transmit bulk power generated from Laxapana Hydropower Complex to the major load centers in and around Colombo. However, due to the limitations in the current carrying capacity of these lines, severe overloading is experienced in the day time when the Laxapana Hydropower plants are in operation. Furthermore, these lines are more than 40 years old. Therefore, there is an urgent requirement to update/replace all the four circuits to facilitate enhanced power evacuation between Polpitiya and Kolonnawa to ensure that full output of the hydropower plants is delivered to the load centre without constraints and excessive losses. Similarly, Kotmale is the key hydropower plant in the Mahaweli complex and the Kotmale grid substation receives the output of many power plants in the complex. The Kotmale - Biyagama 220kV transmission line is one of the most important lines to carry bulk power generated from hydropower stations in Mahaweli Complex in Central Province to the major load centers in Colombo. The 220 kV Kotmale-Biyagama line passes through lightning prone areas and tripping of this transmission line due to lightning has caused total system blackouts in the past.

The proposed New Polpitiya - Pannipitiya 220kV transmission line would improve the system reliability as it provides (i) a higher capacity interconnection between the Laxapana complex and the load centre, effectively replacing the older lines, and (ii) an alternative route to the Kotmale-Biyagama 220kV transmission line, to deliver hydropower to the load centers in the Western province. The proposed transmission development reduces the transmission losses. Apart from the above, development of the New Polpitiya grid substation will facilitate extension of the 220kV transmission system to the Southern Province at a future date, which resolves most of the under voltage problems and line overloading problems in the Southern transmission network.

## 2.2 Padukka Power Transmission Development

Padukka is located in the eastern sector of the Western Province and the proposed system comprises of:

- Construction of Padukka Grid Substation with 2x250 MVA, 220/132/33 kV double busbar including bus coupler, 132kV single busbar including bus section, 33kV single busbar arrangement including bus section, with 4x220kV double busbar transmission line bays, 2x220kV double busbar transformer bays, 2x132kV single busbar transformer bays, 2x132kV single busbar transmission line bays, 4x33 kV feeder bays, 2x33kV S/B T/F bays, Provision for 2x220kV double busbar transmission line bays to connect Kirindiwela-Padukka 220kV transmission line and 100MVar capacitor banks at 132kV busbar
- Construction of 10 km, double circuit, 2xZebra, 132kV transmission line from Athurugiriya to Padukka
- Construction of 15 km, double circuit, 2xZebra, 132kV transmission line from Athurugiriya to Kolonnawa

Kolonnawa Switching Station is a 132kV station which serves major loads in Colombo area. Requirement of a new switching station at Padukka has been identified together with New Polpitiya-Pannipitiya 220kV transmission line in the Long Term Transmission Development Plan 2011-2020, to feed the Kolonnawa Switching Station. CEB has proposed to construct the Padukka Switching Station under the new 220kV line from New Polpitiya to Pannipitiya. Subsequently, considering the load growth in the towns to east of Colombo suburbs, it has been decided to serve 33 kV outgoing feeders too, from Padukka. Thus, in this documentation, Padukka would be classified as a grid substation. A 132kV double circuit twin zebra line is proposed from the Padukka GS (proposed) to Kolonnawa

switching station (existing) via Athurugiriya GS (existing) to transmit power generated at Laxapana hydropower complex to Kolonnawa Switching Station. Apart from transmission system strengthening, The proposed grid substation at Padukka will also improve the voltage profile of the 33 kV distribution systems and reduce distribution losses, and therefore improves the quality of supply in and around Padukka, Panagoda, Talagala, Labugama, Handapangoda and Pahathgama areas.

### 2.3 Kegalle Power Transmission Development

The project is located in the Central Province and comprises of

- Construction of Kegalle grid substation with 2x31.5 MVA, 132/33 kV transformers, 132kV single busbar arrangement including bus section, 33kV single busbar arrangement including bus section, 2x132 kV single busbar transmission line bays, 2x132kV single busbar transformer bays, 8x33 kV feeder bays, 2x33kV transformer bays
- Augmentation of Thulhiriya grid substation with 2x132 kV single busbar transmission line bays
- Installation of 15 MVAR (3x5 MVAR) capacitor banks including 33kV BSC bays at Kegalle 33kV Bus Bar to control load PF
- Construction of 22.5 km, double circuit, Zebra, 132kV transmission line from Thulhiriya to Kegalle

To meet load growth demand in areas around Kegalle, Mawanella, Polgahawela and Rambukkana areas and thereby to relieve loading of Thulhiriya and Kiribathkumbura Grid Substations, it is proposed to construct a new grid substation at Kegalle. The proposed grid substation will also improve the voltage profile of 33 kV distribution system and reduce distribution losses thus improving the quality of supply in and around these areas. This new grid substation is proposed to connect to the national power system by constructing a 14 km double circuit, Zebra, 132kV transmission line from Thulhiriya grid substation.

### 2.4 Reactive power management

The projects are located in Western Province and comprises of:

- 50MVAR at Biyagama 33kV busbar (10x5MVAR inclu. BSC bays)
- 50MVAR at Sapugaskanda 33kV busbar (10x5MVAR inclu. BSC bays)
- 30MVAR at Kolonnawa-new 33kV busbar (6x5MVAR inclu. BSC bays)
- 30MVAR at Kolonnawa-old 33kV busbar (6x5MVAR inclu. BSC bays)

According to present distribution feeding arrangements most of the major loads in and around Colombo and Gampaha are fed from grid substations in Biyagama, Sapugaskanda, Veyangoda and Kolonnawa. Proposed installation of capacitors will improve the voltage profile of the 33 kV distribution systems and thereby improves the quality of supply in the areas. Since reactive power requirement is supplied at the load centre it contributes to the reduction of system losses

### 2.5 MV Network Energy Efficiency Improvement

#### a Vavunia – Kebithigollewa 33kV Distribution Line and Gantry

The project is located in Northern Province and comprises of

- Construction of a 23 km 33 kV DC Lynx Tower Line From Vavunia GSS to Kebithigollewa
- 33 kV 2 section SBB Gantry at Kebithigollewa

The project aims to improve MV Network efficiency and provide system capacity to cater for load growth in the North Province which is forecast to grow at an average of 7% over ten year planning period. Construction of these express lines provide virtual power injection points to improve reliability , improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. The estimated energy savings per month is 45 MWh. Around 18,000 consumers would benefit from this project



### **b Anuradhapura-Kahatagasdigiliya 33 kV Distribution Line & Gantry**

The project is located in North Central Province and comprises of:

- Construction of a 31 km 33 kV DC Lynx Tower Line From New Anuradhapura GSS to Kahatagasdigiliya
- 33 kV 2 section SBB Gantry at Kahatagasdigiliya

The project aims to improve MV Network efficiency and provide system capacity to cater for load growth in the North Central Province (NCP) is forecast at an average 7% over ten year planning period. Electrification ratio (2010) for NCP is 82% and energy losses in the MV system are 1.7%. The construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. The energy saved per month is around 23 MWh and around 12,500 consumers would benefit from this project.

### **c Kiribathkumbura - Galaha 33 kV Distribution Line & Gantry**

The project is located in Central Province and comprises of:

- Construction of a 15 km 33 kV double circuit Lynx Tower Line From Kiribathkumbura GS to Galaha
- 33 kV 3 section DBB Gantry at Galaha

The load growth in the Central Province (CP) is forecast at an average 6% over ten year planning period. Electrification ratio (2010) for CP is 91% and energy losses in the MV system are 2.4%. Construction of the express line will provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. This proposed line will also help in evacuating power generated from Mul Oya mini hydro power station (5 MW) now under construction. The commissioning of this station will also help in further improving the voltage of this gantry. The energy saved per month is 648 MWh. Beneficiaries from this proposal is 14,000 consumers

### **d Akkaraipaththu - Galmadu Junction-Pothuvil 33 kV Distribution Line**

The project is located in Eastern Province and comprises of:

- Construction of 60 km 33 kV DC Lynx Tower Line From Galmadu Junction to Pothuvil via Akkaraipaththu
- 33 kV 2 section SBB Gantries at Akkaraipaththu and Pothuvil

The load growth in the Eastern Province (EP) is forecast at an average 9.5% over ten year planning period. Electrification ratio (2010) for EP is 71% and energy losses in the MV system are 4.2%. Construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility. For the Galmadu junction - Pothuvil line section, energy saved per month is 510 MWh and beneficiaries from this proposal are 35,130 consumers. For the Akkaraipaththu - Pothuvil line section, the energy saved per month in this section is 522 MWh and beneficiaries from this proposal are 46,617 consumers.

## **3 Solar Rooftop Pilot Project**

**Solar Roof-TopProject:** Development of 1 MW of solar rooftop pilot project on a Public Private Partnership (PPP) basis. 200 kW of capacity would be developed on public buildings/ universities on a PPP mode and remaining capacity would be developed on private buildings. A credit line of \$1.5 million for private developers through Government of Sri Lanka and equal to the proposed \$ 1.5 million grant from Asian Clean Energy Fund would be provided. The universities identified for the purpose of developing solar rooftop pilot projects include four key universities namely University of Moratuwa (Colombo, Western Province), University of Peradeniya (Kandy, Central Province), University of Jaffna (Jaffna, Northern Province) and University of Ruhuna (Galle, Southern Province).

For the private developers, around 3 sites would be selected in and around cities of Colombo, Kandy and Jaffna.

The pilot project would serve as a benchmark for future replication and will address the following barriers for developing solar power in Sri Lanka

- Reducing the high capital cost through a bidding framework
- encourage private sector participation to create an ecosystem for self-replication
- contribute to increase in renewable power generation
- overcome any policy and regulatory barriers during the implementation

## A 9. Annex 9: Financial Analysis

### 1 Methodology and key assumptions

1. The financial analysis of the proposed subprojects has been carried out in accordance with ADB's Financial Management and Analysis of Projects. Cost streams used for the purposes of estimation of the financial internal rate of return (FIRR) reflect the costs incurred in delivering the estimated benefits. The methodology used was to assess the financial benefits to the Ceylon Electricity Board (CEB) in terms of additional retail sales arising from increased transmission line and substation capacity, increased distribution substation capacity, improved network reliability and new customer connections, and from the reduction in average cost of sales accruing through network loss reduction. Financial viability was examined by comparing the incremental costs and benefits on a "with investment" and "without investment" basis. A 25-year period was used for subproject evaluation without any terminal value.

2. The weighted average cost of capital (WACC) to CEB was calculated as prescribed by ADB's Guidelines for each subproject, for the overall Project and the financial viability was assessed by comparing WACC to FIRR at the subproject level and also for the aggregated Project. The sensitivity of the FIRR to adverse movements in the underlying assumptions was assessed.

### 2 Tariff Policy

3. Parliament approved the Sri Lanka Electricity Act in March 2009, empowering the Public Utilities Commission of Sri Lanka (PUCSL) to regulate the electricity sector from April 2009. To ensure electricity prices reflect the cost of supply, PUCSL has been empowered to rationalize the tariff structure so that the tariff is reflective of costs and allows the distribution entities ie CEB and Lanka Electricity Company (LECO), to recover all recurrent, efficient costs. Any gap between cost reflective tariffs and consumer tariffs will be met through a direct revenue subsidy from the Government. The tariff methodology also assumes a 2% return on the net fixed assets (NFA). The tariff trajectory used for financial analysis is shown in Table 1.

**Table 1: Tariff Trajectory and Cost of Fuel adopted for Financial Analysis**

	FY13	FY14	FY15	FY16	FY17	FY18	FY19	FY20
Tariff	14.54	15.56	16.65	17.81	19.06	20.39	23.61	24.08
Cost of Fuel	12.05	10.40	10.91	11.87	11.04	11.22	11.51	12.55

Source: ADB Estimates

### 3 Computation of Weighted Average Cost of Capital (WACC)

#### Transmission and Distribution Projects

4. To compute the WACC, it is assumed that the financing sources would consist of CEB and Government equity contributions and foreign sources by way of ADB loan from its Ordinary Capital Resources (OCR) facility and Asian Development Fund (ADF) as indicated in the table below:

**Table 2: Source of Financing**

	USD Million	Share	T&D	Solar Rooftop
OCR	100.00	50.00%	100.00	-
ADF	30.00	15.00%	28.50	1.50
<b>Subtotal</b>	<b>130.00</b>	<b>65.00%</b>	<b>128.50</b>	<b>1.50</b>
Grant	1.50	0.75%	-	1.50
Government	68.50	34.25%	68.50	-

<b>Total</b>	<b>200.00</b>	<b>100.00%</b>	<b>197.00</b>	<b>3.00</b>
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*Source: ADB Estimates*

5. With the estimated project costs and the present commitment of GoSL, ADB is assumed to finance 65% of base costs, with the Government on lending the funds as a local currency loan with a term of 20 years, a 5-year grace period, and a local on-lending margin of 7.16%. The cost of equity for GoSL has been assumed at 13.77% in accordance with last year's (2011) average weighted prime lending rate for all Banks as published by Central Bank, while the cost of debt for ADB has been assumed at 1.15% by summing up the 6 month forward LIBOR, spread of 0.40% and maturity premium (if any). A domestic inflation rate of 7.0% per year and an international inflation rate of 0.5% per year were assumed to compute the real interest rates. The estimated costs of borrowing and equity capital were then adjusted for inflation to obtain the WACC in real terms. The WACC, calculated by applying the weighting percentage to each source of financing, on a pre-tax basis, is 2.62%, as outlined in the table below:

**Table 3: Weighted Average Cost of Capital for Transmission and Distribution Subprojects**

<b>Source of Financing</b>	<b>Amount (\$ Million)</b>	<b>Weight (%)</b>	<b>Nominal Cost (%)</b>	<b>Real Cost (%)</b>	<b>Weighted Cost (%)</b>
ADB	128.50	65.23%	1.15%	0.65%	0.42%
GoSL	68.50	34.77%	13.77%	6.33%	2.20%
Total	197.00	100%			2.62%

Source: ADB Estimates

#### 4 Calculation of Financial Internal Rate of Return (FIRR)

##### Transmission and Distribution Projects

6. There are two types of financial benefits from the proposed investments: (i) an increase in electricity sales and (ii) reduced technical losses in the network. The increase in sales is due to (i) regularization of connections to previously unconnected households, (ii) new connections, and (iii) an increase in consumption by existing consumers due to increased hours of supply. For the estimation of savings, an assessment of technical losses, and to what extent such losses can be reduced due to the project, has been estimated. The incremental operational & maintenance (O&M) costs for the project has also been estimated to account for in the net cash flows from the project.

7. Incremental cash flows attributable to the proposed investments were estimated based on the methodology and assumptions described above. Subproject FIRRs are shown in Table 4. The overall FIRR to CEB is 10.99%. A few of the subprojects focus on improving network reliability and security, and specifically on reducing the likelihood of events that have a low probability of occurrence, but impose a high economic cost when they do. As such, the financial yields from these subprojects in isolation may appear low when compared with other projects, and it is best to consider in that case, the financial viable.

**Table 4: FIRR Results**

	Sub Project	FIRR
<b>A</b>	<b>Transmission infrastructure strengthening in the Northern province</b>	
1	Mannar Power Transmission Development	9.26%
<b>B</b>	<b>Transmission and distribution network energy efficiency improvement</b>	
1	New Polpitiya Power Transmission Development	7.71%
2	Padukka Power Transmission Development	14.98%
3	Kegalle Power Transmission Development	15.32%
4	Reactive Power Management	6.93%
<b>5</b>	<b>MV Network Energy Efficiency Improvement</b>	
5.1	Vavuniya-Kebithigollewa Distribution Line and Gantry	14.14%
5.2	Anuradhapura-Kahatagasdigiliya Distribution Line and Gantry	3.38%
5.3	Kiribathkumbura-Galaha gantry Distribution Line and Gantry	9.21%
5.4	Galmadu Junction-Akkaraipatthu – Pothuvil Distribution Line and Gantries	19.06%
	<b>Total Transmission and Distribution</b>	<b>10.99%</b>

### Solar Rooftop Projects

8. The benefit for the solar rooftop project has been worked out based on the capital subsidy available for the project which the project could utilize.

**Table 5: Solar rooftop Project**

	Sub Project	FIRR
<b>C</b>	<b>Solar Rooftop Project</b>	
1	Solar rooftop	10.68%

9. The overall FIRR for the transmission, distribution and solar rooftop project is **10.99%** which is more than the WACC.

## 5 Risk Assessment and Sensitivity Analyses

### Transmission and Distribution Projects

10. The Regulatory risk for the sub projects is low to moderate. The analysis assumes that PUCSL would continue to implement the planned tariff reforms and that the Government would continue to support the sector through subsidies, thereby providing CEB with revenue adequate to cover its operating costs. The demand risk is low as the demand forecast that has formed the basis of this analysis is considered as conservative. Geopolitical and political risks are present for all projects in Sri Lanka. However, the nature of the investments and the widespread support for expansion of the power system serve to minimize this risk.

11. Financial risks at subproject level include: (i) substantial increase in the prices of civil works and equipment, (ii) delays in project implementation, and (iii) failure to have access to necessary counterpart funds. These risks are considered to be moderate overall. A bottom-up approach has been adopted for estimating the costs for the transmission and distribution subprojects, and was verified against CEB's most recent tender prices for reasonableness. However, the sudden increase in inflation and exchange rate does pose a risk for the prices of equipment procured under the Project. Advance procurement will lessen the time between loan effectiveness and disbursement. CEB's implementation capacity is proven, and turnkey contracting will be used for transmission and distribution subprojects. Counterpart funding is minimal and mostly takes the form of exemption from the requirement to pay taxes and duties, and contributions in-kind.

12. Analysis has been carried out to examine the sensitivity of the FIRR to adverse changes in key variables. The variables considered for the sensitivity of FIRR are a 10% increase in capital costs, 10% reduction in tariff, a 10% increase in O&M costs and 10% rise in the cost of fuel. All combinations of these adverse changes were not worked out, but the combined effect of all adverse changes was calculated. Table 6 shows that the financial performance of the overall Project is robust for the scenarios tested, with FIRR exceeding the aggregate WACC in all cases. On this basis, the investment is considered financially viable and offers acceptable returns under most likely scenarios.

**Table 6: Sensitivity Analysis for Transmission and Distribution Projects**

		Change from Base Case	FIRR (%)
	Base case		10.99%
1	Project Cost	10%	10.27%
2	Tariff	-10%	9.98%
3	O&M	10%	10.87%
4	Cost of Fuel	10%	10.86%
5	Combined (1, 2, 3,4)		9.02%

*Source: ADB estimates*

## A 10. Annex 10: Economic Analysis

### 1 Background and Approach

**1 Project Components:** The project would contribute to the expansion of Sri Lanka's transmission and distribution network by adding 58.5 km of 220 kV transmission lines, 182.5 km of 132 kV transmission lines, 129 km of 33 kV distribution lines, 1000 MVA of 220 kV/132 kV substation transformer capacity, and 94.5 MVA to 132 kV/33 kV substation transformer capacity. In addition, 1 MW of roof top solar photovoltaic-based generation capacity is proposed to be added. The main economic benefits from the subprojects would include, (i) reduction of transmission and distribution losses by strengthening the network, (ii) increased availability of power for additional customers to be served through the construction of new transmission substations and by strengthening of distribution facilities, and (iii) improved quality of power (reliability and voltage) supplied to existing and future customers through extensions to the transmission network, and through distribution system improvements.

**2 Overview of the approach:** The subprojects are elements of the long-term transmission plan and the distribution plans of Ceylon Electricity Board (CEB). Economic analysis was undertaken to determine the economic viability of each subproject. The analysis,

- i) reviewed the electricity demand projections to verify the future use of the planned assets
- ii) reviewed the approach to transmission system planning and distribution planning in Sri Lanka to ensure that each subproject forms a part of the national least cost plan
- iii) established the economic costs and benefits of each subproject, and
- iv) prepared economic cost-benefit analysis of each subproject and the entire project.

Transmission and distribution subprojects were analyzed separately before aggregating them to determine the economic viability of the overall project.

**3 Basis of evaluation and the benchmark:** The economic impact of each subproject was evaluated from a national power system perspective in accordance with *ADB Guidelines for Economic Analysis of Projects*. A 25-year period was used for the evaluation with no terminal value considered for the investment at the end of the period. All costs and benefits have been expressed at a constant April 2012 price level. A domestic price numeraire was used. The economic internal rate of return (EIRR) was considered to be the most suitable indicator of economic viability, and the benchmark EIRR was fixed at 12%, established in previous and similar projects in Sri Lanka.

### 2 Demand forecast and development plans

**4 Demand forecast:** The key to the assessment of benefits is the present demand and the demand forecast for the next 25 years. CEB's demand forecasting methodology follows internationally accepted norms and practices. It uses a top-down econometric approach to estimate the national demand for electricity based on expected national income growth (measured by growth in gross domestic product) and population growth. It relates growth in these variables to electricity demand growth through multiple linear regression analysis of historical data. CEB translates its aggregate demand forecast to generation requirements by estimating the transmission and distribution losses, which in the long term meet the Government's policy target of 12% by year 2015 and beyond, and develops the Long Term Generation Expansion Plan covering 20 years into the future. CEB

Transmission Planning Branch then identifies the transmission network reinforcement and expansion requirements to accommodate the new generation in accordance with the generation expansion plan, and to meet the forecast customer demand in the load centers. Forecast demand to be served at each grid substation is derived by CEB using a bottom-up approach at the distribution level, using a trend extrapolation for existing loads and the knowledge of spot loads expected in the next five years.

5 **Transmission planning:** The PSS/E network analysis software is used by the CEB Transmission Planning Branch to model and examine the transmission network under a range of generation/demand conditions and contingencies, to ensure that the network provides an acceptable level of quality and security of supply. CEB's standard substation and line designs are considered to be reasonable from a cost perspective, effectively balancing simplicity, reliability, and flexibility for future upgrading. CEB has confirmed that it has considered reasonable and practical alternatives to the proposed subprojects, and that the alternatives selected for implementation represent the least-cost means of achieving the desired network performance in terms of voltage, stability, reliability, the required flexibility in network operations. CEB's Long-term Transmission Development Plan covers a period of ten years, and is updated at least once in two years, and is required to be submitted to Public Utilities Commission of Sri Lanka (PUCSL) for approval.

6 **Distribution planning:** CEB Distribution Regions use the SynergyE model to analyse and plan the 33 kV distribution network, which forms the basis of the Distribution System Development Plan developed for each region. This Plan is updated once in two years. The demand forecast for each area under each Region is developed using a bottom-up approach on the basis of trend analysis of past demand and knowledge of new spot loads expected within the next five years. The plan outlines the 33 kV network strengthening required over a 10-year planning window to ensure delivery of power to customers at the specified level of power quality, and provides the economic justification of the plan through the improvement of power quality and reduction of network losses. The plan is approved by CEB and is required to be submitted to PUCSL for approval. Projects selected for implementation are elements of the plan for each distribution region.

7 **Rooftop solar photovoltaic systems:** The project will provide an aggregate of 1 MW of rooftop solar photovoltaic (PV) installations that would produce electricity over the 25-year evaluation period. The economic benefits would be the value of output from these PV systems and the avoided technical losses in transmission and distribution, if such amount of energy was provided from the grid through the existing and future generating plants.

### 3 Evaluation of costs and benefits

8 **Assessment of costs:** Investments for each subproject was determined on the basis of the costs provided by CEB, and reviewed during the study. Taxes and customs duty were not considered. Operation and maintenance costs for transmission and distribution subprojects were estimated to be 2% and 2.5% of capital costs, respectively, based on historical benchmark data used in previous studies.

9 **Evaluation of non-incremental benefits:** Benefits were evaluated on the basis of both (i) non-incremental benefits, and (ii) incremental benefits. The key non-incremental benefit would be the savings in energy losses in the network, when each subproject is implemented. For transmission projects, reduced energy losses were calculated through a load flow analysis to first calculate the system capacity loss savings at peak time, and then using a loss load factor of 0.38 to calculate the corresponding energy savings. These savings in energy losses by the implementation of transmission subprojects were valued at the average generation costs for each year in the evaluation period, determined based on the fuel consumption figures stated in the CEB's Long-term Generation Expansion Plan (December 2010) for the recommended least-cost generation plan. Energy losses



saved in the distribution network were valued at the average fuel cost reflected at the medium voltage distribution level, which was calculated by adjusting the average fuel cost of generation adjusted upwards to account for the avoided transmission losses. An increase of fuel prices by 7% each year in real terms was assumed in evaluating the future economic benefits of loss reduction.

**10 Evaluation of incremental benefits:** These benefits would be from additional delivery of power through each subproject, which otherwise would not have occurred because the existing network is already constrained or would reach its power delivery and/or power quality limits within a few years. The incremental sales expected owing to each transmission project (if any) and for each distribution subproject were calculated as follows: The sale forecast for distribution projects was obtained from CEB's distribution plans (up to 2019), and thereafter increased at the long-term sales growth rates given in the Long-term Generation Expansion Plan (December 2010). For transmission projects in which new grid substations are built, the grid substation loadings (up to 2020) were provided by CEB and same was used to calculate the additional sales. Additional sales were valued at the estimated willingness of consumers to pay. The average willingness to pay was considered to be equal to the forecast selling price of electricity. In general, the willingness to pay would be higher than the selling price, and thus the valuation of economic benefits of incremental sales at the selling price is a conservative estimate.

**11** Accordingly, in the evaluation of benefits, the key determinants of benefits quantified for each subproject are summarized below:

- i) Subproject T1: 31.5 MVA of incremental substation capacity, and loss savings of 3.95 GWh/year
- ii) Subproject T2: 500 MVA of incremental substation capacity
- iii) Subproject T3: 500 MVA of incremental substation capacity
- iv) Subproject T4: 63 MVA of incremental substation capacity
- v) Subproject T5: 160 MVA of incremental reactive power compensation
- vi) Subproject D1: 0.94 GWh/year of loss reduction and incremental sales of 2.60 GWh/year, and increasing at rate of 6.5% pa.
- vii) Subproject D2: 0.40 GWh/year of loss reduction and incremental sales of 0.90 GWh/year, increasing at rate of 6.5% pa.
- viii) Subproject D3: 1.89 GWh/year of loss reduction, growing at 6.5% pa.
- ix) Subproject D4: 5.82 GWh/year of loss reduction and incremental sales of 10.42 GWh/year, increasing at rate of 6.5% p.a.
- x) Subproject C: 0.19 GWh/year of loss reduction and incremental sales of 1.6 GWh/year, decreasing at 1% per year owing to reduction of the output as the PV system ages.

**12 Estimated Economic Benefits:** The quantities and values of economic benefits for the first 5 years following project commissioning are shown in Table 1. The trend for energy quantity savings continued through the 25-year evaluation period, while the value of savings followed the basis of changing electricity prices forecast in this study, and the generation fuel mix derived from CEB's long term generation expansion plan.

**Table 1: Summary of project economic benefits and unit values**

Economic Benefits	Unit	2016	2017	2018	2019	2020	2021
<b>Quantity</b>							
Incremental output (additional sales)	GWh	14	16	25	49	89	90
Non-Incremental output (savings in losses)	GWh	9	67	69	71	72	74
<b>Unit Value</b>							
Average willingness to pay (average tariff)	LKR/kWh	17.81	19.06	20.39	23.61	24.08	25.77
Average resource cost saving (value of losses saved)	LKR/kWh	11.87	11.04	11.22	11.51	12.55	13.43

#### 4 Results of Economic Evaluation

13 **EIRR of project components:** Table 2 summarises the results of economic evaluation of each subproject. The EIRR of most subprojects is near the benchmark of 12%, while the estimated EIRR of the aggregate project is 12.16%

14 **EIRR of specific subprojects:** Some specific subprojects have EIRR below the benchmark 12%. These subprojects will not affect the future economic performance of the project owing to the following reasons. (i) *Mannar power transmission development:* The economic evaluation is based on reducing the losses on the existing 33 kV feeder into Mannar district, and serving the existing and future customers with a reliable power supply. Mannar is a post-conflict development region, since the end of the civil conflict in 2009. Furthermore, Mannar has been identified as a region with a high potential for wind based power generation, and ADB is currently assisting GOSL with a TA to assess the wind resource potential in Mannar, in preparation for a feasibility study. The *Mannar power transmission development* will most likely serve wind power to the load centers outside the Mannar district, the economic benefit of which has not been included in the economic evaluation (ii) *New Polpitiya Power Transmission Development:* This line marks the development of the 220 kV link from the 660 MW Laxapan hydropower cascade to the load centres in the western sector of the country, replacing the 40-year old 132 kV lines. There is additional hydropower potential being developed in this area. The 35 MW Broadlands project is scheduled for commissioning by 2014, and few other minihydro power plants too would be connected. Therefore, the economic benefits of the line would only increase from the benefits conservatively estimated in the analysis. (iii) *Reactive power management:* The reactive power management equipment have a direct bearing on power quality in terms of managing the voltage profile in the transmission system. The economic evaluation has only considered the benefits by way of reduced transmission losses, because the voltage profile improvements were not assigned an economic value in the analysis. (iv) *Anuradhapura-Kahatagasdigiliya Distribution Line and Gantry:* This MV line is an express feeder to Kahatagasdigiliya, and its main contribution is to improve the quality of supply to customers in Kahatagasdigiliya area. The improved quality of supply has not been assigned an economic value in the analysis. As the line is an express feeder, no significant additional consumption is expected to occur owing to the line, and hence the evaluated EIRR is lower.

**Table 2: Results of economic evaluation**

	<b>Component and Subproject</b>	<b>EIRR</b>
A	<b>Transmission infrastructure strengthening in the Northern province</b>	
1	Mannar Power Transmission Development	9.85%
B	<b>Transmission and distribution network energy efficiency improvement</b>	
1	New Polpitiya Power Transmission Development	8.84%
2	Padukka Power Transmission Development	16.60%
3	Kegalle Power Transmission Development	16.83%
4	Reactive Power Management	8.33%
5	<b>MV Network Energy Efficiency Improvement</b>	
5.1	Vavyunia-Kebithigollewa Distribution Line and Gantry	16.16%
5.2	Anuradhapura-Kahatagasdigiliya Distribution Line and Gantry	4.65%
5.3	Kiribathkumbura-Galaha gantry Distribution Line and Gantry	10.10%
5.4	Galmadu Junction-Akkaraipatthu – Pothuvil Distribution Line and Gantries	21.60%
	<b>Total Transmission and Distribution</b>	<b>12.16%</b>
6	<b>Rooftop solar PV</b>	<b>11.72%</b>
	<b>Overall project</b>	<b>12.16%</b>

15 **Sensitivity and risk analysis:** The risks that the subprojects may not achieve satisfactory economic returns were identified. For each of the risks identified, the sensitivity of EIRR was tested and the results are shown in Table 3.

**Table 3: Sensitivity Analysis for Combined Transmission and Distribution Components**

	<b>Sensitivity Parameter</b>	<b>Variation</b>	<b>EIRR</b>
	Base case		12.16%
1	Project capital costs	10%	11.46%
2	Tariff	-10%	11.10%
3	Operation & maintenance	10%	12.03%
4	Cost of Fuel	10%	12.56%
5	<b>Combined impacts of 1-4 above</b>		<b>10.71%</b>

16 **Sustainability:** The proposed investments are critical to the sector's overall investment needs and will make a substantial difference to the quality of electricity supply received by many consumers. The subprojects in the post-conflict recovery areas of Northern and Eastern Provinces will increase the reliability of power and also facilitate transmission of power from cleaner sources. Economic benefits are expected to be sustainable as the sector is already supported by a transparent tariff-setting methodology that proposes full recovery of efficient costs and allows an acceptable rate of return to be earned on capital investments, enabling the assets built to be maintained throughout their economic life.

17 **Conclusion:** The transmission and distribution subprojects were confirmed to be elements in the long term transmission and distribution plans, to meet the forecast demand for electricity at the required quality and reliability. The economic analysis confirms that the proposed investments are economically viable. The analysis yields an overall EIRR of 12.16%. Sensitivity and risk analysis demonstrates that the expected economic performance is robust.

## A 11. Annex 11: CEB's Past Financial Performance & Projections

### 1 Introduction

- The power sector is dominated by the Ceylon Electricity Board, together with its subsidiaries, Lanka Electricity Company (LECO), and several other independent power producers. CEB is a vertically integrated state-owned enterprise under the purview of Ministry of Power & Energy and is responsible for around 60% of the electricity generation, the transmission of power for public supply throughout the country and its distribution to some 90% of all electricity consumers. The balance of the consumers is being served by LECO.
- The financial performance of CEB has come under increasing strain due to the historical fact that the electricity tariff have not kept pace with the rising costs and being a public utility, CEB to meet its obligation of supplying un-interrupted electricity supply in the country, often relying on emergency power at exorbitant prices.

### 2 Summary of Historical Financial Performance

- The current financial position of CEB is not impressive. The accumulated losses from FY2007 to FY 2011 for CEB were about LKR 79,164 million. Though the operating margin for the year FY2010 has been 6% due to exceptional rainfall and a good hydro power generation, the debt service coverage ratio has always been negative in the past, which indicates that the company is deeply in debt, where it is required to borrow from external sources (expensive short term borrowings) to meet its financial liabilities. The deteriorating financial health of the company can be attributed to increased reliance on high-cost thermal electricity generation, substantial increases in the fuel oil costs and consumer tariffs set below cost of supply
- In addition, the Government of Sri Lanka has not provided CEB with adequate financial support to offset the cash shortfall that CEB faces due to inadequate tariffs. Consequently, CEB by 2010 has experienced significant increase in creditors from LKR 40,140 million in FY2007 to LKR 106,127 million in FY2011 for which the company has been forced to take on expensive, short-term loans, and appears to have deferred capital expenditure, affecting the net worth of the company.
- Table 1 below shows CEB financial results and financial indicators for the period 2007 to 2011. Accounting losses and negative cash flows are a persistent feature of CEB's financial performance. Return on assets, debt coverage and self-financing ratios indicate that CEB has been unable to operate as a going concern without financial assistance from the Government. The 2011 results showed deterioration due to failure of monsoon leading to use of high cost fuel oil generation.

**Table 1: CEB's Historical Financial Performance**

	Units	2007	2008	2009	2010	2011
<b>Profit &amp; Loss items</b>						
Revenue	LKR m	87,575	111,287	110,518	122,859	134,313
Cost of Sales	LKR m	(96,080)	(134,362)	(118,187)	(116,168)	(152,427)
Gross Profit/(Loss)	LKR m	(8,505)	(23,075)	(7,668)	6,690	(18,114)
Other Income and Gain	LKR m	9,205	3,581	3,412	2,624	2,690
Distribution Cost	LKR m	(8,618)	(8,087)	-	-	-
Others	LKR m	(3,657)	(3,264)	-	-	-
Administrative Expenses	LKR m	(1,534)	(1,487)	(2,870)	(1,850)	(2,014)
Finance Income	LKR m	-	-	861	-	-
Finance Cost	LKR m	(1,703)	(1,537)	(3,073)	(2,605)	(1,828)
<b>Profit/(Loss) Before Tax</b>	<b>LKR m</b>	<b>(14,812)</b>	<b>(33,870)</b>	<b>(9,339)</b>	<b>4,859</b>	<b>(19,266)</b>

	Units	2007	2008	2009	2010	2011
Income Tax Expense	LKR m	-	-	(2,236)	(4500)	-
<b>Profit/(Loss) After Tax</b>	<b>LKR m</b>	<b>(14,812)</b>	<b>(33,870)</b>	<b>(11,575)</b>	<b>359</b>	<b>(19,266)</b>
<b>Balance sheet Items</b>						
Short term borrowings	LKR m	7,075	4,406	12,862	9,979	11,007
Long term borrowings	LKR m	57,477	64,219	93,797	174,264	192,746
Trade creditors	LKR m	40,140	82,578	85,167	80,044	106,127
Equity	LKR m	275,648	270,176	275,208	281,315	320,253
<b>Cash flow items</b>						
Cash flows from Operations	LKR m	6,777	11,036	10,318	(43,050)	20,855
Net Cash Flows	LKR m	(128)	1,654	(1,778)	936	1,924
Cumulative Cash flows	LKR m	(3,915)	(2,261)	(4,039)	(3,102)	(1,178)
<b>COMMERCIAL</b>						
Electricity sales	GWH	8,276	8,418	8,441	9,268	9,883
Average revenue per unit sold	LKR/kWh	10.6	13.2	13.1	13.1	13.59
Average cost per unit sold	LKR/kWh	12.4	17.2	14.5	12.6	13.37
<b>Financial Ratio</b>						
Return on average net fixed assets		-4.08%	-8.82%	-2.68%	0.08%	-3.59%
Debt (LT) / Debt (LT)+Equity		17.25%	19.20%	25.42%	40.66%	35.24%

- CEB has maintained low levels of debt to equity in the past. The major source of long term borrowings has been Government treasury loans which had increased to LKR 192.7 billion by 31 December 2011. While there has been no debt servicing required for these loans at present, the Government has indicated that they are likely to be converted to commercial loans upon commissioning of the Stage II of Puttalam coal plant in 2013.
- CEB carries a substantial weight of fixed assets, as is expected of a vertically integrated electricity business. However, given the present tariff regime with consumer tariffs set below cost of supply, much of this asset base could not generate a return. The implementation of cost reflective tariffs with a return on net assets would probably assist the situation in future.
- In summary, CEB is fundamentally limited and financially stressed by its inability to generate sufficient cash flow to reinvest in its business and meet its present supplier obligations. Without Government support in the form of subsidies and/or substantial increases in tariffs and/or commissioning of cheaper coal based power plants, CEB's finances and network may further deteriorate.

### 3 Assumptions for the Financial Projections

#### 3.1 Sales and Generation

- Generation projections incorporate strong growth in CEB thermal production, a rapid decline in IPP thermal production and relatively static hydro generation.
- The forecast cost of generation reduces as a percentage of sales over the forecast period. This is due to the assumption that purchases from IPPs will reduce from 4,581 GWh in 2012 to 1610 GWh by 2020, and that there will be a substantial increase in low-cost coal-fired generation, rising to around 11,637 GWh by 2020.

- Table 2 illustrates forecast generation and the long term beneficial impact on CEB of changing its generation mix away from oil and IPPs to lower cost coal power stations.
- The system losses has been assumed to decline from the level of 13.53% in 2010 to 12.00% in 2016 and thereby remaining at that level while the sales to consumers by the distribution utilities have been derived from the system demand and the losses in the system which includes auxiliary and T&D losses.

**Table 2: Projected Generation and System Losses**

Generation Plan	Units	2012	2013	2014	2015	2016	2017	2020
Hydro	Gwh	3,812	5,499	5,548	6,081	6,186	6,268	6,533
Thermal CEB - Non Coal	Gwh	1,682	1,188	-	-	-	-	-
Thermal IPP - Non Coal	Gwh	4,581	4,581	3,404	3,300	3,822	2,193	1,610
Coal CEB	Gwh	1,757	1,932	5,029	5,495	5,760	8,192	11,637
Wind	Gwh	140	168	266	294	350	378	378
Biomass (Dendro)	Gwh	34	34	68	68	102	137	239
Total Generation	Gwh	12,006	13,402	14,315	15,238	16,220	17,168	20,397
Avg. Cost / Unit (without inflationary effects)	LKR/kwh	8.92	8.09	6.91	6.75	6.91	6.26	6.08
<b>Losses</b>								
Auxiliary Consumption	%	2.02%	2.00%	3.70%	3.77%	3.73%	4.72%	5.14%
T & D Losses	%	13.02%	12.77%	12.51%	12.26%	12.00%	12.00%	12.00%
Sales to Consumers	Gwh	10,426	11,423	11,995	12,796	13,669	14,297	15,071

- The projections assume that the Government is committed to support CEB through the forecast period to 2020. Tariffs have been assumed to increase progressively towards full cost recovery from 2017 when the first unit of the Trinco Coal plant is commissioned. Table 3 represents the tariff considered for revenue projections for CEB.

**Table 3: Tariff Projection**

	Units	2012	2013	2014	2015	2016	2017	2018	2019	2020
<b>Tariff Projection</b>	LKR/Kwh	13.59	14.54	15.56	16.65	17.81	19.06	20.39	20.69	20.69

### 1. Capital Expenditure

- Capital expenditure has been forecasted through to 2020 in three categories: generation, transmission and distribution based on the forecasts available with the CEB in the recent 2012 tariff submissions to the PUCSL. The capital expenditure in Generation has been based on the generation profile projected and assuming a gestation period of four years with capital phasing as 10%, 40% 30% and 20% respectively.
- All capital projects have been assumed commissioned at the beginning of each financial year. Table 4 projects the capital expenditure projected in each of the categories in constant LKR terms

**Table 4: Capital Expenditure Projected**

	Units	2012	2013	2014	2015	2016	2017
Generation	LKR m	0	30,246	28,166	36,007	44,009	44,009
Transmission	LKR m	1,021	1,655	1,018	1,018	1,230	1,230
D1	LKR m	16,371	8,859	6,308	6,288	7,152	7,152
D2	LKR m	8,989	11,397	9,983	6,339	9,240	9,240
D3	LKR m	1,947	2,585	1,909	2,439	2,311	2,311

D4	LKR m	3,806	2,314	2,095	2,005	2,138	2,138
<b>Total</b>	<b>LKR m</b>	<b>32,133</b>	<b>57,055</b>	<b>49,479</b>	<b>54,096</b>	<b>66,079</b>	<b>66,079</b>

### 3.2 Long term and Short term debt servicing

- All capital investment has been assumed to be debt and equity funded. The direct source for both equity and debt is assumed to be the Government and carry the same rate of interests. Treasury loans have been assumed to be repayable over twelve years with a 2 year moratorium for principal repayments. An interest rate of 10% per annum on outstanding principal has been applied on long term borrowings and 12% applied on short term working capital borrowings.

### 3.3 Operating Expenses, Depreciation and Tax

- Operating expense have been forecasted based on estimated expenditure available with CEB on the 2012 tariff filing submissions to the PUCSL and assuming a 1.5% of the gross fixed assets for the generation assets added in the future. All expenses are on nominal terms with life of new assets being considered at 25 years and tax rate assumed at 35%.

## 4 Financial Projections for CEB

- To support the analysis of CEB's suitability for the proposed ADB lending, a 10-year financial projection has been prepared based on historical financial data as a base and certain underlying assumptions to project for the future. These projections are not intended to be an accurate forecast of CEB's future performance; they are a projection based on a set of assumptions and adoption of certain policies by the Government that represents a fundamental change in the operation of the electricity sector and pricing regime like:
  - Increasing supply capacity and reducing cost of generation including building coal-fired stations (achieving fuel cost reductions and reducing reliance on IPPs) and
  - Establishing a cost reflective tariff by the independent regulator, PUCSL and rationalize tariff structures by allowing a return on assets / equity infused
- These intentions are critical assumptions in the financial model developed for this exercise. CEB's financial position will remain weak if these changes are not implemented.
- Table 5 below shows a summary of the forecast financial position of CEB through to 2020. Details of Balance sheet items and cash flow projections are illustrated in the Table 6.

**Table 5: CEB's Financial Forecast till FY2020**

	Units	2012	2013	2014	2015	2016	2017	2020
<b>Profit &amp; Loss Items</b>								
Sale of Electricity and Other Income	LKR m	144,401	168,775	189,289	215,684	246,154	275,161	310,029
Fuel & Power Purchase Expenses	LKR m	106,961	113,325	96,314	108,739	130,187	124,890	143,145
Gross Profit	LKR m	34,728	52,775	90,318	104,288	113,310	147,614	164,227
Overheads	LKR m	20,047	29,235	31,078	41,215	45,091	49,238	53,316
Depreciation	LKR m	18,561	20,843	22,823	24,986	27,630	30,273	31,956
Interest on LT Borrowing	LKR m	0	0	42,281	44,728	47,906	50,653	50,498
Interest on ST Borrowing	LKR m	1,842	3,048	3,562	4,129	4,670	5,318	5,965
PBT	LKR m	-3,011	2,324	-6,768	-8,113	-9,330	14,788	25,149
Tax	LKR m	0	813	0	0	0	5,176	8,802
<b>Profit/(Loss) After Tax</b>	<b>LKR m</b>	<b>-3,011</b>	<b>1,510</b>	<b>-6,768</b>	<b>-8,113</b>	<b>-9,330</b>	<b>9,613</b>	<b>16,347</b>
<b>COMMERCIAL</b>								
Units Generated	GWH	11,987	13,094	13,710	14,583	15,533	16,246	17,126



Units Sold	GWH	10,426	11,423	11,995	12,796	13,669	14,297	15,071
Average Tariff	LKR/kWh	13.59	14.54	15.56	16.65	17.81	19.06	20.39
Average Fuel / PP Cost	LKR/kWh	8.92	8.65	7.02	7.46	8.38	7.69	8.36

- Under this scenario CEB moves into a net positive cash flow position from FY2017. This is assisted by the commissioning of the Trinco coal-fired station that contributes to a decline in IPP power purchases from 2017. Fuel and power purchase cost is declining from present LKR 10.19 per kWh in 2011 to LKR 7.69 per kWh in 2017). This would establish a balance between the revenue and cost per unit sold and subsequently yield profits for CEB.

## 5 CEB's Projected Balance Sheet and Cash Flow Statements

**Table 6: Projected Balance Sheet and Cash Flow Statements for CEB till 2020**

Balance sheet	Units	2012	2013	2014	2015	2016	2017	2020
Fixed Assets	LKR m	910,875	967,931	1,017,409	1,071,505	1,137,584	1,203,663	1,245,738
Less: Cumulative Depreciation	LKR m	341,358	362,201	385,024	410,011	437,640	467,913	499,869
NFA	LKR m	569,517	605,729	632,385	661,495	699,944	735,750	745,869
Investments	LKR m	4,698	4,698	4,698	4,698	4,698	4,698	4,698
Working Capital	LKR m	21,229	25,398	29,682	34,408	38,916	44,317	49,707
Cash	LKR m	0	49,137	73,352	57,990	39,931	38,949	40,877
<b>Total Assets</b>	<b>LKR m</b>	<b>595,444</b>	<b>684,962</b>	<b>740,117</b>	<b>758,591</b>	<b>783,489</b>	<b>823,714</b>	<b>841,151</b>
Equity	LKR m	96,090	96,090	96,090	96,090	96,090	96,090	96,090
Capital Reserves	LKR m	362,941	362,941	362,941	362,941	362,941	362,941	362,941
Retained Earnings	LKR m	-141,789	-140,279	-147,046	-155,159	-164,489	-154,876	-138,530
Deferred Liabilities	LKR m	10,374	10,374	10,374	10,374	10,374	10,374	10,374
Working capital Borrowing	LKR m	0	4,169	8,453	13,179	17,687	23,088	28,478
LT Borrowings	LKR m	267,828	351,666	409,305	431,165	460,885	486,097	481,797
<b>Total Liabilities</b>	<b>LKR m</b>	<b>595,444</b>	<b>684,962</b>	<b>740,117</b>	<b>758,591</b>	<b>783,489</b>	<b>823,714</b>	<b>841,151</b>
Cash flow items	Units	2012	2013	2014	2015	2016	2017	2020
<b>Inflows</b>								
Revenue + Govt. Subsidy	LKR m		168,775	189,289	215,684	246,154	275,161	310,029
LT Debt raised net repayments	LKR m		83,838	57,639	21,860	29,720	25,212	-4,300
ST Debt Raised	LKR m		4,169	4,284	4,726	4,508	5,401	5,390
Decrease in working capital	LKR m		168,775	189,289	215,684	246,154	275,161	310,029
<b>Outflows</b>								
Power purchase & Fuel Costs	LKR m		113,325	96,314	108,739	130,187	124,890	143,145
Interest on LT Borrowing	LKR m		0	42,281	44,728	47,906	50,653	50,498
Interest on ST Borrowing	LKR m		3,048	3,562	4,129	4,670	5,318	5,965
Operating Expenditure	LKR m		29,235	31,078	41,215	45,091	49,238	53,316
capital Expenditure	LKR m		57,055	49,479	54,096	66,079	66,079	42,074
Tax	LKR m		813	0	0	0	5,176	8,802
<b>Net Inflow</b>	<b>LKR m</b>		<b>4,169</b>	<b>4,284</b>	<b>4,726</b>	<b>4,508</b>	<b>5,401</b>	<b>5,390</b>
<b>Closing Cash Balance</b>	<b>LKR m</b>		<b>49,137</b>	<b>24,215</b>	<b>-15,362</b>	<b>-18,059</b>	<b>-982</b>	<b>1,929</b>



## 6 Financial Management

- A Financial Management Assessment (FMA) on CEB has been carried out in 2010 as part of the financial due diligence done for the ADB funded Sustainable Power Sector Support Project II.
- Review of this FMA suggests that, in the broader context, CEB is sufficiently equipped and financially disciplined to manage the cashflows expected to be transacted in implementing the proposed ADB project. Further, there were no critical recommendations made in the previous FMA constraining CEB of being considered for the loan projects considered in this study.
- In order to verify whether the financial management practices acceptable for ADB are still being practiced by the CEB and the necessary resource capacities are available to manage the finances of the proposed project, the ADB Financial Management Assessment Questionnaire (FMAQ) was used to collect the relevant information from the CEB. Using the responses to the FMAQ and the review of financial statements and other publications relevant to CEB, a fresh FMA for CEB was developed with following salient points being identified.
- CEB is a statutory board established in 1969 by an act of the Parliament. CEB is capable of providing adequate project accounting, reporting and funds flow capabilities, and has done so on previous ADB loan projects. CEB will establish project finance and accounts team from its permanent accounting staff resource. However, the need to train these staff on relevant ADB procedures to make sure all necessary controls, safeguards and reporting requirements are followed was identified as an important requirement. CEB's existing spreadsheet-based accounting system will be used for project accounting, reporting and disbursements management.
- CEB's annual accounts are prepared on an accrual basis in accordance with Sri Lanka Accounting Standards, which are similar to the International Accounting Standards. Since the beginning of 2012, the new Sri Lanka Financial Reporting Standards will be used in reporting the financial status of the CEB, improving the level of detail and the overall quality of the CEB annual reports. The accounts are audited by the auditor general, who appoints a private firm as auditor. The auditing firm is rotated periodically. CEB's accounting records are maintained at site offices and monthly summaries are forwarded to head office for consolidation. Under the general manager responsible for day-to-day management, additional general managers manage six functional business units (FBUs), one generation unit, one transmission unit, and four distribution units in different geographic areas.
- While adequate for current purposes, CEB is likely to find that new reporting and tariff filing requirements imposed by the Public Utilities Commission of Sri Lanka (PUCSL) put pressure on its manual accounting system. Even though the Mitfin software package and excel spreadsheets are being used as part of the automated accounting system, their full use enabling a fully automated financial system to be operated by the CEB is still lagging behind. While the current practices and systems can meet the companies statutory reporting requirements, they cannot provide useful and timely online information for Management and meet the information requirements of the PUCSL. A dedicated funding should be allocated to meet the cost of a fully automated new system, covering billing, accounting, and management information systems (MIS) including both software and hardware implementation, training, and service support.

## A 12. Annex 12: Summary Poverty Reduction and Social Strategy

### Country and Project Title: SRI: Clean Energy and Network Efficiency Improvement Project –Part-1

Lending/Financing  
Modality:

Project

Department/  
Division:

South Asia Regional Department (SARD) Energy Division  
(SAEN)

<b>I. POVERTY ANALYSIS AND STRATEGY</b>	
<b>A. Link to the National Poverty Reduction Strategy and Country Partnership Strategy</b>	
<p>The goal of the Government's 10-Year Development Framework (10YDF) prepared in 2006 is to achieve rapid economic growth that will benefit the entire population and lead to increased social development of the country. The proposed project is consistent with Sri Lanka's national and sector priorities stated in the country's 10-year development framework prepared in 2006 that focuses on infrastructure development to accelerate economic growth and narrow regional disparities and envisions sustainable development of energy resources, conversion facilities and delivery systems to enable access to and use of energy services by the entire population, and the safe, reliable delivery of such energy services at a competitive price. The framework is based on the government's National Energy Policy and Strategies (NEPS), a ten year plan for the energy sector. The project is consistent with the government's development strategies, as updated in 2010 that aim to (i) increase supply capacity of the system to 3470 MW by 2012 and 6367 MW by 2020; (ii) increase share in grid energy supply from nonconventional renewable energy sources from 4.1% in 2007 to 8.5% by 2012, 10% by 2016, and 20% by 2020; (iii) increase the percentage of households connected to the grid from 88% in 2010 to 100% by 2012; (iv) reduce the total technical and commercial losses of the transmission and distribution network from 14.6% in 2009 to 14.0% by 2012, 13% by 2016 and 12.0% by 2020; and (v) achieve energy savings of 4.3% in 2012, 6.4% in 2016, and 8.7% in 2020 from a potential consumption level through energy conservation. The project is also consistent with the Sri Lanka Country Partnership Strategy (CPS) of the Asian Development Bank (ADB) that focuses on (i) funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources and to achieve energy-efficiency improvements through strengthening of the transmission network, (ii) improving connectivity for the poor, (iii) mitigating climate change through financing individual clean energy projects, and (iv) promoting private sector development and expanding the role of PPP in the energy sector. The project is included in the Sri Lanka Country Operations Business Plan (COBP) 2011-2013. It will further support sustainable development of the power sector of Sri Lanka in line with the national and sector priorities, ADB's CPS and complement activities of other major development partners. The Project has three main components: 1) transmission strengthening 2) distribution system improvements and 3) renewable energy components through solar rooftop projects.</p>	
<b>B. Poverty Analysis</b>	<b>Targeting Classification: General intervention (GI)</b>
<p><b>Key issues.</b></p> <p>In 2006/7, 15.2% of the Sri Lankans or 2.8 million were poor according to the national poverty line, compared to 26.1% in 1990/91. The Poverty Headcount Index again halved from 15.2 percent in 2006/07 to 7.6 percent in 2009/10 with significant improvements in the rural and estate sectors. However, taking the US\$ 2 per day mark as an indicator, the national percentage is as high as 30.3%. Official urban poverty was 6.7%, while rural poverty stood at 15.7% and in the estate sector at 32.0%. The 2010 Human Development Report includes the HDI rankings of 169 countries where Sri Lanka ranks 91 on the index. Sri Lanka's HDI has progressively increased up to 0.659 in 2010 compared to 0.513 in 1980. This increase is mainly due to favourable social indicators of literacy and life expectancy. With regard to the reported total of 31 indicators of the Millennium Development Goals (MDGs) Sri Lanka has already achieved three of them during the mid-term review in 2008. The Project will contribute to a reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka. The outcome of the project will be increased through clean power supply and improved efficiency and reliability in the delivery of Electricity. The Project will have direct and indirect positive social impacts. Efficient and reliable provision of electricity is a key element of socio-economic development as it provides a catalyst for economic growth, which is central to obtaining basic human needs such as health and education, and has a direct bearing on poverty reduction. Poor and vulnerable consumers, as well as social services such as hospitals and schools, will therefore benefit directly from the Project. The Project is expected to improve the living standards of people by improving health conditions, increasing safety and security, increasing agricultural yields, reducing expenditure on energy (by replacing people's dependence on less efficient and more costly types of energy, e.g. kerosene), increasing productivity and diversifying types of economic activity, and increasing the number of hours available for study, recreation and social and cultural activities. Though the proposed Project will generate temporary and limited numbers of jobs; opportunities will be available for both skilled and unskilled workers for a period of years, throughout the civil works activities. Participatory analysis using a combination of qualitative and quantitative techniques will measure post-project benefits in terms of securing impoverished and vulnerable groups equitable access to opportunities and in impoverished group's access to power.</p> <p><b>Design features.</b></p> <p>Though the project will not directly contribute to poverty alleviation; indirectly it is expected to play an important part in improving consumers overall wellbeing and facilitating people's opportunity for enhancing their livelihoods through alternative forms of income and livelihood enhancement opportunities in the affected areas. This is considered to be a positive and important project contribution to the socio-economic development of Sri Lanka's rural poor, in line with ADB's mission to reduce poverty.</p>	

## II. SOCIAL ANALYSIS AND STRATEGY

### A. Findings of Social Analysis

A social analysis was carried out in the project area through baseline socio-economic survey of 436 households in the project area. The average family size of the sampled household is found to be only 4.00. The overall sex ratio of the households is 1011 females for 1000 males. The overall literacy is 97 % and the male literacy rate is 98 % where as female literacy is about 96 %. Most of the households members are educated upto higher secondary level and applies to both genders. 54 % of the total household members (above 18 years) are engaged in productive work. Among the male members about 82 % are in the productive jobs besides 4 % students and 6 % are retired. Similarly among the females 26.4 % are in the productive jobs. At the household level about 26 % are practicing agriculture as a primary activity and 13 % practiced agriculture as secondary activity. Similarly 21 % of the household are engaged in highland crop cultivation and 17 % practice this as secondary occupation. Among other primary activities in 35 % of the households government and private jobs are the primary activities, 17 % households are engaged in business, and 20 % rely on daily wages as primary activity. About 14 % of the households reported employment in the armed services and engagement as skilled and semi-skilled workers as their primary activities. In the surveyed households about 63 % reported of possessing agricultural land.

The households besides single sources also have different other sources of earnings. About 69 % of the households reported earnings from agriculture that includes paddy and high land crop cultivation. Similarly about 38 % of the households also earned from white collar jobs that includes government and private jobs and jobs in the armed services. Moreover, 23 % of the households also earn from daily wages and 17 % earn through skilled and semi skilled works. Nearly one fifth of the households also earn from business. The annual household income from all the sources is LKR 449,803/-. The major contribution in terms of total earnings is from highland crop cultivation, followed by private and government sector jobs. About 18 % of the households admitted of a family member migrated outside for work.

A majority (about 57 %) of the households reported that they visit a government health facility or a government doctor when someone falls ill. About 42 % of the households reported of accessing the government hospitals which are nearest to their respective villages. About 26 % of the household reported that at least one family member reported suffering from illness during the last one year. Among the diseases, non communicable diseases are faced by more than half of the households. In the project area about 89 % of the women participate in the decision making in the household on day to day activities. Similarly in 79 % of the households, women participate in financial matters and 81 % participate in the purchase of household assets. Healthy participation in the household decision making is also seen on matters relating to health care and education of the children. In the project area, about 88 % of the households are electrified. 89 % of the households also use alternate energy and the main source being fuelwood. In the project area 25 % of the electrified households use kerosene and diesel as alternate energy. On the other hand, the non electrified households use multiple sources of alternate energy for lighting, cooking and heating. Among the non electrified households, almost all the households use kerosene / diesel for lighting. Socio-economic conditions in the project area vary from one region to other. The northern region especially the Mannar area suffer most and considered to be backward due to long war affected zone.

### B. Consultation and Participation

Consultations were carried out with project stakeholders, during project preparatory stage. During Project preparation, consultations have been held with the concerned government officials (CEB, MoPE, SLSEA, and Ministry of Land and Land Development etc). Additionally, consultations were also carried out with the affected persons in the project area and with the local community. Focus Group Discussions (FGD) were conducted with local communities at 29 locations and with women groups at 26 locations in various project areas to include them as part of stakeholders during the month February to April, 2012. As an integral part of safeguards planning, affected communities and affected persons were involved during the project design and feasibility stage. Consultations were held to ensure people were adequately informed about the impacts of the Project and these had an opportunity to participate in the design and minimization of environmentally and socially adverse impacts during the early stages of project development. Different consultation techniques were used with stakeholders during the project preparation phase, including in-depth one to one and group interviews, public consultation meetings, focus group discussions, etc. Consultations were also carried out with identified vulnerable groups, including women. Ongoing and continuous consultation was maintained with relevant government officials and with the executing/implementing agencies. These consultations played a vital role in raising awareness, gaining local support, and enabling affected people to voice their opinions and suggestions on project design and implementation.

2. What level of consultation and participation (C&P) is envisaged during the project implementation and monitoring?

☒ Information sharing      ☒ Consultation      ☒ Collaborative decision making      ☐ Empowerment

3. Was a C&P plan prepared?      ☐ Yes      ☒ No

C&P is required for complex resettlement project. The project is categorized as "B" as far as IR is concerned. Consultations will be managed easily by the EA. The nature and scale of impacts associated with the project are not intense and complicated; hence, this does not trigger preparation and implementation of a C&P plan. Local communities and APs were consulted throughout the preparation process to minimise impacts, ensure social acceptance and increase equitability. The consultation and participation process will be on-going throughout the implementation of the Project. Views and concerns of all stakeholders will be taken into consideration and addressed whenever feasible. Finally, local customs, religious practices, and traditional activities are considered to have been fully integrated and considered during the preparation process to avoid discrimination and/or disruption of activities as minimisation measures.

### C. Gender and Development

#### Key issues.

The Project will have minor and temporary resettlement related impacts. The land acquisition will impact two woman headed households

which will be treated as vulnerable and additional provision of assistance has been made in the RP. The project as a whole will not have any direct impact on women because the transmission lines are grid based and the distribution lines are express line. However, CEB will ensure that women are consulted during the project implementation.

**Key actions.** The RP has a special provision for women headed affected households as vulnerable group and provision for additional assistance has been made in the entitlement in the RP. Additionally CEB will ensure that proper health safety, awareness campaign and equal wage payment etc are being followed by the construction contractor.

☒ Other actions or measures

III. SOCIAL SAFEGUARD ISSUES AND OTHER SOCIAL RISKS			
Issue	Significant/Limited/No Impact	Strategy to Address Issue	Plan or Other Measures Included in Design
Involuntary resettlement	<b>Limited Impact</b> The Project will have minimal land acquisition and resettlement impacts, all mitigable and of a temporary nature. No physical displacement will occur due to any land acquisition or resettlement. Minor land acquisition is required for the proposed transmission grid substation and distribution gantry. A total of approximately 7.70 hectares of land will be required for GSS and gantry out of which 5.63 ha is private land and 2.07 ha will be government land. Private land includes land from individual farmers and land from rubber estate company. A total of 6 households will be affected including 2 women headed households due to loss of small piece of land. Additionally, 2 rubber estate owners will be affected due to land acquisition. The transmission and distribution lines will have temporary impact on loss of standing crops and loss of commercial trees such as coconut, rubber, mango, banana etc which will not lead to any kind of displacement. Cash compensation for loss of land, crop and trees will be paid by CEB. The solar roof top subproject will not require any land acquisition and will not have any temporary impact.	An RP has been prepared based on the preliminary engineering design. The RP is in compliance with the NIRP-2001 and in alignment with the ADB's Safeguard Policy Statement 2009. All resettlement losses have been assessed and provisions have been made to APs for compensation and assistance. Additional assistance has been provided to vulnerable HHs.	<input checked="" type="checkbox"/> Resettlement plan
Indigenous peoples	No impact.		<input checked="" type="checkbox"/> None
<b>Labor</b> <input checked="" type="checkbox"/> Employment opportunities <input checked="" type="checkbox"/> Core labor standards	A limited and temporary number of skilled and unskilled job opportunities will become available to the local population for the duration of the construction phase.	Specific assurances will ensure enforcement of CLS by the contractor on the work camps/sites.	<input checked="" type="checkbox"/> No action
<b>Affordability</b>	No particular issue is expected.		<input checked="" type="checkbox"/> No action
<b>Other Risks and/or Vulnerabilities</b> <input checked="" type="checkbox"/> HIV/AIDS	Migrant and local workforce will need to be educated and made aware about the risks of HIV and other preventable transmissible illnesses. The EA will ensure to implement appropriate and necessary preventive and mitigating measures to ensure the health and safety of its workers and the local population.		<input checked="" type="checkbox"/> No action
IV. MONITORING AND EVALUATION			
Are social indicators included in the design and monitoring framework to facilitate monitoring of social development activities and/or social impacts during project implementation? <input checked="" type="checkbox"/> No			

## A 13. Annex 13: Resettlement Plan

### 1 Executive Summary

Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces as well as in the regions of the South. ADB's focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka. ADB is proposing to extend USD 130 Million loan to Sri Lanka's power sector for clean energy and network efficiency improvement. The proposed project will assist GoSL to develop a least-cost project implementation of the following project components: (i) transmission system strengthening to further improve its energy efficiency and enable rural electrification; (ii) distribution system improvement to expand access for the poor and rural household connection; and (iii) solar roof top and renewable energy component.

The project is categorized as "B" for the Involuntary Resettlement and category "C" for the indigenous people. The Resettlement Plan is prepared for the Clean Energy & Network Efficiency Improvement Part-1 (the Project) which is in accordance with the ADB's Safeguard Policy Statement (SPS), 2009, GoSL's National Involuntary Resettlement Policy (NIRP), 2001 and the Land Acquisition Act (LAA) of 1950 with amendments. The RP contains the extent of impact caused by land acquisition due to the construction of the subprojects and identifies compensation and resettlement assistance for Affected Persons (AP) which is primarily economic displacement, in this case, caused due to minimum land acquisition. This RP needs to be updated based on the detailed and final design.

Minimum land acquisition is required in the project. An assessment of land acquisition and resettlement has been carried out for the Project and its components. There is no physical displacement since the project includes transmission, distribution and solar rooftop components. The project will involve construction of new sub stations, upgrading & augmentation of existing substations, construction of transmission lines, construction of distribution gantries and its associated lines, and roof top solar in Sri Lanka. Land acquisition is required only for construction of the new transmission grid substations and distribution gantries. There are 4 proposed new grid substations to be constructed which are Mannar (2 ha of government land), New Polpitiya (2 ha of private land which belongs to a rubber estate company), Padukka (2 ha of government./rubber estate company land) and Kegalle (1.6 ha of private land belonging to 5 households). There are 3 proposed GSS to be augmented which are Vavuniya Pannipitiya, and Thulhiriya. Augmentation work will not require any private land acquisition since the construction activities will be limited to existing CEB premises within the respective GSS. Also, the distribution components will have 5 new gantries which are Kebithigollewa (0.025 ha of private land belonging to one women headed households), Kahatagasdigiliya (0.025 ha of government land), Galaha (0.025 ha of government land), Akkaraipattu (0.01 ha of government land and Pothuvil Gantry (0.016 ha of government land. A total of approximately 7.70 hectares of land will be required for GSS and gantry out of which 5.63 ha private land and 2.07 ha will be government land. Private land includes land from individual farmers and land from rubber estate owner. A total of 6 households will be affected including 2 women headed households due to loss of small piece of land. Additionally, 2 rubber estate owners will be affected due to land acquisition. Construction of transmission and distribution lines will not require any land acquisition as there will only be temporary impact on loss of crops (paddy) during construction for which adequate cash compensation will be paid prior to the construction. Additionally, loss of commercial trees such as rubber, banana, coconut, mango, etc is foreseen along the right of way. The land has been identified and the names/locations of the substations have been identified. There are no structures/buildings affected and there will be no loss of livelihood.

During Project preparation, consultations have been held with the concerned government officials (CEB, MoPE, SLSEA, Ministry of Land and Land Development etc). Additionally, consultations were also carried out with the affected persons in the project area and with the local community. Focus Group

Discussions (FGD) were conducted with local communities at 29 locations and with women's groups at 26 locations in various project areas to include them as part of stakeholders during the month February to April, 2012. Project information will be disseminated through disclosure of resettlement planning documents. Resettlement information leaflet containing information on compensation, entitlement and resettlement management adopted for the project will be made available in the local languages (Sinhalese and Tamil) and the same will be distributed to APs. The summary of the RP and the entitlement matrix will be translated into local languages; disclosed to the APs; and made available at the regional offices of the CEB. A copy of the RP will be disclosed on the EA/IA and ADB website. The consultation will be continued throughout the entire project cycle.

Grievances of APs will first be brought to the attention to the field official of CEB and grievances not redressed by the field staff within 15 days will be brought to the Grievance Redress Committee (GRC). The GRC will have representatives from APs, CEB, SLSEA, MoPE, Divisional Secretary, Ministry of Land and Land Development, field level staff, local administration, revenue authority and local community. The GRC will meet every month (if grievances are brought to the Committee), determine the merit of each grievance, and resolve grievances within a month of receiving the complaint-failing which the grievance will be referred to appropriate court of Law for redressal. Additionally, Public Utilities Commission of Sri Lanka (PUCSL) Act lays down procedures for Grievance Redressal. The Grievance Redress Mechanism (GRM) for the infrastructure development project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way.

The policy framework and entitlements for the Project are based on GoSL's The Land Acquisition Act (LAA), 1950, The National Involuntary Resettlement Policy (NIRP), 2001 (NRRP); and ADB's Safeguards Policy Statement 2009. Based on the above policies, the core involuntary resettlement principles for the Project have been adopted which are: (i) land acquisition, and other involuntary resettlement impacts will be avoided or minimised exploring all viable alternative sub-project designs and the land will be acquired on mutual negotiation basis where feasible; (ii) where unavoidable, time-bound resettlement plans (RPs) will be prepared and APs will be assisted in improving or at least regaining their pre-program standard of living; (iii) consultation with APs on compensation, disclosure of resettlement information to APs, and participation of APs in planning and implementing sub-projects will be ensured; (iv) vulnerable groups will be provided with special assistance; (v) payment of compensation to APs including non-titled persons (e.g., informal dwellers/squatters, and encroachers) for acquired assets at replacement rates; (vi) payment of compensation and resettlement assistance prior to the contractor taking physical acquisition of the land and prior to the commencement of any construction activities; (vii) provision of income restoration and rehabilitation; and (viii) establishment of appropriate grievance redress mechanisms. All APs who are identified in the project-impacted areas on the cut-off date will be entitled to compensation for their affected assets, and rehabilitation measures. APs who settle in the affected areas after the cut-off date will not be eligible for compensation. The project will recognise both titleholders and non-titleholders.

The project will not result in any permanent displacement may it be physical or economic. The project will impact on 8 households altogether who will lose a small portion of land. Rest of the impacts are associated with the temporary loss of crops, therefore, the relocation and income restoration of the APs are very much temporary in nature. The resettlement cost estimate for this subproject includes eligible compensation, resettlement assistance and support cost for RP implementation. CEB will arrange in advance to allot the required budget to meet the costs associated with land acquisition and resettlement resulting from this Project. The total land acquisition and resettlement cost for the Project is estimated to be LKR 286.43 million.

Government of Sri Lanka's (GoSL) Ministry of Power and Energy (MoPE) is the Executing Agency (EA) for overall coordination, whereas Ceylon Electricity Board (CEB) is also the EA and Implementing Agency (IA) for the transmission and distribution components. Additionally, Sri Lanka's Sustainable Energy Authority (SLSEA) is the EA and IA for the renewable energy components especially for the solar rooftop project. However, for the implementation of RP, SLSEA will not be involved as there is no land acquisition and resettlement issues under the solar rooftop project. MoPE has established an



environment cell in the Planning Division to implement the requirements of NEA. CEB has set up an Energy and Environment Division (EED) for dealing with environment related issues at the corporate level to monitor and implement environmental and social good practices. CEB has ongoing ADB-financed projects and will use the existing project management structure complemented by additional staff dedicated exclusively to implementing the Project. Project Implementation Units (PIUs) including experienced staff and headed by senior officers will be set up in CEB to undertake day-to-day project implementation activities.

All land acquisition, resettlement, and compensation will be completed before the start of civil works. All land required will be provided free of encumbrances to the contractor prior to handing over of sub-project sites and the start of civil works. The RP implementation schedule is tentatively calculated as one year. Monitoring will be the responsibility of CEB through its PIU and EED. The PIU will prepare quarterly monitoring reports and those will be compiled into bi-annual reports to be submitted to ADB.

## **2 Introduction and project description**

### **2.1 Overview**

Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces as well as regions in the south. ADB's focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka. In January 2011, ADB approved the Sustainable Power Sector Support Project with focus on Clean Energy and Access Improvement Project with focus on transmission system strengthening, rural electrification and distribution improvement, energy efficiency & renewable energy development etc.

Asian Development Bank's (ADB) involvement in the Power Sector Development Program has been consistent with its country partnership strategy for Sri Lanka which focuses on: Funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources, Improving energy efficiency and reliability by strengthening the transmission network, expanding access to electricity by improving connectivity for the poor, and mitigating climate change by financing clean energy projects and supporting energy efficiency initiatives.

ADB is proposing to extend USD 130 Million loan to Sri Lanka's power sector for clean energy and network efficiency improvement. The specific focus of this PPTA is to identify the transmission and distribution projects which could be funded through the proposed loan. The projects to be identified for the ADB financing are focused on evacuation projects for renewable energy (wind and solar) parks/projects and overall improvement of network efficiency. This would also include assisting ADB in preparing the required documents for finalizing the loan. Ceylon Electricity Board is a corporate body established for development and coordination of the Generation, Transmission and Distribution of Electrical Energy in Sri Lanka.

The proposed project will assist GoSL to develop a least-cost project implementation of the following project components: (i) transmission system strengthening to further improve its energy efficiency and enable rural electrification; (ii) distribution system improvement to expand access for the poor and rural household connection; and (iii) solar roof top and renewable energy component. The transmission component will include strengthening of the system in the Central, Eastern, and Northern parts of the country. It will also enable to address post-conflict electricity needs and bring cheaper hydropower to the population in the Northern and Eastern parts of the country from the North, Northern Central, Colombo and Central Provinces through various transmission lines and substations. Government of Sri Lanka's (GoSL) Ministry of Power and Energy (MoPE) is the Executing Agency (EA) for overall coordination, whereas Ceylon Electricity Board (CEB) is also the EA and Implementing Agency (IA) for the transmission and distribution components. Additionally, Sri Lanka's

Sustainable Energy Authority (SLSEA) is the EA and IA for the renewable energy components especially for the solar rooftop project.

The Resettlement Plan<sup>25</sup> (RP) has been prepared for the Clean Energy & Network Efficiency Improvement Part-1 (the Project) which is in accordance with the ADB's Safeguard Policy Statement (SPS), 2009, GoSL's National Involuntary Resettlement Policy (NIRP), 2001 and the Land Acquisition Act (LAA) of 1950 with amendments. The RP contains the extent of impact caused by land acquisition due to the construction of the subprojects and identifies compensation and resettlement assistance for Affected Persons (AP) which is primarily economic displacement, in this case, caused due to minimum land acquisition. No physical displacement will occur in the project. The RP is based on the engineering design and has been prepared in due consultation with project stakeholders. Attempts have been made by the engineering team during the design stage to minimise land acquisition and resettlement by adopting mitigation measures such as selection of substation and gantry sites mostly on the government land, line alignment to pass through less populated areas etc. The RP needs to be updated based on the final design and alignment.

### 3 Project Components

The project components will broadly involve the following:

#### A. Transmission Projects

- I. Transmission System Strengthening in Mannar region
- II. New Polpitiya 220/132 kV grid substation (GSS) and associated transmission line
- III. Padukka 220/132/33kV GSS and associated transmission line
- IV. Construction of 132/33 kV GSS at Kegalle
- V. Installation of reactive power compensation devices

#### B. Distribution Projects

- VI. Vavyunia-Kebithigollewa 33 kV
- VII. Anuradhapura-Kahatagasdigiliya 33 kV
- VIII. Kiribathkumbura-Galaha gantry 33 kV
- IX. Galmadu Junction-Pothuvil 33 kV

#### C. Roof Top Solar Project – various building

Detailed description of each project components is given in **Annexure-1**.

### 4 Scope of Land Acquisition and Resettlement

#### 4.1 General

A census survey was carried out using a structured questionnaire for the permanent impact especially for the private land acquisition in the months of February - April 2012. All the project sites were visited and assessed for the IR impacts. The survey team was trained by the safeguard specialists and the survey was closely monitored on a regular basis. The census survey included various aspects such as (i) assessment of land including quantity and typology (ii) Inventory of physical assets; (iii) potential income loss; (iv) impact on trees; (v) household characteristics, including social, economic and demographic profile and (vi) presence of informal settlers and non-titleholders.

<sup>25</sup> The project is categorised as B as the impact on Involuntary Resettlement is insignificant. Resettlement is insignificant when less than 200 people experience major "impacts" defined as involving AP being physically displaced from housing and/or having 10% or more of their productive, income generating assets lost. Resettlement having insignificant IR impact is categorised as B which requires a - resettlement plan.



## 4.2 Impact on Permanent Land Acquisition

Minimum land acquisition is required for the project. An assessment of land acquisition and resettlement has been carried out for the projects and its components. No physical displacement is foreseen in the project. The project will involve construction of new sub stations, upgrading & augmentation of existing substations, construction of transmission lines, construction of distribution gantries and its associated lines, and roof top solar in Sri Lanka. Land acquisition is required only for construction of the new transmission grid substations and distribution gantries. There are 4 proposed new grid substations to be constructed which are Mannar (2 hectares of government land), New Polpitiya (2 ha of private land which belongs to a rubber estate owner), Padukka (2 ha of government./rubber estate owner land) and Kegalle (1.6 ha of private land belonging to 5 households). There are 3 proposed GSS to be augmented which are Vavuniya, Pannipitiya, and Thulhiriya. Augmentation work will not require any private land acquisition since the construction activities will be limited to existing CEB premises within the respective GSS. Also, the distribution components will have 5 new gantries which are Kebithigollewa (0.025 ha of private land belonging to one woman headed households), Kahatagasdigiliya (0.025 ha of government land), Galaha (0.025 ha of government land), Akkaraipatthu (0.01 ha of government land and Pothuvil Gantry (0.016 ha of government land. A total of approximately 7.70 hectares of land will be required for GSS and gantry out of which 5.63 ha private land and 2.07 ha will be government land. Private land includes land from individual farmers and land from rubber estate owners. A total of 6 households will be affected including 2 women headed households due to loss of small piece of land and 2 rubber estate owners will be affected due to land acquisition. The land has been identified and the names/locations of the substations have been identified. There are no structures/buildings affected and there will be no loss of livelihoods. Details on the land requirements for the new substations and distribution gantries are provided in Table 1.

**Table 1: Impact on Permanent Land Acquisition**

Components	Area to be Affected (hectare)	Type of Land	Number of Affected Households	Number of Women Headed Households	Number of IP households (if any)	Households Losing more than 10% of their productive Assets
<b>A. Transmission Substations (New)</b>						
Mannar GSS (New)	2	Government	0	0	0	0
New Polpitiya GSS (new)	2	Private (Rubber Estate Owner)	1	0	0	0
Padukka GSS (New)	2	Private (Rubber Estate Owner)	1	0	0	0
Kegalle GSS (New)	1.6	Private	5	1	0	0
<b>Distribution Gantry (New)</b>						
Kebithigollewa Gantry (New)	0.025	Private	1	1	0	0
Kahatagasdigiliya Gantry (New)	0.025	Government	0	0	0	0
Galaha Gantry (New)	0.025	Government	0	0	0	0
Akkaraipatthu Gantry (New)	0.01	Government	0	0	0	0
Pothuvil Gantry (New)	0.016	Government	0	0	0	0

Source: Census Survey, March-April-2012

## 4.3 Temporary Impact on Loss of Crop

Construction of transmission and distribution lines will not require any land acquisition as there will only be temporary impact on loss of crops (paddy) during construction for which adequate cash compensation will be paid prior to the construction. Additionally, loss of commercial trees such as rubber, banana, coconut, mango, etc is foreseen along the right of way (RoW). Efforts will be made to

schedule the construction activities during the off season cultivation period. The compensation will be paid in cash before the construction activities begin. A walkover survey was carried out on a sample basis. Additionally an assessment has been made to calculate the approximate area of land to be considered for crop compensation due to the construction of transmission lines. As per the assessment, approximately 666 hectares<sup>26</sup> of private agricultural land will be temporarily affected considering the loss of crop on a strip of land during the construction which will have approximately 716 households. An assessment on temporary impacts is given in Table 2. Results of the walk survey of each line and the inventory of each line are detailed in Annexure-2. A summary impact on land acquisition and resettlement for each project components are described in Table 3. All the assessment relating to temporary impacts in case of lines are based on sample surveys and assumptions. The detailed assessment and quantity of impacts will be known at the time of detailed and final survey by the contractor.

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<sup>26</sup>The calculation to assess the area to be considered for crop loss under transmission lines is based on current assumptions. It should be noted that the detailed route survey will clearly demarcate the tower footings and right of way which is usually done prior to the commencement of civil works. The Right of Way has been considered as approximately 35 metres for transmission lines and 20 meters for distribution lines and the total length of each transmission line has been multiplied by the proposed RoW width which gives the total area to be covered under the transmission lines. In the project area, 60% of the land has been considered for productive activities/cultivation. The average land holding size per household in Sri Lanka is approximately 0.93 ha (less than a Hectare). The total area of the calculated cultivable land is divided by the average land holding size which gives the approximate numbers of households to be temporarily affected due to the temporary loss of crop.

**Table 2: Assessment on temporary Impacts on Lines and the Right of Way**

SI No	Name of the Sub-Project Components	Line Length (km)	Right of Way (meters)	Affected Area (Hectares)	Estimated Area for Crop Damage (Hectares)	Approx. estimation on temporary affected households	Name of Villages along the RoW as per Walk-Over Survey	General Profile and Cropping Pattern along the RoW
Transmission Lines								
1	Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line.	55	35	192.5	115.5	124	Kuda Nelum Kulama, Kalaththawa, Ambathalagama, Maradankadawala, Ukkulankulama, Rambewa, Ikirigollawa, Wahamalgollawa, Yaya 3, Sangilikandarawa, Katuwala, Medawachchiya, Isinbassagala, Poonawa, Kuda Halmillawa, Galkandagama, Kalnatinakulam, Kovilpudukkulam, Thelulipaikulam, Walikkulam, Vauvnia GSS	<ul style="list-style-type: none"> <li>Private and government owned land</li> <li>Paddy, banana and coconut cultivations along the ROW.</li> </ul>
2	Construction of 220/132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.	70	35	245	147.0	158	Sivunavalkulam, 73,72,71,70,69,68,67,66,65,64,63, 62 Km posts [Murukkankulam], ,61 Km post, Chundikkulam, Irratikulam, 58,57 Km posts, ,53 Km post [Thambanikulam], 52 Km post [Kattidamban], 50 Km post Madhu Road, Poomalakuttan, Pariyanalankulam, Kalliyamurippu, 31,30Km posts, 28,27,26,25,24,23,22,21,20.19.18,17, 16,15,14,13 Km posts, Sopalapullganeswaran, 12,11,10,9,8,7,6,5,4,3 Km posts, Kariyankulam, Thandikulam, Vauvnia GSS	<ul style="list-style-type: none"> <li>Private, Forest and government owned land.</li> <li>Paddy, and coconut cultivations and home gardens are along the ROW.</li> </ul>
3	Construction of 132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.	10	35	35	21.0	23	Ganepalla, Gonagamuwa, Batahenkanda, Malwatta Road, Batakitta, Kalugahatenne, Kalugala	<ul style="list-style-type: none"> <li>Private owned land</li> <li>Rubber, coconut and tea plantations and other mixed crops are along the ROW</li> </ul>
4	Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the exiting Pannipitiya grid substation.	58.5	35	204.75	122.9	132	Erawwala, Pannipitiya, Heenpanvila, Liyanagoda, Unapandura junction, Vakanda road, Welikumbura, Batawala Watte, Thunnana, Jayaweeragoda , Walauwatte, Pahala Hanwella, Ihala Hanwella, Pathagama, Kaluaggala, Suduwella, Boralugoda, Salawa, Pahala Kosgama, Kosgama, Aswatte North, Yogan Estate, Kamburapola	<ul style="list-style-type: none"> <li>Government and private owned land</li> <li>Paddy, coconut, rubber banana and other mixed crop cultivations along the ROW.</li> </ul>

5	Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.	12.5	35	43.75	26.3	28	Walpita, Alsevana, Pathumpura, Maningala, Mullegama, Gamuni Mawatha, Gal Varusa Para, Super Zone, Universal Park, Korathota, Valihinthuduwa Para	<ul style="list-style-type: none"> <li>• Private land</li> <li>• Paddy, coconut and mango cultivations are along the ROW.</li> </ul>
6	Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.	15	35	52.5	31.5	34	Gadallawatte Para, Pothuvarava, Malambe, Thahena, Bandarawatte, Ambalanwatte, Aggona, Walpola, Bogahapara, Polkannattawatte, Puwakgah Meethotamulla, Vihara Mawatha & Kolonnawa awatte,	<ul style="list-style-type: none"> <li>• Private land</li> <li>• Banana trees and coconut trees are along RoW along with paddy</li> </ul>
7	Construction of 132 kV 14 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.	22.5	35	78.75	47.3	51	Thulhiriya, Hunuwala, Kiriwanawatte, Kahambiliyawa, Galkatiya, Weragoda, Hathnagoda, Walgama, Kandedegara, Kolongolla, Galpola, Warakadeniya, Mologoda	<ul style="list-style-type: none"> <li>• Private land</li> <li>• Paddy, coconut, rubber, jak and other cultivations are along the ROW.</li> </ul>
Distribution Lines								
1	33 kV 23 km distribution line from Vavyunia GSS to Kebithigollewa.	23	20	46	27.6	30	Annanagar, Nadunkulam, Vellikulam, Ambalangodalla, Kuda Kachchakudiya, Haye Kanuwa, Dutuwewa, Paluhalmillawa, Kunchuttuwa, Ihala Usgollawa	<ul style="list-style-type: none"> <li>• Agricultural land and forest reserves.</li> <li>• Private and government owned land</li> <li>• Paddy, coconut, maize, mango and teak cultivations are along the ROW</li> </ul>
2	33 kV 31 km distribution line from New Anuradhapura to Kahatagasdigiliya.	31	20	62	37.2	40	Malberiwatte, Kuda Nelum Kulama, Kavarakkulama, Akkara Panaha, Vellaragama, Arappankulama, Kasamaduwa, Thihogama, Nelugollakada, Manelpu Maha Massalawa ra, Diganhalmillawa	<ul style="list-style-type: none"> <li>• Private owned land.</li> <li>• Paddy, coconut, mango and maize cultivations are along the ROW</li> </ul>
3	33 kV 15 km distribution line from Kiribathkumbura GSS to Galaha gantry.	15	20	30	18.0	19	Kiribathkumbura, Hendeniya, Angunawala, Kurunduwatte, Sarasavigama, Watagoda, Wariyagala, Nillamba, Palledelthota, Samadiya	<ul style="list-style-type: none"> <li>• Private and government owned land.</li> <li>• Fruit trees of different varieties, timber trees along the ROW</li> </ul>

4	33 kV 18 km distribution line from Galmadu Junction to Akkaraipatthu	18	20	36	21.6	23	2nd, 3rd[Esanganichana] , 4th, 5th, 6th, 7th, 8th and 9th mile posts, Kotalavadi junction, Eragama, Waripathnachenai, Galmadu Junction	<ul style="list-style-type: none"> <li>• Private lands.</li> <li>• Coconut trees, jak trees and mango trees are along the ROW.</li> </ul>
5	33 kV 42 km distribution line from Akkaraipatthu to Pothuvil.	42	20	84	50.4	54	Inspector Eettam, Hijra Nagar Housing Scheme, Urani, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338 [Sangamankanda], 339 [Tandiyadi], 340,341, 342, 343, 344 [Kanchirankuda], 345, 346,347 Km posts, Sagama 18 Km post, 17 Km post [Alikambe junction road], 16, 15,14 Km posts, Alikambe Junction, Road to Alikambe village, Alikambe village, 2nd mile post Ampara	<ul style="list-style-type: none"> <li>• Agricultural land, forest reserves, tanks and lagoons.</li> <li>• Government and private owned land.</li> <li>• Paddy cultivations are along the ROW</li> </ul>
Total				1110	666	716		

Source: Walk Over Survey, March-April-2012

**Table 3: Summary IR impacts on various subproject components**

SI Nº	Project Components	Permanent Impact (IR) on Land Acquisition	Temporary Impact (IR) on Crops/Trees	Remarks
<b>A</b>	<b>TRANSMISSION PROJECTS</b>			
<b>A.1</b>	<b>Transmission System Strengthening in Mannar region</b>			
	<ul style="list-style-type: none"> <li>Extension of 220 kV New Anuradhapura GSS.</li> </ul>	No	No	Construction activities will be confined to the existing GSS and adequate land is available for the extension within the CEB boundary. Hence, land acquisition and resettlement is not applicable here
	<ul style="list-style-type: none"> <li>Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line.</li> </ul>	No	Yes	The impacts are temporary which will be limited to loss of minimum one season crop (paddy and banana) within the right of way during construction and loss of commercial trees (coconut) are foreseen.
	<ul style="list-style-type: none"> <li>Augmentation of Vavuniya GSS.</li> </ul>	No	No	Augmentation work does not require any additional land acquisition as all the activities will be confined to the existing GSS premise. It is confirmed by the CEB officials that there is availability of adequate space within the CEB premises (in the northern part of the premises where stores of the Uthuru Vasanthaya project is located). Hence, land acquisition and resettlement is not applicable here
	<ul style="list-style-type: none"> <li>Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.</li> </ul>	No	Yes	Vavunia-Mannar transmission line traverses outside the boundary of several forest areas. The impacts are temporary which will be limited to loss of minimum one season crop (paddy) within the right of way during construction, loss of home gardens (vegetable) and commercial trees (coconut, mango and banana) are foreseen.
	<ul style="list-style-type: none"> <li>Construction of 132 kV/ 33 kV Mannar GSS (1 x 31.5 MVA).</li> </ul>	No	No	The proposed Mannar GSS site is located in a paddy land belong to the Irrigation Department. (2 hectares). The identified plot is belonging to Irrigation Department and is between the Murukkan Tamil School and the Agriculture In-Service Training Centre. No private land acquisition is required for the GSS and no physical displacement is foreseen.
<b>A-2</b>	<b>New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.</b>			
	<ul style="list-style-type: none"> <li>Construction of 220/132 kV New Polpitiya GSS which is about 10 km away from the existing Polpitiya GSS.</li> </ul>	Yes	No	The proposed New Polpitiya GSS is situated within a rubber tree estate in Gonagamuwa village near the Lelwala Colony (2 hectare). Losses of rubber trees are foreseen and the land has to be acquired from the rubber estate owner. No physical displacement is foreseen.
	<ul style="list-style-type: none"> <li>Construction of 132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.</li> </ul>	No	Yes	The 10 km transmission line to New Polpitiya GSS traverses the rubber lands, home gardens, secondary forests. The impacts are limited to loss of some commercial trees such as rubber, coconut, jak, tea etc.
	<ul style="list-style-type: none"> <li>Provision of 2x220kV double bus transmission bays to connect New-Polpitiya-New Galle 220 kV transmission line.</li> </ul>	No	No	This bay will be constructed in adjacent to existing substation. No land acquisition is required.
	<ul style="list-style-type: none"> <li>Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-</li> </ul>	No	Yes	The 58.5 km transmission line from New Polpitiya GSS to Pannipitiya GSS through Padukka traverses through urban areas near Pannipitiya, rubber lands, paddy fields, home

	Pannipitiya transmission line through Padukka to the exiting Pannipitiya grid substation.			gardens and some marshy area. The impacts are temporary which will be limited to loss of minimum one season crop (paddy) within the right of way during construction, loss of home gardens (vegetable) and commercial trees (coconut, tea, jak, rubber) are foreseen.
	<ul style="list-style-type: none"> <li>Augmentation of Pannipitiya GSS (2x220kV DB transmission line bays).</li> </ul>	No	No	Augmentation work does not require any additional land acquisition as all the activities will be confined to the existing substation premise. Hence, land acquisition and resettlement is not applicable here
<b>A-3</b>	<b>Padukka 220/132/33 kV GSS and associated transmission line</b>			
	<ul style="list-style-type: none"> <li>Construction of 220/132/33 kV Padukka Grid Substation.</li> </ul>	Yes	No	The proposed location for the Padukka new grid substation is at Batawalawatte in the Meegoda GND. The GSS will require 2 hectares of land (rubber estate owner).
	<ul style="list-style-type: none"> <li>Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.</li> </ul>	No	No	The 12.5 km transmission line from Athurugiriya GSS to Padukka GSS mainly traverses through paddy fields (90% of the length) and home gardens. The impacts are temporary which will be limited to loss of minimum one season crop (paddy) within the right of way during construction and loss of some coconut trees
	<ul style="list-style-type: none"> <li>Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.</li> </ul>	No	Yes	The line mainly traverses through paddy fields. The impacts are temporary which will be limited to loss of minimum one season crop (paddy) within the right of way during construction and loss of some coconut and banana trees
<b>A-4</b>	<b>Construction of 132/33 kV GSS at Kegalle</b>			
	<ul style="list-style-type: none"> <li>Construction of 132/33 kV grid substation at Kegalle.</li> </ul>	Yes	No	The proposed Kegalle GSS will be situated on paddy land (1.6 ha). No physical displacement is foreseen. A total of 5 households will be affected by losing some of their land.
	<ul style="list-style-type: none"> <li>Installation of 15 MVar (3x5 MVar) capacitor banks including 33 kV BSC bays at Kegalle 33 kV Bus Bar to Control load PF</li> </ul>	No	No	All the physical activities will be confined to the Kegalle GSS, therefore, no additional land acquisition is required.
	<ul style="list-style-type: none"> <li>Construction of 132 kV 22.5 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.</li> </ul>	No	Yes	The 22.5 km transmission line from Thulhiriya GSS to Kegalle traverses through paddy fields (12.6 km), home gardens and rubber estates (9.9 km). Loss of large number of rubber trees and home garden trees in the ROW have are foreseen which are largely rubber trees and coconut trees.
	<ul style="list-style-type: none"> <li>Augmentation of Thulhiriya grid substation with 2 Nos. of 132 kV line bays.</li> </ul>	No	No	Augmentation work does not require any additional land acquisition as all the activities will be confined to the existing substation premise. Hence, land acquisition and resettlement is not applicable here
<b>A-5</b>	<b>Installation of reactive power compensation devices</b>			
	<ul style="list-style-type: none"> <li>50MVar at Biyagama 33 kV BB (10x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>50MVar at Sapugaskanda 33 kV BB (10x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>30MVar at Pannala 33 kV BB (6x5MVar)</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is

	including BSC bays.			foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>30MVar at Bolawatta 33 kV BB (6x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>30MVar at Veyangoda 33 kV BB (6x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>30MVar at Kolonnawa-new 33 kV BB (6x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
	<ul style="list-style-type: none"> <li>30MVar at Kolonnawa-old 33 kV BB (6x5MVar including BSC bays).</li> </ul>	No	No	No physical work is anticipated in this component as it is related to supply of equipments. Therefore, no impact is foreseen as far as IR is concerned.
<b>B. DISTRIBUTION PROJECTS</b>				
<b>B-1</b>	<b>Vavyunia-Kebithigollewa 33 kV</b>			
	<ul style="list-style-type: none"> <li>33 kV 23 km distribution line from Vavyunia GSS to Kebithigollewa.</li> </ul>	No	Yes	The 23 km, 33 kV distribution line traverses through forest reserves, home gardens, paddy fields. This is a distribution line and the impacts are quite limited since the right of way is minimal. Temporary impacts are foreseen on loss of crops during construction and loss of some commercial trees is also anticipated.
	<ul style="list-style-type: none"> <li>33/11 kV Kebithigollewa Gantry.</li> </ul>	Yes	No	The land identified for the construction of Kabithigollawa gantry is a private property and CEB will purchase 250 sq. m. of land. No physical displacement is foreseen, however, one women headed household will be affected.
<b>B-2</b>	<b>Anuradhapura-Kahatagasdigiliya 33 kV</b>			
	33 kV 31 km distribution line from New Anuradhapura to Kahatagasdigiliya.	No	Yes	The 31 km, 33 kV distribution line traverses through paddy fields, home gardens, chena lands, scrub jungle and secondary forests, edge and the bund (or dam) of dry zone tank. This is a distribution line and the impacts are quite limited since the right of way is minimal. Temporary impacts are foreseen on loss of crops during construction and loss of some commercial trees is also anticipated.
	33/11 kV Kahatagasdigiliya Gantry.	No	No	The land identified for the construction of the Kahatagasdigiliya gantry is part of an old burial ground which in turn is situated adjoining the school playground of the Kahatagasdigiliya Muslim Maha Vidyalya. The identified land is located along the Upuldeniya road, 500 meters away from the Kahatagasdigiliya town. Land is vested with the Divisional Secretary of Kahatagasdigiliya and negotiations are underway with the DS to obtain this land for CEB. No private land acquisition is required.
<b>B-3</b>	<b>Kiribathkumbura-Galaha gantry 33 kV</b>			
	33 kV 15 km distribution line from Kiribathkumbura GSS to Galaha gantry.	No	Yes	The 15 km, 33 kV distribution line traverses through home gardens, paddy fields, Pinus plantation and scrublands. This is a distribution line and the impacts are quite limited since the right of way is minimal. Temporary impacts are foreseen on loss of crops during construction and loss of some commercial trees is also anticipated.
	33/11 kV Galaha Gantry.	No	No	The proposed location for the gantry is part of a burial ground in the Palle Deltota GND. The land is vested with Land Reform Commission and a request has been made to the LRC by the Area Engineer, Peradeniya via the Divisional Secretary of Doluwa (on 14 <sup>th</sup> March 2012) to obtain LRC permission. people have consented to the gantry construction and it was reported that they have also signed for a no objection letter to the CEB. No land acquisition is required.
<b>B-4</b>	<b>Akkirapaththu-Galmadu</b>			



Junction-Pothuvil 33 kV				
33 kV 18 km distribution line from Galmadu Junction to Akkaraipatthu.	No	Yes	The 18 km, 33 kV distribution line from Galmadu junction to Akkaraipatthu gantry traverses through home gardens, paddy fields, and degraded lands. This is a distribution line and the impacts are quite limited since the right of way is minimal. Temporary impacts are foreseen on loss of crops during construction and loss of some commercial trees is also anticipated.	
33/11 kV Akkaraipatthu Gantry.	No	No	The identified location for the gantry is situated at the 2nd Mile Post along Akkaripattu-Ampara road and is in the middle of paddy fields. No settlements are found in the vicinity. The land is vested with the Divisional Secretary of Akkaripattu and CEB is in negotiation with the DS to obtain 10 x 10 meter land for the construction of the gantry. No private land acquisition is required.	
33 kV 42 km distribution line from Akkaraipatthu to Pothuvil.	No	Yes	The 42 km, 33 kV distribution line from Akkaraipatthu to Pothuvil gantry traverses through paddy fields, forest reserves, edge of tanks (Komari and Paladi), scrublands and degraded lands. This is a distribution line and the impacts are quite limited since the right of way is minimal. Temporary impacts are foreseen on loss of crops during construction and loss of some commercial trees is also anticipated.	
33/11 kV Pothuvil Gantry.	No	No	The location identified for the Potuvil gantry is a marshy land belonging to the Land Reform Commission (LRC) and CEB is in negotiation with LRC to obtain 10x16 meter land for the construction of the gantry.	
C.	ROOF TOP SOLAR PROJECT			
C-1	Roof Top Solar project in	Nil	Yes	Since the site is proposed in Colombo city on the roof top of a high rise building and therefore poses no social and environmental issues.

Source: Social Survey (Census and Walk over Survey), March-April-2012

## 5 Socioeconomic Information and Profile

### 5.1 General

A social analysis has been carried out in the project area through a sample socio-economic baseline survey of approximately 436 households in the project area. The survey was carried out using a structured questionnaire. The objective of the social analysis was to assess the socio-economic profile of the population living in the project area. A baseline study was conducted to ascertain socio-economic and demographic profiles of the villages, in terms of their population, access to basic services, occupation, income and expenditure patterns, health, issues related to women, migration, structures and energy usages at home. All the filled in questionnaires collected from the field was scrutinised in house by trained professionals. A data entry format was designed using MS excel and Data were analysed using SPSS Version 15. The findings are as discussed in the following paragraphs and the detailed social impact assessment report is provided in **Annexure-3**.

### 5.2 Basic household characteristics

Among the household covered during the socio-economic survey, 87 % of the families live in rural areas and 12 % in the semi-urban areas. The majority, about 71 % of the households are Sinhalese, followed by Sri Lankan Tamils. Only 5 % are Muslims and 2 % are Indian Tamils among the households covered in the survey. About 11 % of the families are headed by a woman. Pipe borne water supply is available for 43 % of the households and about 32 % of the households use well water located in their respective yards. About three-fourth of the households never go outside to fetch water. Around 94 % of the households reported having a toilet at their respective households while 88 % are reported to have electricity. The average possession of the rooms among the households is 4.36 of which 4.06 rooms are lighted.

In the project area, 95 % of the structures are residential and only 1 % of the structures are commercial. The average age of the structures is 18 years. Around 54 % of the structures are having tile roofs followed by asbestos (34 %). Only 9 % of the roofs are covered with corrugated iron sheet. Majority about 90 % of the households are having concrete floors. Only 8 % of the households have floors made of clay / earth/ sand. Similarly, 91 % of the structures are having brick walls. Besides brick, walls of different makes are also used by the households. Nearly 5 % of the households are having walls of earth / clay make. About 86 % of the households are permanent in nature. The rest of the houses are temporary or semi-permanent.

### 5.3 Socio-economic profile of the Project Area

The average family size of the sample households is only 4.00. The overall sex ratio of the households is 1011 females for 1000 males. The overall literacy rate is 97 %. For the males, it is 98 % and among the females literacy is 96 %. Most of the households members are educated upto higher secondary level and this applies to both the genders. Only 2 % of the household members are graduates or above. From the analysis of the household members belonging to the age group of 18 years and above, it is evident that 54 % of the total household members in this age group are engaged in productive work. Among the male members about 82 % are in productive jobs besides 4 % students and 6 % are retired. Similarly among the females 26.4 % are in productive jobs.

Among the male members 16 % are farmers / cultivators, 19 % are skilled or semi skilled labourers and only 3 % are agricultural labourers. Among the males 28 % are engaged in white collar jobs working in government, private or in armed forces. Similarly 13 % are either doing business or are self employed. However, 8 % are found to be unemployed among the male household members in this age group. Similarly among the female members 11 % are doing white collar jobs, 6 % are farmers and 5 % are either self employed or doing business. Among the female members beside 49 % house wives about 11 % are unemployed.

At the household level, 26 % are practicing agriculture as a primary activity and 13 % practiced agriculture as secondary activity. Similarly 21 % of the household are engaged in highland crop cultivation and 17 % practice this as secondary occupation. Among other primary activities in 35 % of the households, government and private job are the primary activities, 17 % households are engaged in business, and 20 % rely on daily wages as primary activity. About 14 % of the households reported employment in the armed services and engagement as skilled and semiskilled work as their primary activities.

Different households possess different types of lands in the project area. A single household also possess more than a single type of land. About 64 % of the households possess, sinnakkara land, and the average possession of this type of land is 0.56 hectares. Similarly 24 % possessed land granted by the state and the average possession is 0.58 hectares. Another 16 % have state land on annual permit and the average possession is 0.59 hectares. Encroached land is possessed by 9 % of the households, and 6 % of the household possessed Ande land (share cropping). The total land possessed by the surveyed households is 327.56 hectares and the average possession is 0.75 hectares.

In the surveyed households about 63 % reported possessing agricultural land. The total agricultural land possessed by 276 households is 248.5 hectares which is cultivable. Thus the average possession of cultivable agricultural land is 0.9 hectares. Among the households who possess cultivable agricultural land about 63 % possess paddy land and 89 % possess highlands. In the project area rice is cultivated by 52 % of the households who have agricultural land. Maize and cowpea and green grams are the next major crops but grown by less percentage of the households. The average yield of rice reported to be 56.7 quintals per household. The price of rice varies in the range of LKR 20 to 30/- per kg. Similarly maize is grown only once in a year and the average yield is 17.4 quintals (Price LKR 30 to 32 per kg). Among vegetables 8 % of the households cultivate brinjal, 5 % cultivates cassava and only 2 % cultivates pumpkins. The average yield of brinjal and cassava is 4.4 quintals per household. The average price of brinjal and cassava is LKR 20/- Similarly among fruits about 22 % of the households

cultivate bananas and 9 % grows mangoes in their orchards. The average yield of bananas is 5.3 quintals and mangoes are 6.1 quintals. Among other fruits about 5 % of the households cultivate lime, oranges and water melon. In the project area tea and coconuts are also cultivated. About 13 % each cultivates tea and coconuts.

The households besides single sources also have different other sources of earnings. About 69 % of the households reported earnings from agriculture that includes paddy and high land crop cultivation. Similarly about 38 % of the households also earned from white collar jobs that includes government and private jobs and jobs in armed services. Moreover 23 % of the households also earn from daily wages and 17 % earn through skilled and semi skilled work. Nearly one fifth of the households also earn from business. The annual household income from all the sources is LKR 449,803/-. The major contribution in terms of total earnings is from highland crop cultivation, followed by private job and government jobs. In terms of average earnings, the average annual income from government jobs is maximum and it is reported to be LKR 3,48,576/- , followed by earnings from employment in armed services (LKR 3,40,345/-) and private jobs (LKR 2,94,034). Similarly the average annual income from highland crop cultivation is LKR 218,279/- and from paddy cultivation is LKR 130,161/-.

The average household expenditure as reported by the surveyed households is relatively low than the annual income. The total annual expenditure is reported to be LKR 257,952/-. It reveals that the majority of the households save lot of their earnings made. Among the expenditure about 47 % of the expenses are on food which is the highest. The next highest expenditure is on transportation (8 %) followed by education (8%), health (5%) and clothing (5%).

The most frequently owned durable goods are television and radio, possessed by more than 70 % of the households. Similarly electric fans are possessed by 57 % and refrigerators by 48 %, bicycle by 4 % and rice cookers by 42 % of the households. Nearly one third of the households possess LPG gas and water pumps and two wheelers. Valuable items like cars, computer, and washing machines are possessed by very few households.

Out of 436 households, 31 % of the households reported having taken a loan from different sources. The average loan amount is LKR 179,556/-. About one-third of the households who have taken loans, have invested in the improvement of their houses. Another one-fifth (19 %) have taken loans for investment in agriculture. Out of the 135 households who have taken loans about two third (68 %) have taken loans from the banks. Of the households who have taken loan about 87 % are able to repay the loans on time. However 12 % of the households face some problems while repayment and only 1 % could not able to pay the loan amount on time. The households in the project area have benefitted from different developmental schemes of the Sri Lankan government. Nearly one-fourth of the households out of 436 households surveyed admitted of benefitting from different government schemes. Out of the 103 households those received benefits from the developmental schemes, about 85% received these help from the government and 17 % received it from non-government organisations (NGO).

Out migration in search of job and work also reported from the project area. About 18 % of the households admitted of a family member migrated outside for work. Among the 77 households those reported of migration, the majority 99 % migrated individually and only individual member migrated with family. Among the males members those migrated about 69 % are engaged in formal employment and among the females about 53 % are in formal employment. The income of the migrated members is substantial; it is higher than the annual household income of all the resident households. The total average annual income of the migrated members is LKR 477,680/-.

#### 5.4 Health

57 % of the households reported that they visit a government health facility or a government doctor when someone falls ill at home. And the rest 43 % of the households visit a private doctor or clinic. About 39 % prefer the health facility as treatment is free or less costly. Nearly one fifth of the households prefer the health facility for its near proximity. Similarly 18 % of the households visit

health facility because of the availability of good doctors. 42 % of the households reported of accessing the government hospitals which are nearest to their respective villages. Similarly for 38 % of the households a dispensary is the nearest available health facility. About 29 % of the households reported the presence of a health facility within the village. For the rest 71 % of the households, a health facility is available outside their respective villages. The average distance of the health centre is from the villages covered is 4.62 kilometres, which is relatively nearer for the resident population in the project area.

About 26 % of the households reported that at least one family member suffered from an illness during the last one year. Among the diseases, non communicable diseases are faced by more than half of the households. Out of the 112 households those reported at least one family member have fallen ill, 54 % suffered from non communicable diseases. However 25 % of the household members are suffering from diabetes. Respiratory problems are also an ailment reported from the project area. Most importantly all the sick members have preferred allopathic treatments for their respective ailments.

About 14 % of the household reported that a child is born at their household during the last one year. It is important to note that in the project area about 98 % of the deliveries are have taken place at the hospitals. The households reported multiple places for ante natal checkups. Besides antenatal checkups at government and private health facilities, about 73 % of the households also had ante natal checkups at home by family health workers and mid wives which is a positive finding for maternal health. A pregnant woman had at least 10 ante natal checkups during the entire pregnancy period.

## 5.5 Energy usage pattern

In the project area about 88 % of the households are electrified. All the electrified households receive power and electricity from the government sources. The average year of electrification is 11 years and 6 months in the project area. The availability of electricity is fairly good in the project area. During the dry and wet seasons the availability is more than 23 hours in a day. All the households use electricity for lighting and the average use of electricity for lighting is 4 hours and 13 minutes. Similarly 93 % use electricity for running a television or a music system and the average usage is for nearly 3 hours. About 42 % of the electrified households use electricity for running water pumps and the average use is 27 minutes. Nearly half of the electrified houses use electricity for cooking and the average use is for 53 minutes.

In the project area those have electricity at their home, all of them have lamps and the average possession is 8.32. About 92 % of the households have television and the average possession is one each. Electric fans are possessed by 65 % with an average possession of 1.33. Similarly 55 % possess refrigerators, 49 % possess an iron, 47 % rice cookers and 41 % possess water pumps, all of them possess at least one item each. In the project area, those have electricity at their home, 98 % have electricity meter. Among the households those have electric meter the average consumption per month is 72.5 units.

About 76 % pay their electricity bills either in banks or post office and the rest 25 % at CEB offices. There is hardly any case of electricity theft case reported from the project area. The responsibility of maintenance lies with CEB admitted by all the electrified households. About 89 % of the households also use alternate energy. In the project area 25 % of the electrified households use kerosene and diesel as alternate energy. The average hour of consumption is 1 hour 35 minutes and the monthly average expenditure is LKR 865. Similarly 73 % use wood and average hours of consumption is 2 hours and 19 minutes. Most of the household do not incur any cost on account of procuring the fire woods. However 44 households spent on an average LKR. 437 per month on fire wood. No cost is incurred on fire woods. Another 29 % use gas and their average consumption is 1 hour 19 minutes and the average cost is LKR 728 per month.

On the other hand the non electrified households use multiple sources of alternate energy for lighting, cooking and heating. Among the non electrified households, almost all the households use kerosene / diesel for lighting. Battery for lighting is only used by 4 of the non electrified households. Solar lighting system is present in only 2 of the non electrified households. Similarly for cooking, 94 % of the households use wood and only 9 % use kerosene / diesel. For heating 26 % use fuelwood.

About 96 % of the households those who do not have electricity, use kerosene and diesel lamps and the average number is 2.43. Only 8 % of the households possess battery lamps and the average possession is 1. Solar panels are used by only 2 of the non electrified households and each possesses at least one. All the non electrified households have agreed to pay LKR 7115 per year for the electricity. All the households will use electricity for lighting and about 44 % of the household will use for operating a television. Some of the households will also use for cooking and pumping water.

In the project area, about 90 % of the households are satisfied on electricity's current flow. In the project area about 64 % of the households are satisfied on non electric energy. The rest 36 % are not satisfied on the non electric energy. About 67 % of the households admitted requirement of electric power. Among the non electrified households about 94 % of the households admitted that they will pay electricity bills regularly. The non electrified households are willing to pay LKR 324 in an average per month if their households are electrified. About 94 % of the households showed willingness to cooperate to minimize electricity theft. In the project area about 86 % of the households admitted that the project will help the people.

## 5.6 Role of women in project area

In the project area, about 90 % of the women at the household level as usual are engaged in household works. Similarly in the economic activities 17 % of the women are engaged in agriculture, 16 % are engaged in white collar jobs, 4 % in business and trade and only 3 % work as agricultural and non agricultural labourers. In about 38 % of the households, women are engaged in productive works, the annual contribution of these women is LKR 174,159.

In the project area, about 89 % of the women participate in the decision making in the household on day to day activities. Similarly in 79 % of the household woman participate in financial matters and 81% participate in the purchase of household assets. Healthy participation in the household decision making is also seen on health care and education of the children.

Among the household activities, cooking and cleaning are tow major activities where a woman is responsible. The average time spent in cooking is 2 hours and 47 minutes and for cleaning it is 1 hour and 31 minutes. Fuel wood collection is also one of the major activities for the women in 78% of the households and the average time spent is about 46 minutes. Similarly in 13 % of the households women are engaged in white collar jobs and they spent on an average about 7 hours and 27 minutes. Women are also responsible for daily marketing in nearly two-thirds of the households and on an average they spend about 49 minutes. In the project area, 94 % of the women feel safe during the day time and only 6 % feel safe to some extent during day time. Though the perception on safety as usual is less during the night time, still about 86 % of the women feel safe during the night time and only 12% feel safe to some extent during night time. In the project area about, 87 % of the women feel that they can move freely and about 11 % of the women feel that they can move freely during the day time.

In the project area, about 75 % of the households reported that women do not go outside to fetch water. In about 23 % of the households, women go outside to fetch water every day. Out of the 109 households in the project area where women go outside to fetch water, about 92 % of the women have easy access to water from outside sources. In the project area, about 94 % of the households have toilets at their respective places.

The census survey revealed that only 2 women headed households will be affected by the project. Women in the project area are largely involved in HH work, cultivation and other agricultural activities.

Women will not be affected negatively due to the project. Any negative impacts of project on female-headed household will be taken up on a case-to-case basis and assistance to these families will be treated on a priority basis. Women headed households are considered as vulnerable and provision for additional assistance has been made in the entitlement of the RP. Provision for equal wage and health safety facilities during the construction will be ensured by the EA and IA. Therefore, the project activities will not have any negative impact on women. Therefore, the project will not have any impact on women because the project is focused on transmission and distribution system which will not have any direct impact on women and women will not benefit directly. However, women group have been considered as integral part of stakeholders and consultations were carried out among women group to make them aware about the project.

## 5.7 Impact on Indigenous Peoples

No Tribal or Vedda people are found in the project area. The project will involve construction of new sub stations, upgrading & augmentation of existing substations, construction of transmission lines, construction of distribution gantries and its associated lines in Sri Lanka. However, the extent of impact is very less as there will be no such land acquisition required except for substations and gantries. The substations are proposed on existing government land and private land with better accessibility and mostly in populated area. The transmission and distribution lines will pass through wider area with no impact on indigenous people. No impacts are foreseen on Indigenous Peoples (IP) therefore, no action has been taken.

## 6 Information disclosure, consultation and participation

### 6.1 Consultation

Public consultation was carried out in the project areas with the objectives of minimising probable adverse impacts of the project and to achieve speedy implementation of the project through bringing in awareness among the community on the benefits of the project. During Project preparation, consultations have been held with the concerned government officials (CEB, MoPE, SLSEA, MLLD etc). Additionally, consultations were also carried out with the affected persons (APs) in the project area and with local communities. Focus Group Discussions (FGD) were conducted with the local communities at 29 different project locations. The issues covered during these consultations included the selection of project sites and the identification of potential impacts and other key issues, including addressing the current gaps in electric usage. These consultations provided inputs in identification of the felt needs of the communities, and the relevant stakeholders. The primary stakeholders are the APs, i.e., land owners who are going to lose small piece of land, the farmers who will be impacted temporarily due to loss of crop, local community and EA/IA. The methods used for the consultations are individual meetings, interviews, structured questionnaires, open ended questionnaire and Focused Group Discussion (FGD) with local communities. Additionally, focused group discussions were also carried out among women groups at 26 project locations to include them as part of stakeholder consultations. Summary on public consultations is described in Table 4 and the detailed summary on various FGDs is given in Annexure 4.

**Table 4: Summary Findings on Public Consultations**

Issues Discussed		People's views and perceptions
General Perception about Project		Most of the communities were not aware of the proposed electricity projects. Some communities have mistaken it for some other on-going electricity projects in their respective areas. Overall, it was through the research teams that they first heard about such electricity projects that would be implemented across their communities.
Support of local people for proposed project		Community response patterns were diverse. At one end, the communities expressed their fullest support in view of the projects' national importance. They believed that such projects would contribute to country's development such as expansion of industries and increase the rate of rural electrification. They also hoped that the new projects will improve their electricity supply, reduce power failures and voltage drops experienced particularly in the evenings. At the other end, some communities were concerned about the loss of crops etc and the safety issues during construction. Communities who expressed willingness to support provided the



Issues Discussed	People's views and perceptions
	project expressed that there should be no adverse impact due to the project on their houses, cultivations, livelihoods and safety; expressed willingness to support provided the project adequately compensates any losses in cash
Critical issue and concern by the local people for the project	There were at least seven major issues/concerns that were highlighted. They included (a) fear of losing or causing damages to their residences, cultivations, and livelihoods. This was a major concern of the urban/semi-urban communities who owned limited land; (b) fear of decreasing the land values when electricity lines run over their land or polls/towers installed in the middle of a land; (c) fear of not been able to plant any tall trees e.g. rubber, coconuts, mangoes, banana etc. in the areas over which electricity lines are running. In some areas, existing lines run over at a very low height and touch the leaves of tall trees causing frequent fires; (d) fear of having to cut-down existing tall trees e.g. valuable trees used for timber or fruit trees and thereby losing not only such tree species but also the incomes that they generated for the families; (f) fear of not been able to construct high-rise buildings including storied houses. Some feared that their children will not be able to construct houses in the same compound; (g) fear of increasing risks of insecurity and ill-health to people's lives. Many people believed that living in areas close to electricity lines, towers and polls would increase the threats of lightening. A few communities believed that living closer to electricity lines would increase their vulnerability to cancer. Therefore, they expressed all these concerned should be taken in to consideration by the engineering while finalizing the design and it was assured that CEB will follow the standard norms to avoid habitats etc.
Criteria liked to see during project design, operation stage and construction	The projects should avoid/minimize harm to residences, plantations, cultivations, other forms of livelihoods, religious and other places of community importance such as schools play grounds etc. Line routes should avoid running over houses. Necessary precautions must be taken to ensure safety of people during project construction. Several communities in the urban areas requested that projects should augment/replace the existing lines rather than constructing another parallel new line. If new lines are constructed, there would be resentment from community members on grounds of disturbance caused to their environment and safety. Almost all the communities requested further information on exact line routes before their formal consent is given.
Employment potential in the project	In a majority of the rural communities, people expressed their interest to find paid manual labour work during project construction. They preferred if construction work is carried out during off-seasons [of their agricultural activities] so that they would be able to find alternate income by providing their labour to project construction work. However, some of the communities expressed concerns over the suitability of their labour. They were of the view that project construction work requires skilled [technically competent] labour which is hardly available in their villages. Some others were of the view that construction work is generally handed over to contractors [by CEB] who would bring their own labour force from outside. Thus, they would not require any village labour. In urban/semi-urban settings where inhabitants are largely engaged in formal employment, there would not be any necessity to find employment in the project. Some communities hoped that they would be able to sell food or run boarding places for workers during project construction.
Ethnic Minorities	A majority of the communities covered in consultations composed of a single ethnic group i.e. Sinhalese, Muslims or Tamils. However, there were a few instances of co-existence of minority ethnic groups with a majority ethnic group. For example, in a community where Sinhalese were predominant, there were a few Muslim or Tamil families who lived within the same community. Or else, in a Tamil/Muslim predominant community, there were a few Sinhalese families.
No of shops/commercial establishments	None of the communities had any large scale business enterprises. Almost all the communities had retail grocery shops, whose numbers ranged between 5-15. Among the commercial enterprises were rice mills, flour grinding mills, welding workshops, motor mechanic garages and bicycle repair shops. But they were found only in a few communities.
Number of industrial units	Except for a few communities where there were tea or rubber factories, a garment factory, a paper manufacturing industry, a cement block manufacturing industry and an umbrella manufacturing industry none of the other communities had any industrial units. In a few communities, there were cottage industries such as dress-making, and jostics production.
Socio economic standing: land use, cropping pattern	In the dry zone districts of Anuradhapura, Mannar and Ampara, paddy cultivation was the major source of livelihood of the families. However, paddy cultivation was restricted to a single season of the year due to scarcity of water. In the dry periods, families also cultivated highland crops such as maize, cowpea, green gram, brinjals, chilies etc. which absorbed less water. There were few families who engaged in animal husbandry. The extents of land cultivated by dry zone farmers ranged between 1-3ha. Incomes of the dry zone farmers were supplemented by earnings from casual labour work and the earnings of family members employed in the garment factories and armed services. In the wet zone districts of Kegalle, Colombo, and Kandy, families had multiple incomes and they included employment in the government and private sector, tea/rubber small holdings, labour work in large tea and rubber plantations, and agricultural activities. The land under plantations

Issues Discussed	People's views and perceptions
	[small holdings] or agriculture was less than 1ha. And cultivations were carried out in both seasons of the year. The settlements in the urban/semi-urban areas were largely inhabited by migrant families from other areas who bought land and settled down primarily because of the close proximity of those areas to major townships. The size of land they owned was less than 0.04ha. This land was primarily used for residential purposes and home gardening [only if adequate space was available]. People in these urban settlements were largely dependent on their monthly salaries from government or private sector jobs. The resettled families in the former war affected districts such as Mannar and Ampara had access to limited cultivable land since land ownership issues still remain unresolved.
Sources of irrigation	In the dry zone districts of Anuradhapura, Mannar and Ampara, agricultural activities were largely rain fed. Or else, they were dependent on water provided by minor irrigation tanks. If the tanks have the capacity to provide water during dry season, farmers would engage in agricultural activities during dry periods as well. If not their cultivations are confined to a single season of the year. Some families had large agricultural wells in their compounds and farmers used water motors to pump water from the wells to their highland crop cultivations. In the wet zone districts of Colombo, Kegalle and Kandy, cultivations were done throughout the year with rain water or water from natural canal systems.
Access to Forest Land and Use	None of the communities consulted had extensive dependence on forest resources. Several communities were located far away from forest reserves. On the other hand, access to forests such as those in Anuradhapura or Ampara districts was restricted due to fear of threats from wild elephants. In the Mannar district [affected by conflict] entry to forests was prohibited to civilians due to security reasons and non-clearance of land mines. Occasional collection of firewood from minor forests was reported from a few communities.
Current rates for agricultural land	Prices of agricultural land were subject to variation depending on several criteria e.g. (a) its use - whether the land is used for paddy cultivation or highland crop cultivation; (b) availability of irrigation facilities; and (c) location – whether the land is situated closer to access roads or in the interior and whether it is in the dry zone or wet zone. In some dry zone communities, price of paddy land was higher than highlands while in others it was vice versa. In the wet zone, due to scarcity of land, agricultural land fetched very high prices and was in the range of LKR.500,000 a 0.4ha. On average, price of 0.4ha of paddy or highland in the dry zone would range between LKR.100,000 to LKR.300,000.
Sources of power supply	All the communities were dependent on government sources for electricity supply
Sources of electricity	Government grid is the only source of electricity for the communities.
Average amount of electricity used by per household per day	The quantum of electricity used by a household varied. Households that used electricity only for the purpose of lighting and sometimes for operating a TV as observed in several remote dry zone villages consumed 1-2 units per day. Households that used electricity for lighting as well as for operating electrical appliances such as TVs, refrigerators, irons, and water motors [which were the appliances commonly used] consumed 3-5 units per day.
Unit Rate	The unit rate varied along with the number of units consumed [according to variable standard rates set by CEB]. Households that consumed less than 3 units had to pay LKR.4/- or LKR.5/- per unit whereas households that consumed over and above 4 units had to pay LKR.6/- to LKR.8/- per unit.  Since commercial establishments were scant in most of the villages, unit price for electricity was unknown. However, a random check with a few commercial establishments pointed to LKR.14/- to LKR.16/- per unit.
Average total monthly expenditure per household on grid electricity	The average monthly bill varied between LKR. 125/- to LKR. 300/- for low users whereas for other medium users it ranged between LKR.300/-to LKR.1,000/- per month. However, we have observed that some urban/semi-urban middle class families receiving a monthly bill that ranged between LKR.1,000-LKR.2,000.
Other non grid electricity to use in your village and expenditure	None of the communities consulted reported having used non-grid electricity sources in their villages.
Source of drinking water	Private owned wells and tap water provided by the National Water Supply and Drainage Board (NWSDB) were the two main sources of drinking water for a majority of the families in the communities consulted. Several families had installed motors to pump well water to their individual homes. Families who did not have access to any of the two sources depended on a common well, a neighbour's well or a water stream (e.g. Kandy district) for drinking water. In new resettlements such as in Mannar, government authorities have provided 1-2 common tube wells for each settlement. In some urban/semi-urban settlements, there were community managed water schemes. In some areas such as Kabithigollawa where the salinity level in water was high, people had to depend on a single water source such as a spring. NGOs have provided rain water harvesting



Issues Discussed	People's views and perceptions
	tanks to some of the dry zone villages.
Shortage of water	Families in the wet zone did not experience a major shortage of water as there were several sources to collect water such as rivers, streams, wells etc. in periods of water scarcity. However, in the dry zone, people experienced difficulties in accessing water for both cultivations and domestic use particularly during dry season. Some had to travel 4-5 Km to bring water for their domestic use. In a few villages, local governance authorities have arranged water bowzers to distribute water to households during dry periods.
Negative impact on food grain, availability /land use	In general, people did not see any adverse impact on food/grain availability. However, they cautioned that if electricity polls/towers are installed in the paddy fields or other cultivable land, it would reduce the cultivable area of the farmers.
Will project cause landslides or soil erosion	Since the landscape of a majority of the dry zone villages is flat/plane land, people did not foresee any threats of landslides or soil erosion. However, in the wet zone districts, and communities living around hilly areas, people cautioned of possible landslides and soil erosion if the project has to cut down several trees and clear the forests.
Will project cause widespread imbalance by cutting fruit and commercial trees in the locality	People were unable to give a precise answer to this question as they did not know the exact extent to which the trees would be cut-down. The majority did not foresee such an imbalance. However, they cautioned that if the project cuts down valuable commercial trees e.g. rubber and coconuts and fruit trees such as <i>durian</i> and mangoes in significant numbers it would drastically affect the livelihoods and incomes of families who are dependent on those trees.
Will project cause health and safety issues	Some communities expressed their fears of increasing risks to their lives from lightening when they have to live closer to electricity lines and towers. Some others believed that living closer to electricity lines can cause cancer. But the majority did not foresee any health or safety issues. Installing towers in the middle of settlements would raise safety issues particularly for children. And communities suggested that such towers should be fenced around.
Resettlement and land acquisition	<p>It is only in the case of constructing grid sub stations or distribution gantries that land may have to be acquired or purchased in the open market. CEB has identified government owned barren land for a majority of the proposed grid stations and gantries. Therefore, it will not cause any loss of private properties or population displacements. In the case of private properties identified for the construction of grid stations and gantries, all the land owners are 'willing sellers'.</p> <p>Communities consulted could not recall any land acquisitions for previous development projects. In a few places they could recollect CEB paying compensation to families who lost valuable trees or plots of paddy land where towers were installed. They prefer market rate for valuation of lost assets to be compensated.</p>
Protected areas	No protected areas were observed within the communities consulted.
Health status	Except in some communities in the Anuradhapura district [Kabithigollawa and Kahatagasdigiliya] who reported high incidence of kidney ailments causing from drinking saline water, none of the other communities reported of any chronic diseases prevalent in their respective communities. However, incidence of blood pressure and diabetics were reported in most of the communities. All the communities expressed satisfaction with available health services including maternal and child care services. Family health care worker [midwife] conducted regular home visits and clinics had been held once or twice a month. People from rural areas mostly accessed government free medical services provided by hospitals which were located within 2-8 Km from their respective villages. Though private medical centres too were available within easy reach, they did not go to such places because they could not pay for those services. In the urban areas, people preferred to get treatment from private medical practitioners because of convenience and efficiency. Only exception was an urban shanty dwelling in Colombo where people relied on government medical services as they too could not afford to pay for private medical practitioners.
Will project setting change migration pattern of animals	None of the communities were conscious of the presence of any migrant birds or animals in their localities and therefore did not foresee any impacts on such animals, birds or their habitats.
Poverty Level	A significant proportion (approximately 40%-50%) of the population in the communities consulted reported as having an <i>average</i> socio-economic status. This means that they were able to have three meals a day. The proportion of <i>poor</i> families in the communities accounted for 20-40 percent and they represented families who did not have a stable source of income and were largely dependent on casual labour work. The numbers of <i>very poor</i> families in the communities were negligible in most communities and constituted less than 5%. In the urban/semi-urban settings, very poor families were almost non-existent.

Issues Discussed	People's views and perceptions
Educational status	The literacy rate in general was high in all the communities. The younger generation in the rural communities had a higher educational level compared to their elders. The school drop-out rate was extremely low and most of the children pursued continuous education at least upto GCE OL. Economic difficulties in the families or love affairs were the major reasons for some children to discontinue their education and look for employment or enter into marriage. Education of children in the conflict affected areas [Mannar and Ampara districts] had been adversely affected due to war and displacement. In urban settings, education levels of the population were high compared to their counterparts in rural areas. Communities were also satisfied with the services provided by government schools.
Employment status	Many girls in rural areas who studied upto GCE OL found employment in the garment factories. But their counterpart boys who had similar education could hardly find such employment. Instead they engaged in agriculture, casual labour work or joined armed services. Government sector employees in rural dry zone areas were rather scarce and were limited to a few school teachers or local level officers such as grama niladharis, samurdhi niladharis, midwives and cultivation officers. In some communities, government employees accounted for less than 10% of the population. People who attained higher education particularly in urban areas found employment in both the government and private sector such as school teachers, hospital workers, bank officers etc. Unemployment in urban/semi-urban settings was rather low as many youth could easily find some form of casual employment because of their close proximity to major townships. In rural areas, it was mainly the underemployment that existed as agricultural activities were largely confined to a single season of the year. Underemployment in such communities was reported as 15-20 percent. Some communities observed unemployment among educated youth with their inability to find employment that matches with their educational qualifications.
Migration pattern	Outward migration is comparatively high in rural areas than in urban areas. Many rural girls have found employment in garment factories in Colombo and other cities. Meanwhile, boys who have joined armed services too have migrated from their villages to their respective work stations. Only a very few people have migrated for foreign employment. Marriage is the key factor for inward migration in both rural and urban areas.
Type of compensation expected	Adequate cash compensation was expected for any losses to their houses, properties, cultivations and livelihoods. Some communities asked for replacement of land [if lands were acquired] within the same geographical area in addition to cash compensation. When compensating for loss of cultivations and trees, they requested that prospective income losses from such cultivations and trees should be considered. In many dry zone settlements, land cultivated by most of the farmers was either encroached state land or obtained from government authorities on the basis of annual permits. Thus, many families did not have any legitimate rights for the land they lived and cultivated. Concerns have been expressed by such communities that they would not be entitled to claim any compensation for land [in case of acquisition] since they did not legally own the land.
Perceived benefits from project	Most communities were of the view that the proposed projects would benefit the country as a whole but they would not accrue much direct benefits to their individual communities. They thought that projects would contribute to minimize the prevailing energy crisis in the country; increase the rate of rural electrification and provide energy for the industrial sector. At micro level, they hoped that projects would provide electricity to non-electrified households in their communities and offer labour work during project construction.
Perceived loss	It is temporary in nature due to loss of crops and trees and can be compensated by CEB.
Other organizations active in the area	Not many active community based organizations or NGOs were found in the communities consulted. Funeral Aid Societies, Samurdhi Societies, Farmer Organizations and Rural Development Societies were the four community based organizations that functioned in most of the rural communities. Interventions of external NGOs were almost non-existent or confined to their past interventions. Activities conducted by the CBOs included extending financial and other support for members in family burials, savings and credit schemes and community welfare programs. In urban/semi-urban areas, presence of CBOs was unheard of except for Funeral Aid Societies.
Village Committee	There is no established structure or leadership within the villages that make decisions or take action on matters concerned with community. Some CBOs may take decisions on community matters but they are largely confined to the interests of their membership. [Pradeshiya Sabhas are the only local governance structure that takes decisions on common issues but they are not confined to a single village. A pradeshiya sabha encompasses several villages and grama niladhari divisions]. But a number of communities mentioned that if their communities faced a critical issue, the entire village will get together and make a decision on how to address the problem. Several people mentioned that it was the local politicians and the local administrators who generally make decisions on community issues and gear the development programs and activities. There was hardly any consultation or participation of the communities.

Issues Discussed	People's views and perceptions
Usefulness of consultation	All the communities appreciated the consultation and sharing information on prospective development projects that would go through their villages. Communities noted that such consultations were rather rare and people would know about a project only when the foundation stone is laid for it. Sharing information is important so that communities can support the implementing agencies to minimize adverse effects of the projects and increase the implementation efficiency.

## 6.2 Information Disclosure

To keep more transparency in planning and for further active involvement of APs and other stakeholders, the project information will be disseminated through disclosure of resettlement planning documents. Resettlement information leaflets containing information on compensation, entitlement and resettlement management adopted for the project will be made available in the local languages (Sinhala and Tamil) and to APs. The EA and IAs will keep the APs informed about the impacts, the compensation and assistances proposed for them and facilitate addressing any grievances. The information will also be made available at a convenient place, easily accessible to the APs. The summary of the RP and the detailed RP will be translated into the local languages (Sinhala and Tamil); disclosed to the APs; and made available at CEB's offices. A copy of the RP will be disclosed on the EA/IA and ADB's website.

## 6.3 Continued Consultation and Participation

For continued consultations, the following steps are envisaged in the project:

- CEB will organise public meetings and will appraise the communities about the progress in the implementation of resettlement, social and environmental activities.
- CEB will organise public meetings to inform the community about the compensation and assistance to be paid. Regular update of the progress of the resettlement component of the project will be placed for public display at the CEB offices.
- All monitoring reports of the resettlement components of the project will be disclosed in the same manner as that of the RP.
- Key features of the entitlements will be displayed along the project corridor.
- CEB will conduct information dissemination sessions at major intersections and solicit the help of the local community leaders to encourage the participation of the APs in RP implementation.
- Attempts will be made to ensure that vulnerable groups understand the process and to take their specific needs into account

## 7 Grievance redress mechanisms

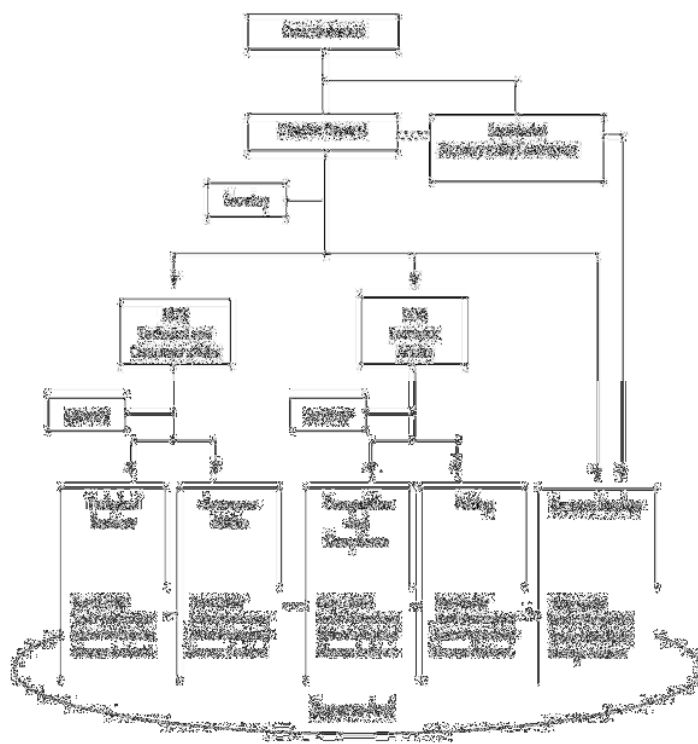
Efficient grievance redress mechanism will be developed to assist the APs resolve their queries and complaints. Grievances of APs will first be brought to the attention of the field officers of CEB. Grievances not redressed by the field level staff within 15 days will be brought to the Grievance Redress Committee (GRC). The GRC will have representatives from APs, CEB, SLSEA, MoPE, Divisional Secretary, Ministry of Land and Land Development, field level staff, local administration and local community – where necessary. The main responsibilities of the GRC will be to: (i) provide support to APs on problems arising from land/property acquisition; (ii) record AP grievances, categorise, and prioritise grievances and resolve them; (iii) immediately inform the EA/IA of serious cases; and (iv) report to APs on developments regarding their grievances and the decisions of the GRC and the PIU. Other than disputes relating to ownership rights under the court of law, GRC will review grievances involving all resettlement benefits, compensation, relocation, replacement cost and other assistance. The GRC will meet every month (if grievances are brought to the Committee), to determine the merit of each grievance, and resolve grievances within a month of receiving the complaint-failing which the grievance will be referred to the appropriate court of Law for redressal. Records will be kept for all

grievances received, including: contact details of the complainant, date the complaint was received, nature of grievance, agreed corrective actions and the date these were effected, as well as the final outcome. The GRCs will continue to function during the life of the Project loan including the defects liability period.

Additionally, Public Utilities Commission of Sri Lanka (PUCSL) Act lays down procedures for Grievance Redressal. The Grievance Redress Mechanism (GRM) for the infrastructure development project provides an effective approach for complaints and resolution of issues made by the affected communities in a reliable way. This mechanism will remain active throughout the life cycle of the project. The Public Utilities Commission of Sri Lanka (PUCSL) Act creates an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda of the country. PUCSL's mission is to regulate all the utilities within the purview of the PAAs, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner. Figure 1 depicts the PUCSL hierarchy.

All the members in PUCSL need to be informed by the PIU regarding procedures of GRM. The information should include procedures of taking/ recording complaints, handling of on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders etc. PUCSL has a standard mechanism of (i) informing the affected people GRM and its functions, (ii) how peoples representatives in the GRC will be selected, (iii) Procedure and the mechanisms adopted for making the complaints, (iv) supporting the complainants in communicating their grievance and attending the GRM meetings and (v) implementing compliance to a GRMs' decision, its monitoring and communication to the people. Periodic meetings of PUCSL are to be conducted by the PIU so that all the members of the PUCSL are familiar with the problems and responses received by individuals in the PUCSL. Figure 1 depicts responsibility hierarchy of PUCSL.

**Figure 1: Responsibility Hierarchy of PUCSL**



## 8 Legal framework

The policy framework and entitlements for the Project are based on GoSL's Land Acquisition Act (LAA), 1950, The National Involuntary Resettlement Policy (NIRP), 2001; and ADB's Safeguards Policy Statement 2009. A brief description on applicable laws and policies to the project are described in more detail below. The salient features of the Government's and ADB policies, along with a gap analysis are summarised in **Annexure-5**.

The law governing acquisition of land for public purposes is the Land Acquisition Act (LAA), enacted in 1950 and which has been the subject of several amendments and revisions. LAA provides the legal basis to acquire land, if required for any project including in the electricity sector. The LAA sets out the procedures for acquiring land and for payment of compensation for acquired land. To ensure that people affected by development projects are treated in a fair and equitable manner, and that they are not impoverished in the process, GoSL has adopted the National Involuntary Resettlement Policy (NIRP) in 2001. This policy established the framework for project planning and implementation.

The Sri Lanka's Land Acquisition Act of 1950 provides for only the compensation for land, structures and crops and does not require project executing agencies (PEA) to address key resettlement issues such as (a) exploring alternative project options that avoid or minimise impacts on people; (b) compensating those who do not have title to land; (c) consulting affected people and hosts on resettlement options; (d) providing for successful social and economic integration of the affected people and their hosts, and (e) full social and economic rehabilitation of the affected people.

ADB has adopted Safeguard Policy Statement (SPS) in 2009 including safeguard requirements for environment, involuntary resettlement and indigenous people. The objectives of the policy are to avoid involuntary resettlement wherever possible; to minimise involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups. The involuntary resettlement safeguards covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary.

Based on the above policies, the core involuntary resettlement principles for the Project have been adopted which are: (i) land acquisition, and other involuntary resettlement impacts will be avoided or minimised exploring all viable alternative sub-project designs and the land will be acquired on mutual negotiation basis where feasible; (ii) where unavoidable, time-bound resettlement plans (RPs) will be prepared and APs will be assisted in improving or at least regaining their pre-program standard of living; (iii) consultation with APs on compensation, disclosure of resettlement information to APs, and participation of APs in planning and implementing sub-projects will be ensured; (iv) vulnerable groups will be provided special assistance<sup>27</sup>; (v) payment of compensation to APs including non-titled persons (e.g., informal dwellers/squatters, and encroachers) for acquired assets at replacement rates; (vi) payment of compensation and resettlement assistance prior to the contractor taking physical acquisition of the land and prior to the commencement of any construction activities; (vii) provision of income restoration and rehabilitation; and (viii) establishment of appropriate grievance redress mechanisms.

<sup>27</sup> Vulnerable groups include poor households, households headed by women, the physically handicapped, and household headed by Indigenous People or ethnic minority.

## 9 Entitlements, assistance and benefits

### 9.1 Eligibility

All APs who are identified in the project-impacted areas on the cut-off date<sup>28</sup> will be entitled to compensation for their affected assets, and rehabilitation measures (as outlined in the entitlement matrix below) sufficient to assist them to improve or at least maintain their pre-project living standards, income-earning capacity and production levels. The project will recognise both titleholders and non-titleholders. APs who settle in the affected areas after the cut-off date will not be eligible for compensation. They, however will be given sufficient advance notice, requested to vacate premises and dismantle affected structures (if any) prior to project implementation.

### 9.2 Entitlements

Based on the above broad principles, a detailed description of each compensation measure and assistance for the project is provided in the entitlement matrix. DPs will be entitled to a combination of compensation measures and resettlement assistance, depending on the nature of ownership rights of lost assets and scope of the impact, including social and economic vulnerability of the DPs. The loss of crop, trees and agriculture during the construction of the transmission lines will be paid as instant cash compensation for the damaged period. People will use the land below the lines after the construction. In case there is a need for repair or maintenance of the transmission lines in the future, the project authorities would reach agreement with the land owners for access to the land for maintenance and repairs, when necessary, and that the land owners would continue to use the land for farming activities. CEB will provide cash compensation to the APs for the temporary loss of crop, if occurred, during the time of maintenance and repair. The entitlement matrix (Table 5) summarises the main types of losses and the corresponding entitlements in accordance with GoSL and ADB policies.

**Table 5: Entitlement Matrix**

Nº	Type of Loss	Application	Definition of Entitled Person	Entitlement	Responsible Agency
1	Loss of private land	Agricultural land, homestead land or vacant plot	Legal titleholders/ APs with customary land rights and APs with Permit from local authority	<ul style="list-style-type: none"> <li>• Compensation at replacement value or land-for-land where feasible.</li> <li>• Provision of stamp duty, land registration and documentation fee for title holder household</li> <li>• Transitional allowance based on three months minimum wage rates</li> <li>• Notice to harvest standing seasonal crops. If notice cannot be given, compensation for share of crops will be provided.</li> <li>• Additional compensation for vulnerable households</li> </ul>	CEB through its respective PIU
2	Loss of government land	Vacant plot, Agricultural land and homestead land	Appropriate government departments	<ul style="list-style-type: none"> <li>• Transfer of land through inter government department</li> <li>• Payment of land value by CEB to the concerned government and departmental transfer of ownership.</li> </ul>	MoPE/CEB
3	Loss of trees and crops	Standing trees and	Legal titleholder/	<ul style="list-style-type: none"> <li>• 60 days advance notice to harvest standing seasonal crops, if harvest is not possible, cash</li> </ul>	CEB through its respective PIU

<sup>28</sup>The cut-off date for title holders is based according to the formal notification under LAA, and for non-titleholders the date of the census survey based on the final design and survey. Those who encroach into the subproject area after the cut-off date will not be entitled to compensation or any other assistance.



		crops	tenant/leaseholder/sharecropper/non-titled AP	<ul style="list-style-type: none"> <li>compensation for crops (or share of crops) equivalent to prevailing market price</li> <li>Cash compensation for perennial crops and fruit bearing trees based on annual net product market value multiplied by remaining productive years</li> <li>Cash compensation equivalent to prevailing market price of timber for non-fruit trees</li> <li>Additional compensation for vulnerable households</li> </ul>	
4	Temporary loss of land	Land temporarily required for sub-project construction	Legal titleholders, non-titled APs	<ul style="list-style-type: none"> <li>Provision of rent for period of occupation for legal titleholders.</li> <li>Compensation for assets lost at replacement value,</li> <li>Restoration of land to previous or better quality</li> <li>Additionally, Cash Compensation will be paid for the temporary damage of crop under the RoW during the maintenance and repair after the construction. In case there is a need for repair or maintenance of the transmission lines in the future, the project authorities would reach agreement with the land owners for access to the land for maintenance and repairs, when necessary, and that the land owners would continue to use the land for farming activities.</li> <li>Additional assistance to vulnerable households</li> </ul>	CEB through its respective PIU
5	Any other loss not identified	-	-	<ul style="list-style-type: none"> <li>Unanticipated involuntary impacts will be documented and mitigated based on the principles of the Resettlement Framework.</li> </ul>	CEB through its respective PIU
6	Impacts on vulnerable APs	All impacts	Vulnerable DPs	<ul style="list-style-type: none"> <li>Additional allowance equivalent to LKR 10,000/- for loss of land or structure</li> <li>Preference in project employment (temporary) where feasible</li> </ul>	CEB through its respective PIU

## 10 Relocation and income restoration

The Project will not result in any permanent displacement may it be physical or economic. Temporary impacts on crops are foreseen for which adequate compensation provision based on market rate has been provided in the entitlement matrix. Transitional allowances to the APs losing land and APs losing commercial crops/trees have been provided in addition to the compensation based on a three months of minimum wage equivalent to LKR 12,000 per HHs. Also, vulnerable APs will be paid an additional assistance on a lump sum basis equivalent to LKR 10,000 per affected household. CEB will ensure that advance notice be issued to the APs prior to the start of the work and all the compensation will be paid prior to the start of the construction. The project will impact on only 8 household (6 farming households and 2 rubber plant owners) who will lose small portion of land. Rest of the impacts are temporary loss on crop, therefore, the relocation and income restoration of the DPs are very much temporary in nature. The APs will also be allowed to cultivate under the transmission lines (under the RoW) after the completion of the work. In case of any maintenance work in the future, CEB will pay the APs for any loss of crop due to the work.

## 11 Resettlement Budget and Financing Plan

### 11.1 General

The resettlement cost is indicative and subject to change which shall be updated based on the detailed and final design and followed by valuation by appropriate authority. The resettlement cost estimate for the project includes eligible compensation, resettlement assistance and support cost for RP implementation. These are part of the overall project cost. The unit cost for land and crops in this budget has been derived through a rapid field appraisal, consultation with APs, relevant government authorities and is based on the examples derived from the similar old practices in projects implemented by CEB. Additionally, contingency provisions (10%) have also been made to take into account variations from this estimate. CEB will arrange in advance to allocate the required budget to meet the requirements of compensation of land acquisition and resettlement cost.

### 11.2 Unit Cost

#### a Compensation

**Private agricultural land:** The average unit rate for agricultural land has been assessed as LKR 2,000,000 per Hectare. The average has been determined keeping in mind the market rate as revealed by the APs

**Crop, Trees and Loss of access due to land due to tower construction:** The unit cost for the loss of crop, trees and loss of access to the land due to tower footing has been derived based on the examples from old project implementation. Average cost per kilometre for transmission line is considered as LKR 800,000 (LKR 0.8 million) and the average cost per kilometre for distribution line is LKR 300,000 (LKR 0.3 million).

#### b Assistance

**Stamp Duty and Documentation Fees:** The unit cost has been assessed on a lump sum basis which is LKR 10,000 per title holder household in case of land acquisition

**Transitional Allowance:** This has been calculated based on three months of minimum daily wage rates.

**Vulnerable HH Allowance:** The unit cost has been assessed on a lump sum basis which is LKR 10,000 per vulnerable household.

#### c RP Implementation and Support Cost

**Administrative cost:** This has been calculated on a lump sum basis which is LKR 2,500,000 which includes staffing requirement, vehicle hire, grievance redress, carrying out consultation and cost for monitoring.

The resettlement budget requirements have been calculated based on the above parameters. The total land acquisition and resettlement cost for the Project is estimated to be LKR 286.43 million. The details are given below in Table 6. This is not the final cost as the calculation is made based on assumptions and the final cost will be calculated upon final design and estimation by the contractor and upon final valuation.

**Table 6: Indicative Resettlement Cost**

	Item	Unit	Unit Rate (LKR)	Quantity	Total Cost (LKR)
<b>A: Compensation for Acquisition of Private Land</b>					
A-1	Agriculture Land (Private) for Permanent Acquisition	Hectare	20,00,000	5.63	1,12,60,000



A-2	Temporary Loss of agricultural Land for crop, trees compensation for Transmission Lines	kilometres	8,00,000	243.5	19,48,00,000
A-3	Temporary Loss of agricultural Land for crop, trees compensation for Transmission Lines	kilometres	3,00,000	129	3,87,00,000
<b>Subtotal: A</b>					<b>24,47,60,000</b>
<b>B: Assistance</b>					
B-1	Documentation Fees	Lump Sum	10,000	8	80,000
B-2	Transitional Allowance	Lump Sum	18,000	724	1,30,32,000
B-3	Vulnerable Allowances	Lump Sum	10,000	2	20,000
<b>Subtotal: B</b>					<b>1,31,32,000</b>
<b>C: Support Implementation of RP</b>					
C-1	Administrative cost	Lump Sum	-	-	25,00,000
<b>Sub-Total C</b>					<b>25,00,000</b>
<b>TOTAL</b>					<b>26,03,92,000</b>
<b>Contingency (10% )</b>					<b>2,60,39,200</b>
<b>Grand Total</b>					<b>28,64,31,200</b>
<b>Grand Total in Million LKR</b>					<b>286.43</b>

### 11.3 Source of Funding and Fund Flow Management

The cost related to land acquisition and resettlement cost will be borne by the EA/CEB. CEB will ensure allocation of funds and availability of resources for smooth implementation of the project's resettlement activities. CEB will, in advance, initiate the process and will try to keep the approval for the resettlement budget in the fiscal budget through the ministry of finance.

## 12 Institutional Arrangements

Government of Sri Lanka's (GoSL) Ministry of Power and Energy (MoPE) is the Executing Agency (EA) for overall coordination, whereas Ceylon Electricity Board (CEB) is also the EA and Implementing Agency (IA) for the transmission and distribution components. Additionally, Sri Lanka's Sustainable Energy Authority (SLSEA) is the EA and IA for the renewable energy components especially for the solar rooftop project. However, for the implementation of RP, SLSEA will not be involved as there is no land acquisition and resettlement issues under the solar rooftop project. According to the National Environmental Act (NEA), there exists a mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for power plants of prescribed capacity and Transmission lines over 33 kV. The Central Environment Authority usually designates the Ministry of Power and Energy as PAA for transmission projects, as per the NEA. Therefore, MoPE has established an environment cell in the Planning Division to implement the requirements of NEA. CEB has set up the Transmission Design & Environment Branch (TDE) for dealing with environment and social issues at the corporate level to monitor and implement environmental and social good practices.

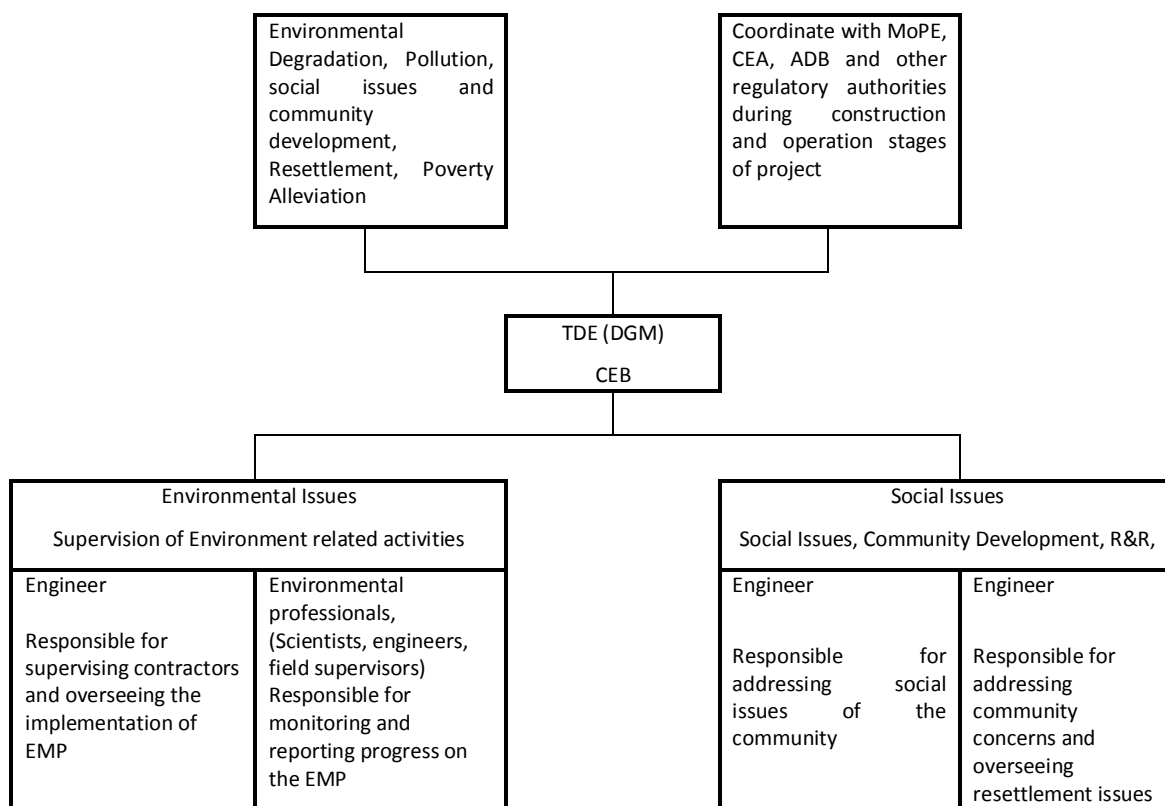
CEB has ongoing ADB-financed projects and will use the existing project management structure complemented by additional staff dedicated exclusively to implementation of the Project. Project Implementation Units (PIUs), including experienced staff and headed by senior officers will be set up in CEB to undertake day-to-day project planning and implementation activities. Full-time project managers with qualified staff will be appointed to supervise sub-projects under each component. The PIUs will be responsible for overall project planning and implementation, including procurement, accounting, quality assurance, social and environmental issues and coordination with concerned agencies.

For the land acquisition and implementation of RP, PIU at CEB will take the overall responsibility with due coordination from the relevant government ministry and department such as Ministry of Land and Land Development (MLLD) and Divisional Secretary. CEB has already an established Transmission Design & Environment Branch (TDE) with capacity in safeguards planning and implementation and the head of the TDE will be responsible for the safeguards implementation of the Project through PIU with its due involvement in the CEB's PIU. Therefore, all the activities related to planning and implementation of safeguards components in this Project will be responsibility of CEB. However, MoPE will facilitate for higher level coordination with MLLD when required. Details on the institutional roles and responsibilities related to land acquisition and resettlement activities are described in Table 8. Figure 2 depicts the institutional organisation structure showing the various entities within CEB and their role vis-à-vis- other government agencies.

**Table 7: Institutional Roles and Responsibilities for Resettlement activities**

Activity	Responsible Agency
<b>Project Initiation Stage</b>	
Setting up of PIU and staff	CEB/MoPE
Finalisation of Project Sites	CEB
<b>RP Preparation and Updating Stage</b>	
Conducting Census and social surveys of all APs	CEB/PIU/TDE
Conducting consultations	CEB/PIU/TDE
Preparation of RP	CEB/PIU/TDE
Approval of RP	CEB/ADB
Disclosure of RP	CEB/ADB
Updation of RP based on detailed and final design	CEB/PIU/TDE
Approval of updated RP	CEB/ADB
Disclosure of updated RP	CEB/ADB
<b>RP Implementation Stage</b>	
Fixing the compensation value	PIU/CEB/MLLD/Divisional Secretary and other relevant government department
Payment of compensation and Assistance	CEB/PIU/
Taking possession of land	CEB/MoPE
Implementation of proposed rehabilitation measures	CEB/PIU
Grievances redressal	CEB/PIU/TDE/GRC
<b>Monitoring</b>	CEB/PIU/TDE

*ADB = Asian Development Bank, AP =Affected Person, TDE = Transmission Design & Environment Branch, GRC = Grievance Redress Committee, MLLD = Ministry of Land and land Development, PIU = project Implementation Unit, RP = Resettlement Plan,*

**Figure2: Institutional Structure and Responsibility for Environmental Management Plan and Resettlement Plan at Ceylon Electricity Board (CEB)**

### 13 Implementation Schedule

All land acquisition, resettlement, and compensation will be completed before the start of civil works. All land required will be provided free of encumbrances to the contractor prior to handing over of sub-project sites and the start of civil works. However, public consultation, grievance redress and monitoring will be continued on an intermittent basis for the entire duration of the project. Implementation schedule for RP activities, including various sub tasks and a time line aligned to the civil work schedule is prepared and presented in Table 8. The implementation schedule for resettlement activities are tentative and subject to modification based on actual progress of the work.

**Table 8: Implementation Schedule**

Activity	Months											
	1	2	3	4	5	6	7	8	9	10	11	12
<b>1. Pre Implementation Stage</b>												
Establishment of PIU at CEB	♦											
Appointment of designated staff at PIU	♦											
Census and Social Survey		♦	♦									
Consultations		♦	♦	♦	♦	♦	♦	♦	♦	♦	♦	♦
Updating the RP based on final design				♦								
RP review and approval (CEB/MoPE and ADB).					♦							
Disclosure of the RP					♦							
Formation of GRC					♦							
<b>2. RP Implementation Stage</b>												
Issue notice to APs						♦						
Disbursement of Compensation and resettlement assistance							♦	♦	♦	♦	♦	

Takeover possession of acquired property	♦
Handover land to contractors	♦
Permission to contractor to begin works through written confirmation to ADB from CEB upon complete payment of compensation/assistance to APs is in particular section	
Start of the Civil Work	♦
<b>3. Intermittent Activity (Monitoring and GRM)</b>	
Monitoring	♦ ♦ ♦ ♦ ♦ ♦
Grievance Redress	♦ ♦ ♦ ♦ ♦ ♦

*ADB = Asian Development Bank, CEB = Ceylon Electricity Board, DP = Displaced Person, GRM = Grievance Redress, ID = Identity Cards, MoPE = Ministry of Power and Energy, PIU = Project Implementation Unit, RP = Resettlement Plan, SLSEA = Sri Lanka Sustainable Energy Authority*

## 14 Monitoring and reporting

Monitoring will be the responsibility of CEB through the PIU and TDE. The extent of monitoring activities, including their scope and periodicity, will be commensurate with the project's risks and impacts. CEB is required to implement safeguard measures and relevant safeguard plans, as provided in the legal agreements, and to submit monitoring reports (semi annually) summarizing implementation performance. ADB will require CEB to:

- establish and maintain roles, responsibilities, lines of communication and procedures for monitoring the implementation of the safeguard plans,
- verify compliance with safeguard measures and their progress toward achieving the intended outcomes,
- document and disclose monitoring results and identify necessary corrective and preventive actions in the periodic monitoring reports,
- follow up on these actions to ensure progress toward the desired outcomes,(v) retain qualified and experienced external expert to verify monitoring information for projects with significant impacts and risks,
- Submit periodic monitoring reports on safeguard measures as agreed with ADB.

The PIU established to work alongside CEB and TDE will be responsible for daily planning, implementation, feedback and trouble shooting, maintenance of individual AP files, managing and maintaining good community relationships and continuous dialogue, scheduling consultation dates, staying abreast of complaints or appeals placed and of submitting periodic progress reports. The PIU will prepare quarterly monitoring reports and will compile the report which will be submitted by CEB to ADB on a semi-annual basis. Monitoring reports documenting progress on resettlement implementation and RP completion reports will be provided by the CEB to ADB for review. Additionally, ADB will monitor projects on an ongoing basis until a project completion report is issued.

The indicators for achieving the proposed objectives during the implementation of the RP are of two types: (i) Process Indicators (Indicating project inputs, expenditure, staff deployment, etc.) and (ii) Output Indicators: Indicating results in terms of numbers of DPs compensated, area of temporarily occupied lands restored, etc. Input and output indicators related to physical progress of the work will include items such as: (i) Training of EA/IA and other staff completed, (ii) Census, assets inventories, assessments and socio-economic studies completed, (iii) Grievance redress procedures in-place and functionality, (iv) Compensation payments disbursed, (v) Relocation of DPs completed where applicable, (vi) Project employment provided to DPs, (vii) Infrastructure rehabilitated or constructed, (ix) Income restoration activities initiated, (x) Number of HHs displaced and resettled, and (xi) Monitoring and evaluation reports submitted.

## Annexure 1: Project Details and Description

Refer to Annex 8.

## Annexure 2: Social Impact Assessment (SIA) Report

### 1 Introduction

#### General

This is a Social Impact Assessment (SIA) prepared for the Clean Energy & Network Efficiency Improvement Part-1 (the Project). A social analysis has been carried out in the project area through a sample socio-economic baseline survey of approximately 436 households in the project area. The survey was carried out using a structured questionnaire. The objective of the social analysis was to assess the socio-economic profile of the population living in the project area. A baseline study was conducted to ascertain socio-economic and demographic profiles of the villages, in terms of their population, access to basic service, occupation, income and pattern of expenditures, health, issues related to women, migration, structures and energy usages at home. All the filled in questionnaires collected from the field was scrutinised in house by trained professionals. A data entry format was designed using MS excel and Data were analysed using SPSS Version 15.

#### Project Components

The project components will broadly involve the following:

- A. Transmission Projects –
  - I. Transmission System Strengthening in Mannar region,
  - II, New Polpitiya 220/132 kV grid substation (GSS) and associated transmission line,
  - III, Padukka 220/132/33kV GSS and associated transmission line,
  - IV. Construction of 132/33 kV GSS at Kegalle, and
  - V. Installation of reactive power compensation devices.
- B. Distribution Projects –
  - VI. Vavyunia-Kebithigollewa 33 kV,
  - VII. Anuradhapura-Kahatagasdigiliya 33 kV,
  - VIII. Kiribathkumbura-Galaha gantry 33kv, and
  - IX. Galmadu Junction-Pothuvil 33 kV.
- C. Roof Top Solar Project – various building

#### Scope and Objectives of the Study:

The broad scope and objectives of the study are as follows:

- Preparation of general socioeconomic profile of the households along the transmission and distribution lines
- Baseline data generation including socio-economic and demographic profiles of the villages, in terms of their population, caste composition, education, health, water, fodder, fuel, credit, employment, migration, agriculture, livestock, infrastructure, etc.
- Assessment of the impact of the Project on the social and economic lives, and livelihoods of the people in the Project area
- Preparation of baseline information

#### Methodology:

A structured questionnaire was administered at the household level to elicit the socio-economic profile of the population living in the project area.

## Data Processing and Analysis

All the filled in questionnaires collected from the field was scrutinised in house by trained professionals. A data entry formatted was designed using MS excel and Data were analysed using SPSS Version 15.

## Organisation of the SIA Report

This report summarises the results from the survey and stakeholder meetings. The report has been structured into the following sections:

- **SECTION 1: INTRODUCTION:** Discusses the project objective, geographic location, scope and methodology of the study.
- **SECTION 2: BASIC HOUSEHOLD CHARACTERISTICS:** This Section specifically deals with the household characteristics like socio-religious composition, household condition and access to basic amenities in the survey area.
- **SECTION 3: SOCIO-ECONOMIC PROFILE OF THE PROJECT AREA:** This Section provides a detailed account of the demographic profile, of employment, number of earning members, possession of assets, agricultural land, pattern of agricultural practise, and sources of incomes and expenditure pattern and the migration patterns.
- **SECTION 4: HEALTH:** This Section provides a detailed account of the health facilities available and treatment seeking places, reasons for preferences, and the ante natal care.
- **SECTION 5: WOMEN'S PARTICIPATION:** This Section discusses about the women in the project area. The different economic and household activities performed by them, their participation in decision making, time spent on performing different household activities. The perception on their safety and mobility is also analysed.
- **SECTION 6: CONCLUSIONS AND RECOMMENDATIONS:** This Section presents the conclusions and recommendations derived from the overall social assessment.

## 2 Basic household characteristics

This section specifically dealt on the household characteristics like socio-religious composition, household condition and access to basic amenities in the survey area.

### 2.1 Settlement Type

Among the household covered during the socio-economic survey about 87 % of the family lives in rural areas and 12 % in the semi-urban areas. For details refer **Table 2.1**.

**Table 2.1 Type of Settlement**

Sl. No.	Types	No	%
1	Rural	380	87
2	Semi Urban	53	12
3	Urban	3	1
	Total	436	100

### 2.2 Ethnic composition of the Households

The majority 71 % of the households are Sinhalese, followed by Sri Lankan Tamils. Only 5 % are Muslims and 2 % are Indian Tamil among the households covered in the survey. For details refer **Table 2.2**.

**Table 2.2 Ethnicity of the households**

Sl. No.	Ethnicity	No	%
1	Sinhalese	311	71
2	Sri Lankan Tamil	94	22
3	Indian Tamil	8	2
4	Muslim	23	5
<b>Total</b>		<b>436</b>	<b>100</b>

### 2.3 Women Headed Families

Out of the 436 households, 11 % of the families are headed by a woman. For details refer **Table 2.3**.

**Table 2.3 Percentage of families headed by women**

Sl. No.	Women Headed	Frequency	%
1	Yes	49	11
2	No	387	89
3	Total	436	100

Among the women headed families nearly two third of them are widows.

**Table 2.4 Marital status of the woman**

Sl. No.	Marital Status	Frequency	%
1	Married	9	18
2	Single Never Married	2	4
3	Widow	32	65
4	War widow	1	2
5	Husband migrated	1	2
6	Separated	4	8
7	Total	49	100

### 2.4 Source of Drinking Water

During the socio-economic survey the households were asked to report two main sources of drinking water. Pipe water supply is available for 43 % of the households and about 32 % of the households use well water located in their respective yards. Public well as a source of drinking water is reported by 13 % of the households. Details are given in **Table 2.5**.

**Table 2.5 Source of drinking water for the Households**

Sl. No.	Sources	Frequency	%
1	Piped into residence / yard / plot	189	43
2	Public tap	25	6
3	Hand pump in residence / yard plot	42	10
4	Public hand pump	32	7
5	Well in residence / yard / plot	140	32
6	Public well	57	13
7	Spring	26	6
8	River / stream	9	2
9	Pond / lake	1	0
10	Others	1	0
11	Total	436	100



## 2.5 Scarcity of Drinking Water

About three-fourth of the households never goes outside to fetch water. Similarly among the others 23 % goes outside everyday to fetch water. Details are given in **Table 2.6**.

**Table 2.6 Incidence of women going outside to fetch water**

SI No	Occasion	No	%
1	Never	327	75
2	Everyday	101	23
3	1 to 2 days	7	2
4	5 to 6 days	1	0
	<b>Total</b>	436	100

## 2.6 Toilet Facility

86 % of the households reported having a flush toilet and 8 % have own pit toilets at their respective households. Only 3 % of the households have no toilet facility at their households and rely on bush or field. Details are shown in **Table 2.7**.

**Table 2.7 Type of toilet facilities at the households**

SI No	Toilet	Number	%Age
1	Own flush toilet	376	86
2	Shared flush toilet	10	2
3	Public flush toilet	1	0
4	Own pit toilet / latrine	33	8
5	Shared pit toilet / latrine	2	0
6	No facility / bush / field	13	3
	<b>Total</b>	436	100

## 2.7 Availability of Electricity

In the surveyed households, 88 % reported having electricity. The details are given in **Table 2.8**.

**Table 2.8 Availability of electricity at the households**

SI. No.	Whether Electrified	Number	%
1	Yes	383	88
2	No	53	12
3	<b>Total</b>	436	100

## 2.8 Structure of the houses

In the surveyed households, 86 % of the households are permanent in nature. The rest of the houses are temporary or semi-permanent. The details are given in **Table 2.9**.

**Table 2.9 Type of Structure**

SI No	Structure Type	No	%
1	Temporary	25	5.7
2	Semi permanent	27	6.2
3	Permanent	377	86.5
4	No Information	7	1.6

	<b>Total</b>	436	100.0
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## 2.9 Availability of Rooms

The average possession of the rooms among the households is 4.36 and 4.06 rooms are lighted. The details are given in **Table 2.10**.

**Table 2.10 Number of rooms**

SI No	Rooms	Beneficiary
1	Average No. of Rooms	4.37
2	Average No. of Lighted Rooms	4.06
3	Average AC Rooms	Only 4 rooms

## 2.10 Summary

Among the household covered during the socio-economic survey about 87 % of the family lives in rural area and 12 % in the semi-urban area. Majority about 71 % of the households are Sinhalese, followed by Sri Lankan Tamils. Only 5 % are Muslims and 2 % are Indian Tamil among the households covered during the survey. About 11 % of the families are headed by a woman. Pipe water supply is available for 43 % of the households and about 32 % of the households use well water located in their respective yards. About three-fourth of the households never goes outside to fetch water. About 94 % of the household reported having a toilet at their respective households. About 88 % reported having electricity. About 86 % of the households are permanent in nature. The average possession of the rooms among the households is 4.36 and 4.06 rooms are lighted.

## 3 Socio-economic profile of the project area

This section provides a detailed account the demographic profile, of employment, number of earning members, possession of assets, agricultural land, pattern of agricultural practice, sources of incomes and expenditure patterns.

### 3.1 Population Distribution

The status of key demographic profile has been analysed for 1780 members (885 males and 895 females) in 436 households covered during the survey. The analysis was made on the overall size of the population reported among the surveyed households. A summary table on key demographic indicators is shown in Table 3.1. As evident from the table, the average family size of the sampled household is found to be 4.00. The overall sex ratio of the households is 1011 females for 1000 males. However among the children in the age group of 0-14 years this is low and recorded to be 897 females to 1000 males. Details are described in **Table 3.1**.

**Table 3.1: Status of key demographic indicators for the sampled households**

Sl. No	Key Indicators	Findings	
1	Average Family Size	4	
2	Sex Ratio	1011	
3	Literacy	97 % (Male 98 %, Female 96 %)	
4	Population in Key Age groups		
	Age Groups	Percentage to Total Population	No of Females per 1000 males
A	0-14 years age	21.74 %	897
B	15 years to 59 years	66.40 %	1031
C	60 years +	11.85 %	1131

### 3.2 Literacy level (6 Years and above)

The overall literacy is 97%. For males, it is about 98 % and among the females literacy is about 96 %. Most of the households members are educated upto higher secondary level and this applies to both the genders. Only 2 % of the household members are graduates or above. For details refer **Table 3.2**.

**Table 3.2 Educational Qualification of the Household members aged above 6 years**

Sl. No	Level of Education	Male		Female		Total	
		No	%	No	%	No	%
1	Illiterate	15	2	31	4	46	3
2	Literate but no formal education	10	1	9	1	19	1
3	Nursery	1	-	0	0	1	-
4	Primary (std. 1 to 5)	142	17	125	15	267	16
5	Upper primary (std. 6 to 8)	136	17	143	17	279	17
6	Secondary (std. 9 to 10)	228	28	221	27	449	27
7	Senior secondary (std. 11 to 12)	261	32	262	32	523	32
8	Graduate & more	15	2	25	3	40	2
9	Diploma/ Technical /ITI	6	1	3	0	9	1
10	Professional degrees (Er./MBBS/MBA)	1	0	1	0	2	0
11	Not Ascertained	2	0	3	0	5	0
	Total	817	100	823	100	1640	100

### 3.3 Gender wise Primary Occupation (18 Years & above)

The occupation of the household members belonging to the age group of 18 years and above was analysed. It is important to note that out of the total 1780 household members, 1282 (72 %) belong to this age group. Overall 54 % of the total household members in this age group are engaged in productive work. Among the male members, about 82 % are in the productive jobs besides 4 % students and 6 % are retired. Similarly, among the females, 26.4 % are in the productive jobs out of the total 653 female members in this age group. Among the females, about 49 % are house wives or home makers.

Out of the 629 male members 16 % are farmers / cultivators, 19 % are skilled or semi skilled labourers and only 3 % are agricultural labourers. Among the males 28 % are engaged in white collar jobs working in government, private or in armed forces. Similarly 13 % are either doing business or are self employed. However about 8 % is found to be unemployed among the male household members in this age group.

Similarly among the female members 11 % are doing white collar jobs, 6 % are farmers and 5 % are either self employed or doing business. Among the female members beside 49 % of house wives, about 11 % are unemployed. Details are described in **Table 3.3**.

**Table 3.3 Primary Occupation (18 Years and above)**

Sl. No	Primary Occupation	Male		Female		Total	
		No	%	No	%	No	%
1	Farmer / Cultivator	103	16	41	6	144	11
2	Agricultural Labourer	20	3	5	1	25	2
3	Construction & related work	6	1	2	0	8	1
4	Skilled / semi skilled / other non agricultural labourer	118	19	15	2	133	10
5	Animal Husbandry	2	0	7	1	9	1
6	Government job	47	7	33	5	80	6
7	Private job	72	11	33	5	105	8
8	NGO job	3	0	1	0	4	0

9	Business	49	8	15	2	64	5
10	Self employed	33	5	17	3	50	4
11	Retired (60 Yrs & Above)	35	6	34	5	69	5
12	Un-employed	50	8	93	14	143	11
13	House wife		0	323	49	323	25
14	Student	24	4	29	4	53	4
15	Fisher Man/Boat Owner	1	0		0	1	0
16	Armed Services	63	10	2	0	65	5
17	Other	3	0	3	0	6	0
	Total	629	100	653	100	1282	100

### 3.4 Household Engagement in Different Activities

#### 3.4.1 Agriculture

As already discussed, overall 54 % of the total household members are engaged in productive works (male 82 % and females 26 %). At the household level, different members are engaged in different activities. Thus the socio-economic survey also aimed at analysing the various activities performed by households as primary and secondary activities with a focus on the rural and urban variations.

Overall, 47 % of the households are engaged in agriculture both paddy and highland crop cultivation as the main activity. Nearly half of the households in the rural area are practising agriculture as the main activity. On the other hand in the urban area about one fifth of the households reported agriculture as primary activity. Likewise overall 30 % practiced agriculture as secondary activity, for rural household, it is 31 % and among the urban area it is only 23 %.

At the household level about 26 % are engaged in paddy cultivation as a primary activity. Among the rural households about 28 % and in the urban areas only 9 % stated this to be their primary activity. Similarly 21 % of the household are engaged in highland crop cultivation, 23 % in rural area and 11 % in urban areas. As secondary occupation highland crop cultivation practiced by 17 % of the households and this is nearly same among the households in both rural and urban areas. **For details refer table 3.4a and 3.4b.**

#### 3.4.2 White Collar Jobs

White collar jobs both in government and private sector are performed by 35 % of the households as the primary activities. Among the rural households, this is reported by 31 % the urban households 55 % of the households are engaged in this profession as a primary activity. Only 1 % of the households are engaged in jobs as secondary occupation. **For details refer table 3.4a and 3.4b.**

#### 3.4.3 Business

Business and trading as a primary activity is reported by 17 % of the households. In the rural area a little less than 17 % are engaged in business, and in urban areas about 20 % are also engaged in business. **For details refer table 3.4a and 3.4b.**

#### 3.4.4 Labour and daily wages

In the project area one of the primary activity is also working as labourers for other farmers, daily wage workers and skilled and semi skilled workers. Overall 35 % of the household members are engaged in this field. This is true for both rural and urban areas. However, skilled workers like carpenters, masons, electricians and plumbers are more in rural areas than in urban areas. Labour work as secondary activity is reported by only 4 % of the households and all of them are from the rural area. **For details refer table 3.4a and 3.4b.**

#### 3.4.5 Employment in Armed Services

Employment in armed services is also one of the major primary activities for the people of the surveyed households. Overall about 14 % are engaged in armed services. The primary activity is seen more among the rural households than the urban households. **For details refer table 3.4a and 3.4b.**

### 3.4.6 Pensioners and Foreign Remittance

Earnings from pension and foreign remittance are also a major primary activity reported by 12 % of the households. Among the rural areas this is about 11 % and among the urban area this is about 18 %. **For details refer table 3.4a and 3.4b**

**Table 3.4a Main Activities**

SI No	Activities	Main Activity					
		Rural		Urban/ Semi Urban		Total	
		Nos.	%	Nos.	%	Nos.	%
1	Paddy / Rice Cultivation	108	28	5	9	113	26
2	Highland Crop Cultivation	87	23	6	11	93	21
3	Working for Other Farmers	4	1	1	2	5	1
4	Cottage Industry	4	1	2	4	6	1
5	Government Job	55	14	13	23	68	16
6	Private Job (Formal Sector)	65	17	18	32	83	19
7	Business / Trading	63	17	11	20	74	17
8	Daily Wage	76	20	13	23	89	20
9	Marine Fishing	0	0	0	0	0	0
10	Inland/fresh water fishing	1	0	0	0	1	0
11	Animal Husbandry	8	2	0	0	8	2
12	Employment in the Armed Services e.g. Police, Army, civil security etc	57	15	2	4	59	14
13	Pensioners	32	8	9	16	41	9
14	Skilled/semi skilled workers e.g. carpenters, masons, electricians, plumbers etc.	57	15	5	9	62	14
15	Foreign Remittances	13	3	1	2	14	3
16	Total	380	100	56	100	436	100

**Table 3.4b Allied Activities**

SI No.	Activities	Allied Activity					
		Rural		Urban/ Semi Urban		Total	
		Nos.	%	Nos.	%	Nos.	%
1	Paddy / Rice Cultivation	53	14	3	5	56	13
2	Highland Crop Cultivation	63	17	10	18	73	17
3	Working for Other Farmers	3	1	0	0	3	1
4	Cottage Industry	5	1	1	2	6	1
5	Government Job	4	1	0	0	4	1
6	Private Job (Formal Sector)	1	0	1	2	2	0
7	Business / Trading	2	1	2	4	4	1
8	Daily Wage	9	2	0	0	9	2

SI No.	Activities	Allied Activity					
		Rural		Urban/ Semi Urban		Total	
		Nos.	%	Nos.	%	Nos.	%
9	Marine Fishing	0	0	0	0	0	0
10	Inland/fresh water fishing	0	0	0	0	0	0
11	Animal Husbandry	4	1	1	2	5	1
12	Employment in the Armed Services e.g. Police, Army, civil security etc	0	0	0	0	0	0
13	Pensioners	0	0	0	0	0	0
14	Skilled/semi skilled workers e.g. carpenters, masons, electricians, plumbers etc.	3	1	0	0	3	1
15	Foreign Remittances	0	0	0	0	0	0
16	Total	380	100	56	100	436	100

### 3.5 Types of Lands Possessed by Households

#### 3.5.1 Sinnakkara Land

Different households possess different types of lands in the project area. A single household also possess more than a single type of land. About 64 % of the households possess, Sinnakkara land, and the average possession of this type of land is 0.56 hectares. Sinnakkara land is possessed by 61 % of the households in the rural areas where as 84 % of the households in urban areas possess this type of lands. However the average possession of this type of land is more among the rural households than in the urban households. The average Sinnakkara land possessed by rural households is 0.66 hectares and this is only 0.27 hectares in the urban areas. For details refer **Table 3.5a and 3.5b**.

**Table 3.5a Types of Lands as possessed by the households**

SI No	Type Of Land	No. of HH	% of HH	Total Land in Hectares	Average Possession in Hectares
1	<i>Sinnakkara</i>	279	64	166.137	0.595
2	Rented Lease Land	13	3	9.376	0.721
3	<i>Ande</i> Land (Share Cropping)	27	6	19.758	0.731
4	State land on annual permit	71	16	41.879	0.59
5	Land Granted by the State	105	24	61.124	0.582
6	Encroached Land	40	9	29.264	0.731
7	Others	2	0	0.027	0.135
	Total	436	100	327.565	0.751

#### 3.5.2 Rented Lease Land

Only 3 % of the households possess rented lease land. In terms of percentage of households in rural and urban this is more or less same. The average possession among the 12 rural household is 0.7 hectares and among 2 households in urban area is .8 hectares. For details refer **Table 3.5a and 3.5b**.

#### 3.5.3 Ande Land (Share Cropping)

Only 6 % of the households possess Ande land. Nearly 7 % of the households possess this type of land where as in urban households only 2 households possess this land. The total Ande land is 19.76 hectares, among the rural households the average possession is 0.78 hectares and with the urban households this is only 0.15 hectares. For details refer table 3.5a and 3.5b.

#### 3.5.4 State land on annual permit

Overall about 16 % of the households possess state land on annual permit, nearly 18 % in rural households and 7 % of the households in urban areas have this type of lands. Among the 67 households in the rural area those have state land on annual permit the average possession is 0.613 hectares. Among the 4 households in urban area the average possession is 0.187 hectares. For details refer **Table 3.5a and 3.5b**.

### 3.5.5 Land granted by State

Nearly one fourth of the total households covered in the socio-economic survey possess land granted by the state. In the rural households about 26 % and in the urban households about 12 % have this type of land. Among the 98 households in the rural area those have land granted by the state the average possession is 0.618 hectares, whereas among the urban households the average possession is only 0.082 hectares. For details refer table 3.5a and 3.5b.

### 3.5.6 Encroached Land

In the project area lands are also encroached by the households. About 9 % of the households have lands that are encroached. The encroached lands are seen more among the rural households than the urban. Among the 10 % of the rural households the average possession of encroached land is 0.74 hectares. Similarly among in the urban area only one households is having encroached land. For details refer **table 3.5a and 3.5b**.

**Table 3.5b Types of Lands as possessed by the households**

Sl No	Type Of Land	Rural				Urban/ Semi Urban			
		No. of HH	HH to %	Total Land in Hectares	Average Possession in Hectares	No. of HH	HH to %	Total Land in Hectares	Average Possession in Hectares
1	Sinnakkara	232	61.05	153.5355	0.661	47	83.93	12.60	0.268
2	Rented Lease Land	12	3.16	7.758	0.705	2	3.57	1.618	0.809
3	Ande Land (Share Cropping)	25	6.58	19.455	0.7782	2	3.57	0.303	0.1515
4	State land on annual permit	67	17.63	41.129	0.613	4	7.14	0.75	0.187
5	Land Granted by the State	98	25.79	60.544	0.618	7	12.50	0.58	0.0828
6	Encroached Land	39	10.26	28.86	0.74	1	1.79	.404	.404
7	Others	2	0.53	0.027	0.135	0	0.00	-	-
	Total	380	100.00	311.31	0.82	56	100.00	16.26	0.29

## 3.6 Possession of Agricultural land

In the surveyed households about 67 % reported of possessing agricultural land. Among the rural households about 69 % and among the urban areas about 52 % possess agricultural land. Details are shown in Table 3.6

**Table 3.6 Percentage of households possessing agricultural land**

Sl.No.	Response	Rural		Urban / semi urban		Total	
		No	%	No	%	No	%
1	Yes	264	69	29	52	293	67
2	No	116	31	27	48	143	33
	Total	380	100	56	100	436	100

The total agricultural land possessed by 293 households is 248.5 hectares which is cultivable. Thus the average possession of cultivable agricultural land is 0.848 hectares. In the rural area among the 264 households those have agricultural land the average possession is 0.9 hectares which is higher than the urban households those have agricultural land. Among the urban households those have agricultural land the average possession is only 0.374 hectares.

Among the households those possess cultivable agricultural land about 59 % possess paddy land and 84 % possess highlands. Paddy land is possessed more among the rural households. About 63 % of the households in rural area and only 28 % of the households in urban areas have possessed land for paddy cultivation. The average possession of paddy land among the rural households is 0.888 hectares and the average possession for the urban households is 0.693 hectares. Among the rural households those have agricultural land about 83 % possess land for highlands crop cultivation. Among the urban households about 93 % of the households use land for highland crop cultivation. Among the rural households the average possession of highland crop cultivation land is 0.418 hectares and for the urban households this is about 0.196 hectares only. For details refer Table No. 3.7

**Table 3.7 Average possession of types of agricultural land**

SI No	Cultivable Land		No. of HH	% of HH	Total Land in Hectares	Average Possession in Hectares
1	Paddy Land	Rural	165	63	146.52	0.888
		Urban / semi urban	8	28	5.55	0.693
		Total	173	59	152.06	0.878
2	Highlands	Rural	218	83	91.134	0.418
		Urban / semi urban	27	93	5.3	0.196
		Total	245	84	96.45	0.393
	<b>Total</b>	Rural	264	90	237.668	0.900
		Urban / semi urban	29	10	10.845	0.374
		Total	293	100	248.513	0.848
3	<b>Total Non Cultivable Land</b>	Rural	366	76	55.557	0.152
		Urban / semi urban	53	95	4.228	0.080
		Total	419	96	59.786	0.143

Out of the 436 households covered during the socio-economic survey about 96 % of the households also possess non cultivable lands. Among the rural areas about 76 % of the households and among the urban households about 95 % have possessed non cultivable lands. The average possession of non cultivable land among the rural households is 0.152 hectares and among the urban households it is 0.08 hectares. For details refer Table No. 3.7.

### 3.7 Pattern of Cultivation

In the project area rice is cultivated by 143 households out of the 293 households those who have agricultural land. Maize and cowpea and green grams are the next major crops but grown by less percentage of the households. Among the households those cultivated rice about 64 % cultivates for one season and the rest for 2 seasons. The average yield of rice reported to be 56.7 quintals (100 kg=one quintal) per household. The price of rice varies in the range of LKR 20 to 30/- per kg. Similarly maize is grown only once in a year and the average yield is 17.4 quintals (Price LKR 30 to 32 per kg).

Among vegetables 8 % of the households cultivate brinjal, 4 % cultivates cassava and only 2 % cultivates pumpkins. The average yield of brinjal and cassava is 4.4 quintals per household. The average price of brinjal and cassava is LKR 20.



Similarly among fruits about 21 % of the households cultivate bananas and 9 % grows mangoes in their orchards. The average yield of bananas is 5.3 quintals and mangoes are 6.1 quintals. Among other fruits about 5 % of the households cultivate lime, oranges and water melon.

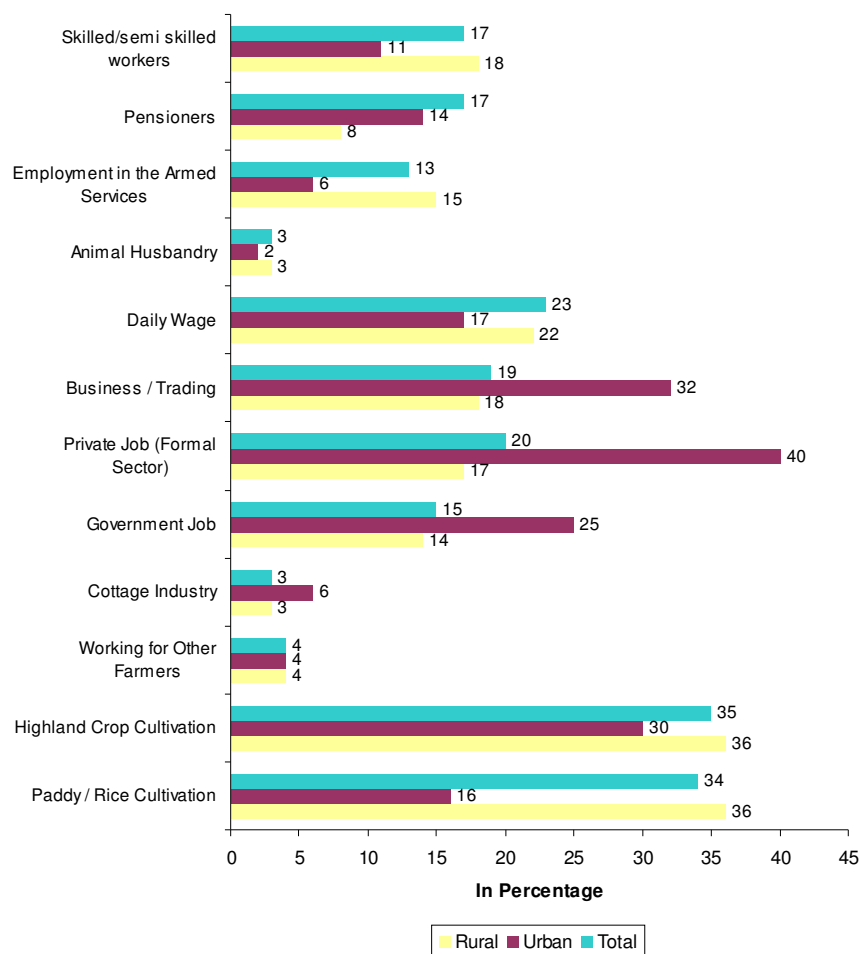
In the project area tea and coconuts are also cultivated. About 12 % each cultivates tea and coconuts. The average yield of tea is 32 quintals and on an average a household yield 439 coconuts. Details are given in Table 3.8.

**Table 3.8 Cropping pattern and average yield**

Sl No	Items	No. of HH	% of HH	Total Yield in Quintals	Average Yield in Quintals
1	Rice	143	49	8111.1	56.7
2	Maize	40	14	694.7	17.4
3	Cowpea	26	9	24.3	0.9
4	Green Grams	18	6	10.5	0.6
5	Groundnuts	6	2	12.7	2.1
6	Cessamy	4	1	9.0	2.3
7	Kurakkan	6	2	5.0	0.8
8	Cashew	2	1	0.7	0.4
9	Others (Nuts)	5	2	19.0	3.8
<b>Vegetables</b>					
10	Potatoes	0	0	0.0	0.0
11	Pumpkins	5	2	6.6	1.3
12	Cassava	13	4	56.6	4.4
13	Brinjals	22	8	95.9	4.4
<b>Fruits</b>					
14	Banana	62	21	326.7	5.3
15	Mangoes	25	9	152.8	6.1
16	Pineapples	4	1	6.2	1.6
17	Lime	8	3	19.7	2.5
18	Oranges	4	1	4.5	1.1
19	Water Melon	2	1	20.0	10.0
<b>Others</b>					
20	Cinnamon	2	1	1.2	0.6
21	Rubber	6	2	21.1	3.5
22	Tea	36	12	1151.5	32.0
23	Coconut	36	12	15800*	439*
	Total	293	100		
		*in Numbers			

### 3.8 Sources of Earnings

The households besides single sources also have different other sources of earnings. About 69% of the households reported earnings from agriculture that includes paddy and high land crop cultivation. Similarly about 38% of the households also earned from white collar jobs that includes government and private jobs and jobs in armed services. Moreover 23% of the households also earn from daily wages and 17% earn through skilled and semi skilled works. Nearly one fifth of the households also earn from business. Details are shown in Figure 3.1.

**Figure 3.1 Source of Income**

Among the rural households agriculture is one of the major sources of income for 72 % of the households. Besides agriculture about 44 % of the households also earn from daily wages, working for other farmers and skilled and semi-skilled works. Similarly 31 % of the rural households reported government and private jobs as source of income for their families. Similarly about 15 % of the households also reported employment in armed service as one of the sources of income. Animal husbandry and cottage industry are sources of income for 6 % of the households.

Similarly among the urban households majority about 65 % of the households reported earning from private and government jobs. For nearly one third of the urban households business is an important source of income. Income from agriculture is also source for 46 % of the urban households. Besides agriculture about 32 % of the households also earn from daily wages, working for other farmers and skilled and semi-skilled works which is lower than the rural households. Animal husbandry and cottage industry are sources of income for 8 % of the households. Details are shown in Figure 3.1.

### 3.9 Average earnings from different reported Sources

The overall annual household income from all the sources is LKR 450,694/-. The annual income of the urban area is 15 % more than that of the rural areas. The average household annual income for the rural area is LKR 442,175/- and for the urban area is LKR 508,936/-.

The overall major contribution in terms of total earnings is from highland crop cultivation, followed by private job and government jobs. In the rural areas the higher contributor to the total income is highland crop cultivation followed by government jobs and employment in armed force. On the other

hand among the urban households private jobs contribute maximum income followed by business and govt jobs.

In terms of average earnings, the average annual income from government jobs is maximum and it is reported to be LKR 3,48,576/- , followed by earnings from employment in armed services (LKR 3,40,345/-) and private jobs (LKR 2,94,034). Similarly the average annual income from highland crop cultivation is LKR 218279/- and from paddy cultivation is LKR 1,30,161. The average annual income for rural and urban areas varies according to the activities performed. In rural areas the household average income reported to be highest from government jobs which is LKR 361,170, followed by income from armed forces (LKR 370,800) and private jobs (LKR 264,000). Similarly in urban areas private jobs contribute to the highest average annual income which is LKR 388,429. For details refer Table 3.9.

**Table 3.9 Average incomes from different sources**

SI No	Sources		No. of HH	% of HH	Total income In LKR	Average Income
1	Paddy / Rice Cultivation	Rural	138	36	18361200	133052
		Urban / SU	9	16	772500	85833
		Total	147	34	19133700	130161
2	Highland Crop Cultivation	Rural	136	36	31021350	228098
		Urban / SU	16	29	2157000	134813
		Total	152	35	33178350	218279
3	Working for Other Farmers	Rural	16	4	1091560	68223
		Urban / SU	2	4	294000	147000
		Total	18	4	1385560	76976
4	Cottage Industry	Rural	10	3	1228000	122800
		Urban / SU	3	5	368000	122667
		Total	13	3	1596000	122769
5	Government Job	Rural	53	14	19142000	361170
		Urban / SU	13	23	3864000	297231
		Total	66	15	23006000	348576
6	Private Job (Formal Sector)	Rural	66	17	17424000	264000
		Urban / SU	21	38	8157000	388429
		Total	87	20	25581000	294034
7	Business / Trading	Rural	67	18	17449400	260439
		Urban / SU	17	30	4843000	284882
		Total	84	19	22292400	265386
8	Daily Wage	Rural	85	22	16560400	194828
		Urban / SU	11	20	2472000	206000
		Total	96	22	19032400	196210
9	Marine Fishing	Rural	2	1	144000	72000
		Urban / SU	0	0	0	0
		Total	2	0.5	144000	72000
10	Inland/fresh water fishing	Rural	1	0.3	120000	120000
		Urban / SU	0	0	0	0
		Total	1	0.2	120000	120000
11	Animal Husbandry	Rural	11	3	965600	87782
		Urban / SU	1	2	400000	400000
		Total	12	3	1365600	113800
12	Employment in the Armed Services	Rural	56	15	18744000	340800
		Urban / SU	3	5	996000	332000
		Total	58	14	19740000	340345
13	Pensioners	Rural	31	8	6376200	205684

SI No	Sources		No. of HH	% of HH	Total income In LKR	Average Income
	Urban / SU					
		Total	9	16	1809000	201000
			40	9	8185200	204630
14	Skilled/semi skilled workers	Rural	69	18	17245960	249941
		Urban / SU	6	11	1859000	309833
		Total	75	17	19104960	254733
15	Total All	Rural	376	87	166257670	442175
		Urban / SU	55	13	27991500	508936
		Total	431	100	194249170	450694
	Not Reported	Rural	4			
		Urban / SU	1			
		Total	5			

### 3.10 Itemised annual average expenditure

The total annual expenditure is reported to be LKR 257,952/-. Among the expenditure about 47 % of the expenses are on food which is the highest. The next highest expenditure is on transportation (8 %) followed by education (8%), health (5%) and clothing (5%). For details refer Table 3.10.

The expenditure pattern is more in urban areas than in rural households. The average annual expenditure in urban areas is LKR 329,312 and in rural areas it is LKR 247,437. In the rural areas the expenditure on food is about 47 % of the total expenses and in urban areas it is about 45 %. In the rural area besides the food expenses the next maximum expenditure is on agriculture which is reported to be 10%, and 8% expenses are on transportation. Similarly in urban area besides food the next highest expenditure is on transportation 10% followed by education 8%, and loan repayment 6%. For details refer Table 3.10a and 3.10b.

**Table 3.10a Overall Expenditure Pattern of the Household**

SI No	Items	Reported HH	% HH	Total Expenditure	Annual Average	% to total Expenditure
1	Food	436	100	52602000	120647	47
2	Transportation	404	93	9544100	21890	8
3	Clothing	428	98	5278700	12107	5
4	Health	419	96	6052900	13883	5
5	Education	264	61	8821200	20232	8
6	Communication	31	7	319729	733	0
7	Social functions	380	87	3238900	7429	3
8	Agriculture (such as seeds, hiring of farm implements, fertilizer etc.)	229	53	9825000	22534	9
9	Consumption of fuel for household	280	64	5007280	11485	4
10	Electric Bill	364	83	2683220	6154	2
11	Alcohol / Cigarettes / Tobacco	56	13	1113400	2554	1
12	On Loan Repayments & Others	76	17	4217000	9672	4
13	Water Bills	107	25	290550	666	0
14	Mobile	371	85	3473000	7966	3
	Total	436	100	112466979	257952	100

**Table 3.10b Expenditure Pattern of the Household (Rural vs Urban)**

SI No	Items	Rural	Urban
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		Reported HH	% HH	Annual Average	% to total Expenditure	Reported HH	% HH	Annual Average	% to total Expenditure
1	Food	380	100	116416	47	56	100	149357	45
2	Transportation	352	93	20063	8	52	93	34289	10
3	Clothing	373	98	11826	5	55	98	14018	4
4	Health	366	96	13282	5	53	95	17963	5
5	Education	223	59	18906	8	41	73	29232	9
6	Communication	24	6	610	0	7	13	1571	0
7	Social functions	331	87	7019	3	49	88	10205	3
8	Agriculture (such as seeds, hiring of farm implements, fertilizer etc.)	215	57	23567	10	14	25	15529	5
9	Consumption of fuel for household	235	62	11608	5	45	80	10650	3
10	Electric Bill	308	81	5254	2	56	100	12260	4
11	Alcohol / Cigarettes / Tobacco	46	12	2572	1	10	18	2429	1
12	On Loan Repayments & Others	61	16	8128	3	15	27	20150	6
13	Water Bills	81	21	525	0	26	46	1623	0
14	Mobile	320	84	7661	3	51	91	10036	3
	Total	380	100	247437	100	56	100	329312	100

### 3.11 Possession of Household Assets

The most frequently owned durable goods are television and radio, possessed by more than 70% of the households. Similarly electric fans are possessed by 57% and refrigerators by 48%, bicycles by 4% and rice cookers by 42% of the households. Nearly one third of the households possess LPG gas stoves, water pumps and two wheelers (motor cycles). Valuable items like cars, computer, washing machines are possessed by very few of the household. Details are described in Table 3.11.

However the possession of the household assets varies between the rural and urban areas. Television is most common durable goods possessed by 82 % of the households in rural areas and with 96 % of the households in urban areas. Radio is possessed by 73 % of the rural areas and by 79 % of the urban households. There is substantial gap in the possession of assets between the rural and urban areas on the items like electric fans, refrigerators, rice cookers, LPG gas connection, computers, washing machines, internet connections, and cars. All these items are possessed more in percentage by the urban households than the rural households.

**Table 3.11 Possession of Household assets**

SI No	Assets	Rural		Urban		Total	
		No. of HH	% of HH	No. of HH	% of HH	No. of HH	% of HH
1	Television	310	82	54	96	310	82
2	Radio	279	73	44	79	279	73
3	Electric Fans	205	54	42	75	205	54
4	Refrigerator	176	46	34	61	176	46
5	Push Bicycle	175	46	29	52	175	46
6	Rice Cooker	149	39	34	61	149	39
7	L.P.G Connection/ Gas Cylinder	105	28	34	61	105	28
8	Water Pumps	117	31	22	39	117	31
9	Motor cycle/Scooter	122	32	13	23	122	32
10	Three Wheelers	52	14	11	20	52	14
11	Computer	41	11	14	25	41	11

SI No	Assets	Rural		Urban		Total	
		No. of HH	% of HH	No. of HH	% of HH	No. of HH	% of HH
12	Washing Machine	24	6	12	21	24	6
13	Internet	10	3	10	18	10	3
14	Car	4	1	12	21	4	1
15	Two wheel tractors	18	5	0	0	18	5
16	Four Wheel Tractors	12	3	0	0	12	3
17	Lorries	9	2	3	5	9	2
18	Vans	10	3	2	4	10	3
19	Buses	1	0	1	2	1	0
20	Canoes	1	0	0	0	1	0
21	Fish Nets	1	0	0	0	1	0
	Total	380	100	56	100	380	100

### 3.12 Indebtedness

Out of 436 households, about 31% of the households reported have taken a loan from different sources. Among the rural households about 30% and among the urban households about 39% of the households have taken loans. For details refer Table 3.12.

**Table 3.12 Percentage of households taken loan**

SI.No.	Taken Loan	Rural		Urban		Total	
		No	%Age	No	%Age	No	%Age
1	Yes	113	30	22	39	135	31
2	No	267	70	34	61	301	69
	Total	380	100	56	100	436	100

### 3.13 Average loan amount

The average loan amount is LKR 1,79,556/-. About 30 % have taken a loan amount in the range of LKR 20000/- to LKR 50000/-. Similarly 16% of the households have taken a loan amount in the range of LKR 50001 to LKR 100000/-. About 43% of the households have taken loans exceeding LKR 100,000/-. For details refer Table 3.13.

**Table 3.13 Average Loan Amount**

SI No	Amount in Sri Lankan Rupees	No	%Age
1	Up to 10,000	7	5
2	LKR. 10,001 to 20,000	9	7
3	LKR. 20,001 to 50,000	40	30
4	LKR. 50,001 to 100,000	22	16
5	LKR 100,001 to 200,000	21	16
6	LKR 200,001 to 500,000	28	21
	More Than 5 Lakh	8	6
7	Total	135	100
	Average Loan	179556	

### 3.14 Use of Loan Amount

About one third of the households those who have taken loan have invested in the improvement of their houses. Another one fifth (19 %) have taken loan for investment in agriculture. For helping

relatives, about 13% have taken loans. Similarly another 12 % have taken loan for fulfilling social obligations like (marriage/ rituals, etc. For details refer Table 3.14.

**Table 3.14 Reported use of the borrowing**

SI No	Usages of the Borrowings	No	%Age
1	Meeting the medical expenses	4	3
2	To repay debts	3	2
3	On food	1	1
4	On education	2	1
5	To start/upgrade business	6	4
6	For Agricultural Activities	26	19
7	Helping relatives	17	13
8	Improvement in house	44	33
9	Social obligation (Marriage / rituals / funerals)	16	12
10	Religious visit	1	1
11	Durable goods	2	1
12	To meet the daily Expenses	7	5
13	Others	11	8
	Total	135	100

### 3.15 Sources of Loan

Out of the 135 households having taken loans, about two third (68 %) have taken loan from the banks. Most importantly about 11 % have taken loan from NGOs / Self Help Groups. Similarly about 10 % have taken loan from the government schemes. For details refer Table 3.15.

**Table 3.15 Source of the Loan**

SI No	Source	No	%Age
1	Banks	92	68
2	Local /private money lender	4	3
3	Shopkeeper/traders	5	4
4	NGO /Self Help Group (SHG)	15	11
5	Relative/friends	2	1
6	Chit Fund/Committee	2	1
7	Government Scheme	13	10
8	Others	2	1
	Total	135	100

### 3.16 Management of Repayment of Loan

Among the households those have taken loan about 87 % are able to repay the loans on time. However 12 % of the households face some problems while repayment and only 1 % could not to pay the loan amount on time. For details refer table 3.16.

**Table 3.16 Management of repayment of loan**

SI.No.	Do you manage to make your repayments on time	Frequency	Percent
1	Yes, always	118	87
2	Some times	16	12
3	No	1	1
	Total	135	100

### 3.17 Benefits from different Government Schemes

The households in the project area have benefitted from different developmental schemes of the Sri Lankan government. Nearly one-fourth of the households out of 436 households surveyed admitted of benefitting from different government schemes. For details refer table 3.17.

**Table 3.17 Availing benefits from Schemes**

SI No	Any benefits from schemes	No	%
1	Yes	103	24
2	No	333	76
	<b>Total</b>	436	100

### 3.18 Sources of Receiving Benefits

Out of the 103 households those received benefits from the developmental schemes, about 85 % received help from the government and 17 % received it from non governmental organisations (NGO). For details refer table 3.18.

**Table 3.18 Sources of receiving benefits**

SI No	Source	No	%
1	Government	88	85
2	NGO	17	17
3	Others	4	4
	<b>Total</b>	103	100

### 3.19 Types of Help

About 97 households stated various types of help received under the developmental schemes. 62 % of the households received grants under various developmental schemes. 7 % received loans, 3 % received trainings and another 11 % received agricultural equipments. For details refer table 3.25.

**Table 3.19 Types of Help**

SI No	Types of Help	No	%
1	Loan	7	7
2	Training	3	3
3	Employment	0	0
4	Grant	60	62
5	Equipments	11	11
6	Others	26	27
	<b>Total</b>	97	100

As stated very few households have received trainings. The training is mostly on dress making, gem cutting, nursery management, organic fertilizer and welding. It is important to note that about 69 % stated that their annual income increased after receiving the schemes.

### 3.20 Migration

Out migration in search of employment also reported from the project area. About 18 % of the households admitted of a family member having migrated outside for work. For details refer Table 3.20.

**Table 3.20 Migration of household members**

Sl.No.	Response	Rural		Urban		Total	
		No	%	No	%	No	%



1	Yes	72	19	6	11	78	18
2	No	308	81	50	89	358	82
	Total	380	100	56	100	436	100

### 3.21 Types of Migration

Among the 77 households those reported of migration, 99 % migrated individually and only one individual member migrated with family. For details refer Table 3.21.

**Table 3.21 Types of migration**

Sl.No.	Migration types	No	%
1	Individually	77	99
2	With Family	1	1
	Total	78	100

It is important to note that within a family, more than one family member has also migrated for work. In all 75 male members and 15 female members have migrated outside for work.

### 3.22 Place of Migration

Among the households those reported migration about 73% have migrated to other districts, and only 18 % migrated within the district. 8 % has migrated outside Sri Lanka. For details refer Table 3.22.

**Table 3.22 Place of Migration**

Sl No	Place	No	%
1	Within the district	14	18
2	Other districts	57	73
3	Capital city	1	1
4	Outside of the country	6	8
	Total	78	100

### 3.23 Types of Jobs Performed by Migrated Members

Of the male migrants, 69 % of males and 53% females have engaged in formal employment. Similarly about 17 % males are working as non agricultural labourers and among the females 2 women are working as non agricultural labourers. For details refer Table 3.23.

**Table 3.23 Types of Jobs**

Sl No	Types of Jobs	Male		Female	
		No	%	No	%
1	Agricultural Labour	1	1	0	0
2	Non-agricultural Labour	13	17	2	13
3	Trade & Business	1	1	0	0
4	Formal Employment	52	69	8	53
5	Others	8	11	5	33
	Total	75	100	15	100

The income of the migrated members is substantial; it is higher than the annual household income of all the resident households. The total average annual income of the migrated members is LKR 477,680.

### 3.24 Summary

The demographic indicators of the surveyed households indicate that the family size is small and the sex ratio favours the females. Similarly the literacy in the project area is high at 97 % and this is more or less same for both the genders. Higher education is limited in the project area as very few

household members are found to be graduates and above. Most of the household members are educated till the level of secondary and higher secondary.

The occupational trend of the surveyed household suggests that the rate of employment among the males is quite higher than that of the females. Overall 82 % of the males those above 18 years are employed and among the females about 26 % are employed. Employment in white collar jobs, farming, skilled and semi skilled work are the important professions practiced by the male members. Among the females nearly half of them are house wives and nearly one tenth are engaged in white collar jobs. The overall unemployment is 11 % and the unemployment is more among the female members.

The socio-economic survey also attempted to know the main and allied activities at the household level and the variation in the rural and urban areas. Agriculture as a main activity is performed nearly by half of the rural households and by one fifth in the urban areas. Agriculture is also a secondary activity for many of the households covered under the study. About 31 % practice agriculture as a secondary activity, which is more among the rural residents. Similarly difference between rural and urban households is there in terms of their engagement in white collar job. In urban areas majority about 55 % of the households are in either government or private jobs and this is about 31 % among the rural households. Overall about 17 % of the households are in business and very few households see business as a secondary activity. Business families are almost equally distributed among rural and urban areas. In the project area one of the primary activity is also working as labourers for other farmers, daily wage workers and skilled and semi skilled workers. Nearly one third of the household are engaged in this field but skilled workers like carpenters, masons, electricians and plumbers are more in rural areas than in urban areas. Working in armed forces as a primary activity is more in the rural households than in the urban households in the project area. Earnings from pension and foreign remittance are also a major primary activity for the urban households.

Different households possess different types of lands in the project area. A single household also possess more than a single type of land. Sinnakkara land is possessed by 61 % of the households in the rural areas where as 84 % of the households in urban areas possess this type of lands. In terms of lands the average land possession is more among the rural households than among the urban households. The average possession of all types of lands is 0.82 hectares among the rural households and among the urban houses it is only 0.29 hectares.

More than two-third of the households possess agricultural land. As usual agricultural land is possessed by more households in rural area than in the urban areas. The average possession of agricultural land is two and half times more than that of the urban families. Paddy land is possessed more in percentage with the rural households where as highland for crop cultivation is possessed more in percentage with the urban households.

Rice and maize are two important crop grown by the agricultural households. Cowpea and green grams are also grown but by less percentage of the households. Besides field crops, vegetables like brinjal, cassava and pumpkins are cultivated by very few of the households. Fruits like bananas and mangoes are also cultivated but in less households. Among other fruits about 5 % of the households cultivate lime, oranges and water melon. Tea and coconuts are also cultivated, in the surveyed households.

The households besides single sources also have different other sources of earnings. Agriculture, paddy and high land crop cultivation and white collar jobs that include government and private jobs and jobs in armed services are the major source of income. Among the rural households agriculture is one of the major sources of income for three-fourth of the households. On the other hand among the urban households majority about two third of the households reported earning from private and government jobs as major sources of income.

The average household income of the urban area is more than the rural area. The average household annual income for the rural area is LKR 442,175/- and for the urban area is LKR 508,936/-. In the rural

areas the higher contributor to the total income is highland crop cultivation followed by government jobs and employment in armed force. On the other hand among the urban households private jobs contribute maximum income followed by business and govt jobs.

The total annual expenditure is reported to be LKR 257,952/-. The expenditure on food is highest in both the rural and urban area. The expenditure pattern is more in urban areas than in rural households. In the rural area besides the food expenses the next maximum expenditure is on agriculture. Similarly in urban area besides food the next highest expenditure is on transportation followed by education and loan repayment.

The possession of household assets also depends on the household income and expenditure. The income of urban households is more and that is also reflected in the possession of assets. Television is most common durable goods possessed by 82 % of the households in rural areas and with 96 % of the households in urban areas. There is substantial gap in the possession of assets between the rural and urban areas on the items like electric fans, refrigerators, rice cookers, LPG gas connection, computers, washing machines, internet connections, and cars. All these items are possessed more in percentage by the urban households than the rural households.

The indebtedness is seen marginally more among the urban households than the rural households. Loans are mostly taken for the improvement of the houses and for investment in agriculture. Banks are best sources of taking a loan for the households. Most of the households are able to repay the loan amount on time. The households in the project area have benefitted from different developmental schemes of the Sri Lankan government. Nearly one-fourth of the households mostly from rural area have benefitted from different government schemes. Majority received these helped from the government and some households received it from non governmental organisations (NGO).

Out migration in search of job and work also reported from the project area. Migration is marginally more in rural areas than the urban areas. Almost all the members migrated individually. Most of the migrated members both male and females are engaged in formal sectors. The income of the migrated members is substantial; it is higher than the annual household income of all the surveyed households.

## 4 Health

This section provides a detailed account the health facilities available and treatment seeking places, reasons for preferences, major illness of the family members and availability of ante natal services and the perception on the quality of care.

### 4.1 Treatment seeking places

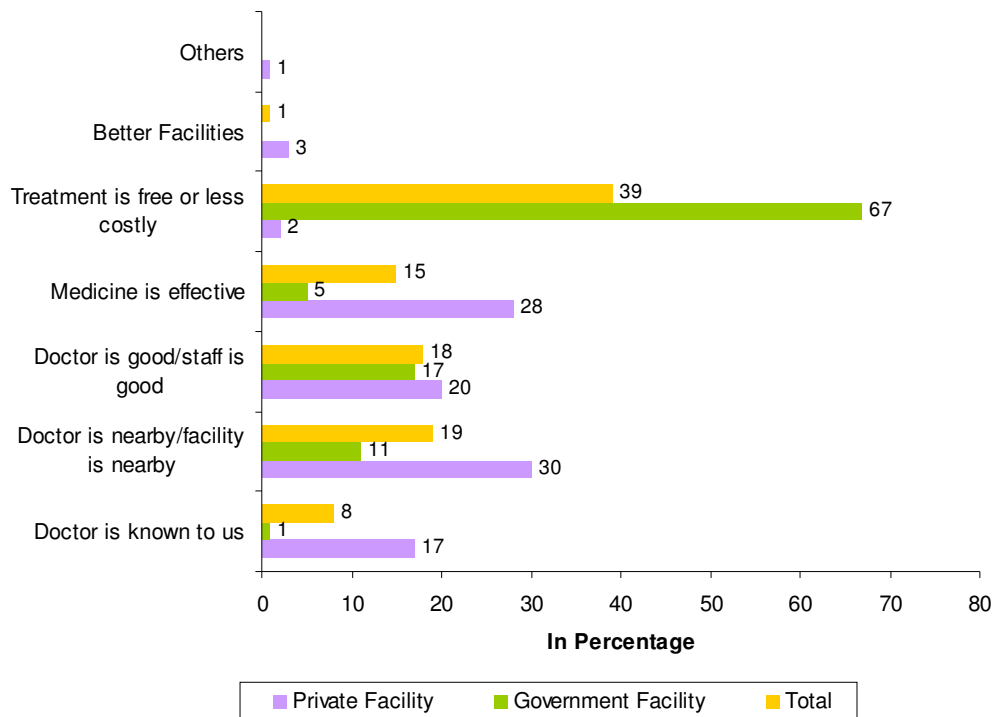
The respondents were asked on the places where they usually visit if some one falls ill in their families. Majority about 57% of the households reported that they visit a government health facility or a government doctor. And the rest 43% of the households visit a private doctor or clinic. Details are shown in **Table 4.1**.

**Table 4.1 Treatment seeking Place**

SI No	Health Facilities	No	%Age
1	Private Doctor/Clinic	189	43
2	Government Doctors/Health Centres	247	57
	<b>Total</b>	436	100

### 4.2 Reasons for Preferring the Health Facilities

Out of the 436 households surveyed, 39 % prefer the government health facility as treatment is free or less costly. Nearly one fifth of the households prefer the health facility for its close proximity. Similarly 18 % of the households visit health facility because of the availability of good physicians. However there are varied reasons for preferring a private hospital but majority of the household visit a government hospital because of free treatment. Details are shown in **Figure 4.1**

**Figure 4.1 Reasons for preference of government and private facilities**

#### 4.3 Nearest Health Facilities

About 42 % of the households reported of accessing the government hospitals which are nearest to their respective villages. Similarly for 38 % of the households, a dispensary is the nearest available health facilities. Private health facilities are preferred by 43 % of the households. For details refer Table 4.2.

**Table 4.2 Nearest health facility to the village**

Sl.No.	Nearest Place	No	%
1	Dispensary	167	38
2	Primary Health Centre	11	3
3	Govt. hospital	185	42
4	Private Health Facility	72	17
5	Ayurveda	1	0
	Total	436	100

#### 4.4 Location and Distance of the Health Facility

About 29 % of the households reported the presence of a health facility within the village. For the rest 71 % of the household a health facility is available outside of their respective villages. For details refer Table 4.3.

**Table 4.3 Location of the Health Facilities**

Sl.No.	Location	No	%
1	Within the Village	125	29
2	Outside the Village	311	71
	Total	436	100

The average distance to health centre from the villages is 4.62 kilometres. Out of the 311 households those reported of availability of health facilities outside their villages, 10 % of the households reported the average distance to be within 1 kilometre. For nearly one fourth of the households a nearest health centre is available within 1 to 2 kilometres. For 41 % of the household the health facility is 2 to 5 kilometres away from the village. For details refer Table 4.4.

**Table 4.4 Distances of the Health Facilities**

Sl.No.	Distance in KMs	No	%
1	Within 1 Km	30	10
2	1.1 Km to 2 Kms	71	23
3	2.1 Kms to 5 Kms	128	41
4	5.1 Kms to 10 Kms	61	20
5	More than 10 Kms	21	7
6	Total	311	100
	Average Distance	4.62 Kms	

#### 4.5 Modes of Transport

About two third of the households prefer public transport system to reach the health facilities. Another 35 % also use their own transport to reach the health facilities. Most importantly for 20 % of the households the health facility is so nearer that they walk. For details refer Table 4.5.

**Table 4.5 Modes of transport available to reach the facility**

SI No	Transport	No	%
1	Public transport	284	65
2	Vehicle from health facility	12	3
3	Own transport	151	35
4	Hired Vehicles	94	22
5	Walk	86	20
	Total	436	100

#### 4.6 Incidence of Illness

About 26 % of the household reported that at least one family member reported suffering from illness during the last one year. For details refer Table 4.6.

**Table 4.6 Reported Incidence of Illness of family members at the Household**

SI No	Illness	No	%
1	Yes	112	26
2	No	324	74
	Total	436	100

#### 4.7 Number of Members Affected

Out of the 112 households who reported that at least a household member suffered from illness during the last one year, 85% had only one member having fallen ill. In the remaining 15% households, at least 2 members had fallen ill. For details refer Table 4.7.

**Table 4.7 Number of family members fallen ill**

SI No	Number of members	No	%
1	One Member	95	85
2	Two Members	17	15
	Total	112	100

#### 4.8 Prevailing Diseases

Among the diseases, non communicable diseases are faced by more than half of the households. Out of the 112 households those reported at least one family member having fallen ill, 54 % suffered from non communicable diseases. 25 % of the household members are suffering from diabetes. Respiratory problems are also an ailment reported from the project area. Very few incidences of dengue and malaria are reported from the project area. Most importantly all the sick members have preferred allopathic treatments for their respective ailments. For details refer Table 4.8.

**Table 4.8 Types of Diseases**

SI No	Diseases	No	%
1	Respiratory Problems	18	16
2	General Fever	4	4
3	Malaria	1	1
4	Dengue	2	2
5	Gastro Intestinal Problems	4	4
6	Non communicable diseases	61	54
7	Diabetes	28	25
8	Tuberculosis	1	1
9	Others	8	7
10	Total	112	100

#### 4.9 Child Birth

About 14 % of the household reported that a child was born at their household during the last one year. For details refer Table 4.9.

**Table 4.9 Delivery of a child at the Household**

SI.No.	Whether a child delivered	No	%
1	Yes	63	14
2	No	373	86
	Total	436	100

#### 4.10 Place of Delivery

It is important to note that in the project area about 98 % of the child deliveries occurred happening at hospitals. For details refer Table 4.10.

**Table 4.10 Place of Delivery**

SI No	Place	No	%
1	At home	1	2
2	At govt. health facility	62	98
	Total	63	100

#### 4.11 Place of ante natal check ups

The households reported multiple places of ante natal check ups. Besides antenatal check ups at government and private health facilities, about 73 % of the households also had antenatal check ups at home by family health workers and mid wives which is a positive aspect in respect of maternal healthcare. For details refer Table 4.11.

**Table 4.11 Place of Antenatal Check ups**

Sl.No.	Places	No	%
1	At home by Family Health workers / Mid wives	45	73
2	At govt. health facility	44	71
3	At Pvt. Health facility	20	32
	Total	62	100

A pregnant woman had at least 10 ante natal check ups during the entire pregnancy period. Among the households those reported a delivery at their household, about 68 % were very satisfied on the services they received during ante natal check ups and 31 % were just satisfied.

#### 4.12 Summary

The treatment seeking places are government and private health facilities for the surveyed households. There are multiple reasons for the households visiting a private health facility. Free or less costly treatment is one of the major reasons for the households those visit a government health facility. Government hospitals and dispensary is the nearest available health facilities. For 29 % of the households there is the presence of a health facility within the village. The average distance of the health centre is from the villages covered is 4.62 kilometres, which is relatively nearer for the resident population in the project area.

About one fourth of the household reported that at least one family member reported suffering from illness during the last one year. Among the diseases, non communicable diseases have been faced by more than half of the households. The other diseases seen in the project area are non communicable diseases, diabetes, and Respiratory problems.

It is important to note that in the project area almost all the babies are delivered in hospitals. The households reported multiple places of ante natal check ups. Besides ante natal check ups at government and private health facilities, a substantial number of households reported having ante natal check ups at home by family health workers and mid wives which is a positive finding for maternal health.

## 5 Role of Women In Project Area

This section discusses about the women in the project area, their economic participation, their participation in decision making at the household and the perception on their safety and mobility is also analysed.

### 5.1 Activities performed by Women:

In the project area, in 90 % of the households the women are engaged in household work. Similarly in the economic activities, 17 % of the women are engaged in agriculture, 16 % are engaged in white collar jobs, 4 % are engaged in business & trade and only 3 % work as agricultural and non agricultural labourers. In about 38 % of the households, women are engaged in productive works, the annual contribution of these women is LKR 174,159. The details are given in Table 5.1.

**Table 5.1 Types of economic and non economics activities performed by women**

Sl No	Types of Activities	No	%
1	Paddy Cultivation	28	6
2	Highland Crop Cultivation	46	11
3	Allied Activities (Dairy, Poultry, piggery, etc)	6	1
4	Trade & Business	19	4
5	Agricultural Labour	8	2
6	Non Agricultural Labour	5	1
7	Skilled/semi skilled workers	7	2
8	Cottage industries	7	2

SI No	Types of Activities	No	%
9	Private Job	36	8
10	Government Job	37	8
11	Household Work	394	90
12	Employment in the Armed Services e.g. Police, Army, civil security etc	3	1
13	Pensioners	17	4
14	Self Employed	11	3
15	Total	436	100

## 5.2 Women's participation in decision making

In the project area, 89 % of the women participate in the decision making in the household on day to day activities. Similarly in 79 % of the households, women participate in financial matters and 81 % participate in the purchase of household assets. Healthy participation in the household decision making is also seen on health care and education for the children. The details are given in Table 5.2.

**Table 5.2 Women's Participation in Household's Decision Making**

SI No	Types of Participations	No	%
1	Financial matters	346	79
2	Education of child	307	70
3	Health care of child	330	76
4	Purchase of assets	352	81
5	Day to day activities	388	89
6	On social functions and marriages	348	80
7	Others	-	0
	<b>Total</b>	436	100

## 5.3 Time spent by women on different activities

Among the household activities, cooking and cleaning are two major activities where a woman is responsible. The average time spent in cooking is 2 hours and 47 minutes and for cleaning is 1 hour and 31 minutes. Fuel wood collection is also one of the major activities for the women in 78% of the households and the average time spent is about 46 minutes.

Similarly in 13 % of the households women are engaged in white collar jobs and they spent on an average 7 hours and 27 minutes. Women are also responsible for daily marketing in nearly two third of the households and on an average they spent 49 minutes. The details are given in Table 5.3.

**Table 5.3 Average time spent by Women's in performing different activities in a day**

SI No	Types of Activities	No of HH Reported	% of HH	Average Time
1	Cooking	432	99	2 Hrs 47 Minutes
2	Cleaning (House, clothes, utensils, etc)	432	99	1 Hr 31 Minutes
3	Fuel wood collection	342	78	46 minutes
4	Water collection	140	32	30 Minutes
5	Daily marketing	281	64	49 Minutes
6	Caring for the young and sick	139	32	2 Hrs 45 Minutes
7	Watching TV (other leisure activities)	356	82	2 Hrs 6 Minutes
8	Agricultural Activities	113	26	2 Hrs 58 Minutes
9	Labour Work	17	4	5 Hrs 42 Minutes
10	Employment (Pvt. Govt Jobs)	56	13	7 Hrs 27 Minutes
11	Others Business etc in Minutes	21	5	3 Hrs 9 Minutes



#### 5.4 Women's perception on safety during day time

In the project area, 94 % of the women feel safe during the day time and only 6 % feel safe to some extent during day time. The details are given in Table 5.4.

Table 5.4 Women's Perception on the safety during day time

Sl No	Perception	No	%
1	Yes	409	94
2	To some extent	24	6
3	No	0	0
4	Don't know / can't say	3	1
	<b>Total</b>	436	100

#### 5.5 Women's perception on safety during night time

The perception on safety as usual is less during the night time. About 86 % of the women feel safe during the night time and only 12 % feel safe to some extent during night time. The details are given in Table 5.5.

Table 5.5 Women's perception on the safety during night time

Sl. No	Perception	No	%
1	Yes	376	86
2	To some extent	51	12
3	No	4	1
4	Don't know / can't say	5	1
	<b>Total</b>	436	100

#### 5.6 Women's perception on their mobility

In the project area about 87 % of the women feel that they can move freely and about 11 % of the women feel that they can move freely during the day time. The details are given in Table 5.6.

Table 5.6 Women's perception on their mobility

Sl No	Perception	No	%
1	Can move freely	381	87
2	Only during the day time	50	11
3	No cannot move freely	2	0
4	Cant say / don't know	3	1
	<b>Total</b>	436	100

#### 5.7 Incidence of women going outside to fetch water

In the project area, about 75 % of the households reported that women do not go outside to fetch water. In about 23 % of the households, women go outside to fetch water everyday. The details are given in Table 5.7.

Table 5.7 Incidence of women going outside to fetch water

Sl No	Occasion	No	%
1	Never	327	75
2	Everyday	101	23
3	1 to 2 days	7	2
4	5 to 6 days	1	0
	<b>Total</b>	436	100

## 5.8 Access to Water

Out of the 109 households in the project area where women go outside to fetch water, about 92 % of the women have easy access to water from outside sources. The details are given in Table 5.8

**Table 5.8 Percentage of women reported easy access to water**

SI No	Easy Access to water	No	%
1	Yes	100	92
2	No	9	8
	<b>Total</b>	109	100

## 5.9 Toilet at the Household

In the project area about 94 % of the households have toilets at their respective places. The details are given in Table 5.9.

**Table 5.9 Percentage of households having toilet**

SI No	Toilet	No	%
1	Yes	410	94
2	No	26	6
	<b>Total</b>	436	100

## 5.10 Easy Access to Toilets

In the project area out of the 26 households those don't have a toilet at home; about 65 % of the women of their households have easy access to toilets. The details are given in Table 5.10

**Table 5.10 Percentage of women having access public toilets & bathing facilities in the evening**

SI No	Easy Access to Public Toilets	No	%
1	Yes	17	65
2	No	9	35
	<b>Total</b>	26	100

## 5.11 Street Lights

In the project area about 47 % of the households admitted that that there is no adequate provision of street lighting during the night. Similarly about 30 % stated that street lights functions only for some time. The details are given in Table 5.11.

**Table 5.11 Adequate street lighting during the night**

SI No	Street Light	No	%
1	Yes Adequate	100	23
2	Yes, but only sometimes	132	30
3	No street lighting	204	47
	<b>Total</b>	436	100

## 5.12 Women's Perception on Mobility with Adequate Street Lights

About 94 % of the women in the households admitted that that the provision of adequate street lights will result in the increase of the women's mobility during the evening. The details are given in Table 5.12

**Table 5.12 Percentage of women admitted provision of adequate street lights will result in the increase of the women's mobility during the evening**

Sl No	Street Light	No	%
1	Yes	409	94
2	No	27	6
	<b>Total</b>	436	100

### 5.13 Summary

In the project area at the household level besides household works, women of some of the households are engaged in agriculture, white collar jobs, business and trade and also work as agricultural and non agricultural labourers. The women in economic activities also contribute substantially to the overall household income.

At the household level the women participation is more on the decisions related to daily activities. Women also have a very positive participation on all other matters related to financial matters, purchase of household assets, health care and education of the children.

Among the household activities cooking and cleaning are two major activities where a woman is responsible. A woman at the household spends most of her time in performing these two duties. Fuel wood collection and daily marketing is also a major work done by the women.

Most of the women feel safe during the day time and the perception on safety as usual is less during the night time. In the project area most of the women feel that they can move freely.

## 6 Structures and energy usage

This section discusses about the type of residential structures used by the households in the project area, along with the types of walls, roofs and floors. Besides the number of rooms available the main focus of this chapter are on the energy usages both electrical and non electrical.

### 6.1 Use of Structures

In the project area, 95 % of the structures are residential and only 1 % of the structures are commercial. 3 % of the structures are both residential and commercial. The details are given in Table 6.1.

**Table 6.1 Use of the Structure**

Sl No	Usages	No	%
1	Residential	416	95
2	Commercial	5	1
3	Residential cum commercial	13	3
4	Others	1	0
5	<b>Total</b>	435	100
6	Missing	1	0
	<b>Total</b>	436	100

### 6.2 Age of the Structures

In the project area, the average age of the structures is 18 years. Nearly one fifth of the structures was built during the last 5 years. About 28 % of the structures are 11 to 20 years old and another 29 % are 21 to 50 years old. The details are given in Table 6.2.

**Table 6.2 Age of the Structure**

SI No	Age	No	%
1	Less than 1 year	8	2
2	1 year to less than 5 years	83	19
3	6 years to less than 10 years	72	17
4	11 years to less than 20 years	120	28
5	21 years to less than 50 years	126	29
6	50 years and above	14	3
7	No Information	13	3
	<b>Total</b>	436	100
8	<b>Average Age</b>	<b>18 yrs</b>	

### 6.3 Type of Roofs

In the project area, 54 % of the structures are having tile roofs followed by asbestos (34 %). Only 9 % of the roofs are covered with corrugated iron sheet. The details are given in Table 6.3

**Table 6.3 Type of Roofs**

SI No	Roof Type	No	%
1	Simple (thatch / sack / bamboo / slats)	5	1
2	Earth/clay/sand	1	0
3	Brick	1	0
4	Concrete	2	0
5	Corrugated iron sheet	39	9
6	Tile	236	54
7	Asbestos sheet	148	34
8	Others	4	1
	<b>Total</b>	436	100

### 6.4 Type of Floors

90 % of the households are having concrete floors. In only 8 % of the households, the floors are of clay/earth/ sand. The details are given in Table 6.4.

**Table 6.4 Type of Floors**

Sl. No	Roof Type	No	%
1	Earth/clay/sand	37	8
2	Brick	3	1
3	Concrete	393	90
4	Corrugated iron sheet	2	0
5	Asbestos sheet	1	0
	<b>Total</b>	436	100

### 6.5 Type of Walls

91 % of the structures are having brick walls. Besides brick, walls of different makes are also used by the households. Nearly 5 % of the households are having walls of earth / clay make. The details are given in Table 6.5.

**Table 6.5 Type of Walls**

Sl. No	Walls	No	%
1	Simple (thatch / sack / bamboo / slats)	2	0.5
2	Earth/clay/sand	20	4.6
3	Wood	7	1.6

4	Brick	396	90.8
5	Concrete	2	0.5
6	Corrugated iron sheet	6	1.4
7	Tile	1	0.2
8	Asbestos sheet	1	0.2
9	Others	1	0.2
	Total	436	100.0

## 6.6 Structure of the Houses

In the surveyed households about 86 % of the households are permanent in nature. The rest of the houses are temporary or semi-permanent. The details are given in Table 6.6.

**Table 6.6 Type of Structure**

SI No	Structure Type	No	%
1	Temporary	25	5.7
2	Semi permanent	27	6.2
3	Permanent	377	86.5
4	No Information	7	1.6
	Total	436	100.0

## 6.7 Availability of Rooms

The average possession of the rooms among the households is 4.36 and 4.06 rooms are lighted. The details are given in Table 6.7.

**Table 6.7 Number of Rooms**

SI No	Rooms	Beneficiary
1	Average No. of Rooms	4.37
2	Average No. of Lighted Rooms	4.06
3	Average AC Rooms	Only 4 rooms

## 6.8 Availability of Electricity

In the project area, 88 % of the households are electrified. All the electrified households receive power and electricity from the government sources. The details are given in Table 6.8.

**Table 6.8 Percentage of Households Electrified**

Sl. No.	Whether Electrified	Rural		Urban		Total	
		No	%Age	No	%Age	No	%Age
1	Yes	327	86	56	100	383	88
2	No	53	14	0	0	53	12
3	Total	380	100	56	100	436	100

## 6.9 Average Years of Electrification

The average year of electrification is 11 years and 6 months among the surveyed households in the project area. Nearly one fifth of the electrified households have been electrified during the last one year. Similarly about one fourth have been electrified during the last 5 years. About 26 % of the households have been electrified for more than 15 years. The details are given in Table 6.9.

**Table 6.9 Percentage of Households Electrified**

Sl. No	Years	No	%
1	Less Than 1 Year	21	5
2	1 Year to 2 Years	41	11
3	3 Years to 5 Years	55	14
4	6 to 10 Years	101	26
5	11 to 15 Years	66	17
6	More Than 15 Years	99	26
	<b>Total</b>	383	100
7	<b>Average Yrs of Electrification</b>	<b>11 years 6 months</b>	

**6.10 Seasonal Availability of Electricity**

The availability of electricity is fairly good in the project area. During the dry and wet seasons the availability is more than 23 hours in a day. The details are given in Table 6.10.

**Table 6.10 Seasonal availability of electricity**

Sl No	Items	In hours
1	Average Availability of electricity during Dry season	23.16 Hrs
2	Average Availability of electricity Wet Seasons	23.78 Hrs

**6.11 Usage of Electricity**

All the households use electricity for lighting. The average use of electricity for lighting is 4 hours and 13 minutes. 93 % use electricity for running a television or a music system and the average usage is 3 hours. 42 % of the electrified households use electricity for running water pumps and the average usage time is 27 minutes. Nearly half of the electrified houses use electricity for cooking also and the average usage time is 53 minutes. The details are given in Table 6.11.

**Table 6.11 Types of Usage of Electricity**

Sl. No	Usage Type	Using		Average hours
		No	%	
1	Electricity for Lighting	383	100	4 Hrs 13 minutes
2	Electricity for cooking	183	48	53 minutes
3	Electricity for heating and cooling	235	61	19hrs 19 minutes
4	Electricity for pumping water	160	42	27 minutes
5	Electricity for running TV and tape recorder	356	93	2hrs 55 minutes
6	Electricity for computer	68	18	39 Minutes
7	Electricity for running business	27	7	6 hrs 37 minutes
	<b>Total</b>	383	100	

**6.12 Possession of Electrical Appliances**

All the electrified households have bulbs and the average possession is 8.32. The urban households possess on an average 9.5 bulbs and the rural households have 8.1 bulbs. About 92% of the households have television and the average possession is one each. Electric fans are possessed by 65% with an average possession of 1.33. The urban households have more fans than the rural households. Similarly 55% possess refrigerators (rural 54%; urban 66%), 49% possess iron (rural 14 %; urban 21 %), 47 % rice cookers (rural 45 %; urban 61 %) and 41 % water pumps (rural 40 %; urban 46 %), all of them possess at least one item each. The details are given in Table 6.12.

**Table 6.12 Possession of electrical appliances**

Sl. No	Appliances		No of HH	%	Total Nos.	Average Nos.
1	Lamps (Electric Bulbs, Tube lights, etc)	Rural	325	99.3	2629	8.1
		Urban	56	100	533	9.5
		Total	381	100	3162	8.3
2	Heater	Rural	151	46	152	1
		Urban	21	38	21	1
		Total	172	45	173	1
3	Fans	Rural	204	62	260	1.27
		Urban	46	82	74	1.6
		Total	250	65	334	1.33
4	TVs	Rural	299	91	300	1
		Urban	54	96	54	1
		Total	353	92	354	1
5	Washing Machines	Rural	26	8	29	1.11
		Urban	15	27	16	1
		Total	41	11	45	1.09
6	Water Pumps	Rural	131	40	134	1.02
		Urban	26	46	27	1.03
		Total	157	41	161	1.02
7	Air conditioners	Rural	5	2	6	1.2
		Urban	2	4	3	1.5
		Total	7	2	9	1.29
8	Refrigerators	Rural	175	54	177	1.01
		Urban	37	66	38	1.03
		Total	212	55	215	1.01
9	Rice Cookers	Rural	147	45	149	1
		Urban	34	61	34	1
		Total	181	47	183	1
10	Iron	Rural	47	14	47	1
		Urban	12	21	12	1
		Total	59	15	187	1
11	Iron Blender	Rural	6	2	6	1
		Urban	3	5	3	1
		Total	9	2	9	1

**6.13 Electric Meter**

98% of the electrified households have electricity meter. The average consumption per month is 72.5 units. The details are given in Table 6.13.

**Table 6.13 Possession of electricity meter**

Sl No	Possess Electric Meter	No	%
1	Yes	374	98
2	No	9	2
	<b>Total</b>	383	100

#### 6.14 Place of Payment

76 % of electrified households pay their electricity bills either through banks or post office and the rest 25 % through CEB offices. The details are given in Table 6.14.

**Table 6.14 Place of payment of electricity bills**

Sl. No	Place	No	%
1	Abans shop	2	1
2	Bank	185	51
3	CEB	91	25
4	Post Office	86	24
	<b>Total</b>	<b>364</b>	<b>100</b>

#### 6.15 Period of Electricity Bill

About 90 % of the electrified households pay their electricity bills on monthly basis. Only 6 % pay on quarterly basis and the rest 4 % pays bi-monthly. The details are given in Table 6.15.

**Table 6.15 Payment of electricity bills**

Sl No	Period	No	%
1	Monthly	330	90
2	Bi-monthly	16	4
3	Quarterly	22	6
	<b>Total</b>	<b>368</b>	<b>100</b>

#### 6.16 Electricity Theft

There is hardly any case of electricity theft case reported from the project area. Only 5 % of the households admitted of having electricity thefts. The responsibility of maintenance lies with CEB. The details are given in Table 6.16.

**Table 6.16 Electricity theft cases**

Sl. No	Theft Case	No	%
1	Yes	20	5
2	No	349	95
	<b>Total</b>	<b>369</b>	<b>100</b>

#### 6.17 Use of Non Electrical Source

89 % of the households use alternate energy. The details are given in Table 6.17.

**Table 6.17 Use of non electrical sources by electrified households**

Sl. No	Use non electrical source	No	%
1	Yes	386	89
2	No	50	11
	<b>Total</b>	<b>436</b>	<b>100</b>

#### 6.18 Average consumption of non electrical energy

25 % of the electrified households use kerosene and diesel as alternate energy. The average time of consumption is 1 hour 35 minutes and the monthly average expenditure is LKR 865. 73% use fuelwood and average time of consumption is 2 hours and 19 minutes. Most of the households do not incur any



cost on the fuelwood. However 44 households spend on an average LKR 437 per month on fuelwood. Another 29 % use gas and their average time of consumption is 1 hour 19 minutes and the average cost is LKR 728 per month. The details are given in Table 6.18.

**Table 6.18 Consumption time of alternate energy sources by electrified households**

SI No	Alternate Source	No. of HH	% HH	Average Hrs of consumption	Average Monthly Expenditure in LKR
1	Kerosene/ Diesel	110	25	1 hr 35 minutes	865
2	Battery	5	1	1 hr 48 minutes	not reported
3	Wood	317	73	2 hrs 19 minutes	LKR. 437 by 44 HH
4	Gas	126	29	1 hr 19 minutes	728
5	Solar	4	1	2 hrs 49 minutes	not reported
	<b>Total</b>	436	100		

### 6.19 Alternate energy usage in non electrified households

The non electrified households use multiple sources of alternate energy for lighting, cooking and heating. Among the non electrified households almost all the households use kerosene / diesel for lighting. Battery for lighting is only used by 4 of the non electrified households. Solar lighting system is present in only 2 of the non electrified households. Similarly for cooking 94 % of the households use wood and only 9 % use kerosene / diesel. For heating 26 % uses wood. The details are given in Table 6.19.

**Table 6.19 Alternate energy sources and their use by non electrified households**

SI No	Energy Sources	Lighting		Cooking		Heating	
		No	%	No	%	No	%
1	Kerosene/ Diesel	53	100	5	9	3	6
2	Battery	4	8	0	0	0	0
3	Wood	1	2	50	94	14	26
4	Gas	0	0	0	0	0	0
5	Solar	2	4	0	0	0	0
	<b>Total</b>	53	100	53	100	53	100

### 6.20 Use of Non Electrical Appliances in non Electrified Households:

96 % of the non-electrified households use kerosene and diesel lamps and the average number is 2.43. Another 8 % of the households possess battery lamps and the average possession is 1. Solar panels are used by only 2 of the non-electrified households and each possesses one. All the non electrified households have agreed to pay LKR 593 per month for the electricity. The details are given in Table 6.20.

**Table 6.20 Use of non electrical appliances in non electrified households**

SI No	Appliances	No of HH	%	Total Nos	Average No
1	Kerosene/Diesel Lamps	51	96	124	2.43
2	Battery Lamps	4	8	4	1
3	Gas Cylinders	0	0	0	0
4	Solar Panel	2	4	2	1
	<b>Total</b>	53	100		

### 6.21 Preference for electricity use by non electrified households

All the households will use electricity for lighting, and about 44 % of the household will use for operating a television. Some of the households will also use for cooking and pumping water. The details are given in Table 6.21.

**Table 6.21 Type of use of electricity as preferred by non electrified households**

Sl. No	Preference	No	%
1	Will use for lighting	53	100
2	Will use for cooking	7	13
3	For heating and cooling	4	8
4	Will use TV and radio	44	83
5	For pumping water	10	19
6	Other electric Appliances	5	9
	Total	53	100

### 6.22 Satisfaction on the current flow

90 % of the households are satisfied on electricity's current flow. The details are given in Table 6.22.

**Table 6.22 Percentage of households satisfied on the current electricity flow**

Sl. No	Whether satisfied	No	%
1	Yes	345	90
2	No	38	10
	Total	383	100

### 6.23 Satisfaction on the non electric energy

64 % of the households are satisfied with non electric energy sources. The rest 36 % are not satisfied with the non electric energy sources. The details are given in Table 6.23.

**Table 6.23 Percentage of households satisfied on non electric energy**

Sl. No	Whether satisfied	No	%
1	Yes	278	64
2	No	158	36
	Total	436	100

### 6.24 Diesel generator as a polluting agent

94 % of the households admitted that diesel generator creates pollution. The details are given in Table 6.24.

**Table 6.24 Percentage of households admitted diesel generator creating pollution**

Sl. No	Diesel Pollutes	No	%
1	Yes	409	94
2	No	27	6
	Total	436	100

### 6.25 Diesel / kerosene as expensive fuels

98 % of the households admitted that diesel and kerosene as expensive fuels. The details are given in Table 6.25.

**Table 6.25 Percentage of households admitted diesel / kerosene as expensive**

Sl. No	Diesel / kerosene as expensive	No	%
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1	Yes	426	98
2	No	10	2
	Total	436	100

#### 6.26 Requirement of Electric Power:

67 % of the households admitted requirement of electric power. The details are given in Table 6.26.

**Table 6.26 Percentage of households feels the requirement of electric power**

Sl. No	Electric power required	No	%
1	Yes	294	67
2	No	142	33
	Total	436	100

#### 6.27 Regular Payment of Bill

Among the non electrified households, 94 % of the households admitted that they will pay electricity bills regularly. The details are given in Table 6.27.

**Table 6.27 Percentage of households admitted of paying electricity bill regularly**

Sl. No	Will pay electric bill Regularly	No	%
1	Yes	50	94
2	No	3	6
	Total	53	100

The non electrified households are willing to pay LKR 324 in an average per month if their households are electrified.

#### 6.28 Electricity theft

94 % of the households showed willingness to cooperate to minimize electricity theft. The details are given in Table 6.28.

**Table 6.28 Percentage of households those will cooperate to minimize electricity theft**

Sl. No	Will cooperate in case of theft	No	%
1	Yes	410	94
2	No	26	6
	Total	436	100

#### 6.29 Benefits of the Project

In the project area about 86 % of the households admitted that the project will help the people. The details are given in Table 6.29.

**Table 6.29 Percentage of households feels the project will help**

Sl. No	Whether the project will help	No	%
1	Yes	374	86
2	No	62	14
	Total	436	100

### 6.30 Summary

In the project area most of the structures are residential and are permanent in nature. Electricity is available for all the households in urban areas and in the rural area 86 % of the households are electrified. The availability of electricity is fairly good in the project area. During the Dry and Wet seasons the availability is more than 23 hours in a day.

All the households use electricity for lighting and about 93 % uses for running television. Electricity is also used cooking, heating and cooling, pumping water, etc.

In the project area those have electricity at their home, the common electrical appliances used are electric bulbs, electric fans, refrigerators, Iron, rice cookers and water pumps. Besides electric fans and bulbs all other items are possessed as a single item by the households. In terms of rural and urban areas more percentage of urban households possess electrical items than the rural households.

All the electrified households have a electricity meter. Among the households those have electric meter the average consumption per month is 72.5 units. There is very minimum case of electricity theft case reported from the project area.

Most of the households also use alternate energy. Wood, kerosene oil and gas are the widely used alternate fuels in the surveyed households. The per day hours of consumption is more for wood followed by kerosene oil. The average monthly bill is more on kerosene / diesel, and gas in the surveyed households. On the other hand the non electrified households use multiple sources of alternate energy for lighting, cooking and heating. Among the non electrified households almost all the households use kerosene / diesel for lighting.

Almost all the households those don't have electricity, use Kerosene and Diesel lamps for lighting, for cooking and heating use woods, All the non electrified households have agreed to pay LKR. 593/- per month for the electricity. On usage of electricity the demand is using electricity for lighting, and running television. Some of the household will also use for cooking and pumping water.

In the project area most of the households are satisfied on electricity's current flow. In the project area about 64 % of the households are satisfied on non electric energy. About two third of the households admitted requirement of electric power. Among the non electrified households almost all the households admitted that they will pay electricity bills regularly. The non electrified households are willing to pay LKR. 324/- in an average per month if their households are electrified. About 94 % of the households showed willingness to cooperate to minimize electricity theft. In the project area about 86 % of the households admitted that the project will help the people.

## 7 Conclusions: Major Findings

### 7.1 Basic Household Characteristics

The socio-economic survey was conducted among 436 selected households in the project area. Majority about 87 % of the households covered belong to rural areas and the rest are from the semi urban area. The project area is dominated by Sinhalese people followed by Sri Lankan Tamils. Indian Tamil and Muslim are the minorities living in this area. Among the households covered nearly one tenth of families are headed by women and majority of them are widows. Basic infrastructure like source of drinking water, toilet facilities and availability of electricity are analysed from the survey findings to understand the easy accessibility of the residing population to these facilities. More than three fourth of the households have easy access to water at their respective households. About 77 % of the households get water from supplied piped water, hand pump or well located at their respective residence. Similarly the scarcity of water is noticed in the rural areas as 26 % of the households face this problem everyday. In the urban household only 2 % of the households reported facing scarcity of water. About 94 % of the household reported having a toilet at their respective households, however among the rural households about 4 % of the households defecate in the open area (open fields/

bushes). In the urban areas all the households covered are electrified where as in the rural area about 86 % of the households are electrified. About 86 % of the houses of the households covered are permanent in nature and this is more in the urban areas than the rural areas. In rural areas 7 % of the households are temporary and about 6 % are semi permanent. The average possession of the rooms among the households is 4.36 and 4.06 rooms are lighted

## 7.2 Socio-economic Profile of the Project Area

The demographic indicators of the surveyed households indicate that the family size is small and the sex ratio favours the females. Similarly the literacy in the project area is high at 97 % and this is more or less same for both the genders. Higher education is limited in the project area as very few household members are found to be graduates and above. Most of the household members are educated till the level of secondary and higher secondary.

The occupational trend of the surveyed household suggests that the rate of employment among the males is quite higher than that of the females. Overall 82 % of the males those above 18 years are employed and among the females about 26 % are employed. Employment in white collar jobs, farming, skilled and semi skilled work are the important professions practiced by the male members. Among the females nearly half of them are house wives and nearly one tenth are engaged in white collar jobs. The overall unemployment is 11 % and the unemployment is more among the female members.

The socio-economic survey also attempted to know the main and allied activities at the household level and the variation in the rural and urban areas. Agriculture as a main activity is performed nearly by half of the rural households and by one fifth in the urban areas. Agriculture is also a secondary activity for many of the households covered under the study. About 31 % practice agriculture as a secondary activity, which is more among the rural residents. Similarly difference between rural and urban households is there in terms of their engagement in white collar job. In urban areas majority about 55 % of the households are in either government or private jobs and this is about 31 % among the rural households. Overall about 17 % of the households are in business and very few households see business as a secondary activity. Business families are almost equally distributed among rural and urban areas. In the project area one of the primary activity is also working as labourers for other farmers, daily wage workers and skilled and semi skilled workers. Nearly one third of the household are engaged in this field but skilled workers like carpenters, masons, electricians and plumbers are more in rural areas than in urban areas. Working in armed forces as a primary activity is more in the rural households than in the urban households in the project area. Earnings from pension and foreign remittance are also a major primary activity for the urban households.

Different households possess different types of lands in the project area. A single household also possess more than a single type of land. Sinnakkara land is possessed by 61 % of the households in the rural areas where as 84 % of the households in urban areas possess this type of lands. In terms of lands the average land possession is more among the rural households than among the urban households. The average possession of all types of lands is 0.82 hectares among the rural households and among the urban houses it is only 0.29 hectares.

More than two-third of the households possess agricultural land. As usual agricultural land is possessed by more households in rural area than in the urban areas. The average possession of agricultural land is two and half times more than that of the urban families. Paddy land is possessed more in percentage with the rural households where as highland for crop cultivation is possessed more in percentage with the urban households.

Rice and maize are two important crops grown by the agricultural households. Cowpea and green grams are also grown but by less percentage of the households. Besides field crops, vegetables like brinjal, cassava and pumpkins are cultivated by very few of the households. Fruits like bananas and mangoes are also cultivated but in less households. Among other fruits about 5 % of the households

cultivate lime, oranges and water melon. Tea and coconuts are also cultivated, in the surveyed households.

The households besides single sources also have different other sources of earnings. Agriculture, paddy and high land crop cultivation and white collar jobs that include government and private jobs and jobs in armed services are the major source of income. Among the rural households agriculture is one of the major sources of income for three-fourth of the households. On the other hand among the urban households majority about two third of the households reported earning from private and government jobs as major sources of income.

The average household income of the urban area is more than the rural area. The average household annual income for the rural area is LKR 442,175/- and for the urban area is LKR 508,936/-. In the rural areas the higher contributor to the total income is highland crop cultivation followed by government jobs and employment in armed force. On the other hand among the urban households private jobs contribute maximum income followed by business and govt jobs.

The total annual expenditure is reported to be LKR. 257,952/-. The expenditure on food is highest in both the rural and urban area. The expenditure pattern is more in urban areas than in rural households. In the rural area besides the food expenses the next maximum expenditure is on agriculture. Similarly in urban area besides food the next highest expenditure is on transportation followed by education and loan repayment.

The possession of household assets also depends on the household income and expenditure. The income of urban households is more and that is also reflected in the possession of assets. Television is most common durable goods possessed by 82 % of the households in rural areas and with 96 % of the households in urban areas. There is substantial gap in the possession of assets between the rural and urban areas on the items like electric fans, refrigerators, rice cookers, LPG gas connection, computers, washing machines, internet connections, and cars. All these items are possessed more in percentage by the urban households than the rural households.

The indebtedness is seen marginally more among the urban households than the rural households. Loans are mostly taken for the improvement of the houses and for investment in agriculture. Banks are best sources of taking a loan for the households. Most of the households are able to repay the loan amount on time. The households in the project area have benefitted from different developmental schemes of the Sri Lankan government. Nearly one-fourth of the households mostly from rural area have benefitted from different government schemes. Majority received these helped from the government and some households received it from non governmental organisations (NGO).

Out migration in search of job and work also reported from the project area. Migration is marginally more in rural areas than the urban areas. Almost all the members migrated individually. Most of the migrated members both male and females are engaged in formal sectors. The income of the migrated members is substantial; it is higher than the annual household income of all the surveyed households.

### 7.3. Health

The treatment seeking places are government and private health facilities for the surveyed households. There are multiple reasons for the households visiting a private health facility. Free or less costly treatment is one of the major reasons for the households those visit a government health facility. Government hospitals and dispensary is the nearest available health facilities. For 29 % of the households there is the presence of a health facility within the village. The average distance of the health centre is from the villages covered is 4.62 kilometres, which is relatively nearer for the resident population in the project area.

About one fourth of the household reported that at least one family member reported suffering from illness during the last one year. Among the diseases non communicable diseases faced by more than half of the households. The other diseases seen in the project area are non communicable diseases, diabetes, and Respiratory problems.

It is important to note that in the project area almost all the babies are delivered in hospitals. The households reported multiple places of ante natal check ups. Besides ante natal check ups at government and private health facilities, a substantial number of households reported having ante natal check ups at home by family health workers and mid wives which is a positive finding for maternal health.

#### 7.4 Role of Women in Project Area

In the project area at the household level besides household works, women of some of the households are engaged in agriculture, white collar jobs, business and trade and also work as agricultural and non agricultural labourers. The women in economic activities also contribute substantially to the overall household income.

At the household level the women participation is more on the decisions related to daily activities. Women also have a very positive participation on all other matters related to financial matters, purchase of household assets, health care and education of the children.

Among the household activities cooking and cleaning are two major activities where a woman is responsible. A woman at the household spent most of her time in performing these two duties. Fuel wood collection and daily marketing is also a major work done by the women.

Most of the women feel safe during the day time and the perception on safety as usual is less during the night time. In the project area most of the women feel that they can move freely.

#### 7.5 Structures and Energy Usage

In the project area most of the structures are residential and are permanent in nature. Electricity is available for all the households in urban areas and in the rural area 86 % of the households are electrified. The availability of electricity is fairly good in the project area. During the Dry and Wet seasons the availability is more than 23 hours in a day.

All the households use electricity for lighting and about 93 % uses for running television. Electricity is also used cooking, heating and cooling, pumping water, etc.

In the project area those have electricity at their home, the common electrical appliances used are electric bulbs, electric fans, refrigerators, Iron, rice cookers and water pumps. Besides electric fans and bulbs all other items are possessed as a single item by the households. In terms of rural and urban areas more percentage of urban households possess electrical items than the rural households.

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are willing to pay LKR. 324/- in an average per month if their households are electrified. About 94 % of the households showed willingness to cooperate to minimize electricity theft. In the project area about 86 % of the households admitted that the project will help the people.



## Annexure 3: Details on Consultations

### Details of Public Consultations and findings

SI no	Name of the Project Components	Major Issues Discussed and Points Asked	Summary of People's Perception, Opinion and Suggestion
1	Transmission System Strengthening in Mannar region	<ul style="list-style-type: none"> <li>General perception about the project and the awareness about the proposed project.</li> <li>Support of local people for the proposed project?</li> <li>Any critical issue or concern by the local people regarding the project?</li> <li>Any criteria you would like to see considered during project design, construction and operation stage?</li> <li>Employment potential in the project which is of benefit to village</li> <li>Ethnic Minorities /Indigenous peoples composition (If there are Indigenous People, please mention about the names of the IP and number of households)</li> <li>Access to the forest land and the use of the forest land (if any)</li> <li>Loss of residential/commercial structures, if any due to the project</li> <li>Loss of community life like any Market Places or community activities to be affected</li> <li>Will the project cause widespread imbalance by cutting fruit and commercial trees in the locality.</li> <li>Will the project cause health and safety issues in the area.</li> <li>Resettlement and Land acquisition (if foreseen due to setting up of power plant, distribution/transmission line especially on private land). Has there been land acquisition before? If yes, what was the process of land acquisition and compensation package?</li> </ul>	<ul style="list-style-type: none"> <li>People will support if it benefits our village and country</li> <li>Do not know how we can support because we do not know much about it</li> <li>Projects never asked for our support</li> <li>Project should not be harmful to us.</li> <li>Population in this area (Mannar) is very scarce. So there will not be a major problem.</li> <li>Existing line runs at a very low height. We are unable to grow any permanent crops or construct houses under the lines. Therefore, people may not agree to allow installing another line.</li> <li>It is alright if the existing line is improved. But if there is a parallel line to the existing line, more land will be required.</li> <li>If the existing line can be updated, damages to residential and commercial structures can be minimized</li> <li>Minimize damages to people, cultivations, and vegetation.</li> <li>People who live in this area are those affected by war. They have lost everything in the war. Therefore, we request that the project should not further affect the livelihoods, cultivations and houses of people here.</li> <li>If lines run over our land, our children may not be able to build a house for them. Lines should be installed far away from houses and preferably over paddy fields and forests.</li> <li>Polls should be installed far away from houses.</li> <li>If polls/towers are installed in the middle of settlements they should be fenced particularly for the safety of children</li> <li>We do not have a major unemployment problem. But at least some people may be able to find work.</li> <li>We do not think our people will have the technical knowledge and training to get employment in the project.</li> <li>If the line route is expanded, we may lose part of our land. Then we may not be able to use that land.</li> <li>If lines are running over the houses or close to houses, risks of dangers can increase. And we will have to live in fear. We may also not be able to grow what we want.</li> <li>Project will not affect our temple and school.</li> <li>Madhu forest reserve surrounds our village. And the Madhu shrine is only a few Km away.</li> <li>Even we cannot grow big trees under the lines we still can grow green gram, cowpea, sesame and kurakkan.</li> <li>This is a flat land and therefore landslides cannot be expected.</li> <li>People will lose incomes if trees are cut down [if they earn any income from them]</li> </ul>

		<ul style="list-style-type: none"> <li>Protected areas (national park, protected forest, religiously sensitive sites, historical or archaeological sites), if any</li> <li>Will the project siting adversely change migration pattern of animals that would destroy fields, habitats</li> <li>Will the project siting adversely impact the water or soil resource in the locality</li> <li>Type of compensation expected (Cash or Kind)</li> <li>Perceived benefits from the project</li> <li>Perceived losses from the project</li> <li>What other organizations of a social nature (NGOs/CBOs/ Civil Society) active in the area? Name of these organisations</li> <li>Any Other Issues you may feel to share:</li> <li>(Demand of power, whether they welcome the project, will there be cooperation from the local community during the implementation, security measures, etc)</li> <li>Will there be likely involvement of local people in the implementation of the project?</li> </ul>	<ul style="list-style-type: none"> <li>There are migrant birds. But we do not think the project can affect the birds. Too many lines can increase the risks of lives of birds.</li> <li>There aren't many migrant birds in this area.</li> <li>There are forest reserves. As the lines run at a height and above the forests, they may not affect the forests</li> <li>If forests are cleared, it will affect the rainfall pattern. And if jak and coconut trees are cut down, we may not be able to replace them and can affect the family incomes.</li> <li>Not because of the project, but because our people cannot cultivate due to our original lands have turned into thick jungle; government/army is not helping us to clear the land; authorities are not issuing/renewing new permits for the land we cultivated before the war; and we do not have adequate water for cultivation</li> <li>Should be given adequate compensation if our assets are lost/damaged.</li> <li>Compensation packages should take into account the long-term losses to people. When existing lines were installed compensation was paid for valuable trees that were cut down. Each tree was paid LKR.7000-8000. Compensation was not paid for land.</li> <li>We prefer an alternate land close to the town rather than cash compensation if our land is acquired.</li> <li>If a poll/tower is installed on a land, we expect at least LKR.200,000 as compensation. For trees, if they are removed we should be paid according to their market value.</li> <li>These lands do not have any legal titles. They are encroached land. We have been living here for several years. But if the land is acquired, we may not get any compensation or alternate land.</li> <li>Project will not affect water and soil resources</li> <li>Do not know what the benefits would be.</li> <li>The entire country will benefit. A few people in the village may find employment during project construction</li> <li>There will not be any direct benefit to us.</li> <li>People will lose incomes from their cultivable land if that land is acquired</li> <li>Project should provide electricity for non-electrified households and improve voltage drops.</li> <li>If lines run over agricultural land, our cultivations will be damaged. If they run closer to our homes, land values will decrease</li> <li>We support the project because it helps in addressing the energy crisis in the country</li> <li>Difficult to say anything because we do not know exactly what the situation is. This may be a good project. There are several un-electrified households. They spend about LKR 1,000 for kerosene oil. If they get electricity, their costs would go down.</li> <li>We need to look at how the project will be implemented and which areas are going to be affected. Depending on that people will give their consent</li> <li>We can involve as labourers during project implementation We may be able to work in the project during off season.</li> <li>CEB has identified two plots of land for the construction of the proposed Mannar GSS. One belongs to the Irrigation Department and the other to a private party. However, the legal</li> </ul>
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			<p>entitlements of the latter are unclear.</p> <ul style="list-style-type: none"> <li>• It is necessary to get environmental clearance for the land belonging to the Irrigation Department as it is part of the tank bed of Giant Tank.</li> <li>• Additional land acquisition is not required for the augmentation of New Anuradhapura and Vauvnia GSS because there is sufficient space within the premises belonging to CEB if any physical extensions are necessary for the expansion of GSS.</li> </ul>
2	New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.		<ul style="list-style-type: none"> <li>• There is no objection to the project. But we have no idea of how we can support the project.</li> <li>• If lines run over houses families may oppose the project</li> <li>• People will object if the project affects their common/community centres</li> <li>• Our cultivations are destroyed by wild boars frequently. If the project leads to clearance of forests, threats from wild boars can aggravate.</li> <li>• We have to support the project because it is good for the future development of the country</li> <li>• Should minimize harmful effects on people, their cultivations and other property</li> <li>• Damages to people's private property can be minimized if lines run over the army base [There is an army base for training soldiers for shooting]</li> <li>• If the proposed lines run closer to the mountains like the existing line, we have no problem.</li> <li>• If the new line can go parallel to the existing line, problems will be less</li> <li>• Displacement from our agricultural lands and houses should be avoided.</li> <li>• Can affect the paddy lands. But it will not be a significant impact</li> <li>• There will be no landslides or soil erosion. Lines are running over marshy lands.</li> <li>• There aren't many birds in this area.</li> <li>• There are a lot of birds coming to this area. If trees are cut down, it can affect such birds.</li> <li>• Our village borders part of the Sinharaja forest reserve</li> <li>• We get water from the river during dry season. If more trees are cut down, streams will run out of water</li> <li>• Cash compensation according to the nature and the degree of loss.</li> <li>• Should be compensated with cash or land if land is acquired.</li> <li>• Because of a previous electricity project that ran close to Kelani river, we lost our land. We were not paid any compensation</li> <li>• We have no faith in compensation since we were not paid earlier</li> <li>• Do not see a major benefit</li> <li>• Would improve the electricity supply</li> <li>• Not sure whether it will damage the environment. If that happens, dryness will increase.</li> <li>• Farmers will not be able to cultivate around towers [if they are installed in the paddy fields].</li> <li>• May reduce the extent of cultivable land</li> <li>• Can affect the water streams if several trees are cut down</li> <li>• We have the risk of losing our houses and property</li> <li>• If young people can find employment in the project, it is good.</li> <li>• A majority of our people are rubber tappers or casual labourers. It is good if they get additional</li> </ul>

			<p>employment or income from the project.</p> <ul style="list-style-type: none"> <li>Families can also provide food and boarding places for workers during construction period</li> <li>There is no major barrier to implement the project</li> <li>We do not think the project will create serious problems for us. Already there are lines running over our village. There is no negative impact on us.</li> <li>We may not be able to grow anything along the ROW</li> <li>Can cause landslides/soil erosion because this is a mountainous area</li> <li>People in this area get incomes from fruit trees such as durian. If such trees are cut down, they would lose their incomes</li> <li>We hear that risks of lightening are high in areas where electricity lines are installed. This endangers our lives</li> <li>We request adequate compensation if the project causes losses to our property and assets. If lines are installed at a height and not affecting the cultivations we do not expect compensation</li> <li>Good if the project can provide employment for our people</li> <li>We support the project. It will improve our electricity supply</li> <li>Land required for the construction of proposed GSS in New Padukka and New Polpitiya respectively has not been identified yet by CEB.</li> </ul>
3	Construction of 132/33 kV GSS at Kegalle and associated transmission line	<ul style="list-style-type: none"> <li></li> </ul>	<ul style="list-style-type: none"> <li>We do not like this project. It can cause losses to our land. We may have to restrict our cultivations under the electricity lines.</li> <li>We do not like to support this project. Because when we objected to the earlier project, Divisional secretary threatened us to take us to courts if we did not agree to cut the trees.</li> <li>Our people will not support. In the previous project, people beat the electrical engineer too. People have only a plot of land. When polls are installed on such land, they lose the land.</li> <li>If the line goes parallel to the existing line, we have no problem. It will minimize the damage.</li> <li>People do not like electricity lines crossing over their gardens, because it destroys coconut, jak and durian cultivations.</li> <li>People fear that projects would affect their properties and cultivations.</li> <li>People should be consulted. Damages to property and cultivations should be minimized. Even small damages should be compensated. Compensation should be paid before the project is implemented.</li> <li>We do not think our people can work in the project. Because it requires skilled labour. Our people do not have such skills.</li> <li>Can affect houses. When lines run over houses, value of land goes down.</li> <li>We may not be able to cultivate under the lines.</li> <li>Risks of lightening can increase. Even now, houses that are located under 33Kv lines cannot get access to some TV channels.</li> <li>If land is acquired, we expect a very high compensation. Because there are families who sell durian. If such durian trees are cut down it affects their incomes. However, people may not get much compensation for land because they do not have legal titles to the land</li> <li>People may not show much keen interest in the project. People here already have electricity.</li> </ul>

			<ul style="list-style-type: none"> <li>• People objected when the previous project was planning to take the lines over Mahawatte temple. Then it was taken over the rubber land belonging to the temple. A large number of rubber trees were cut down and incomes were reduced.</li> <li>• If rubber trees have to be cut down for the project, it will affect our incomes. We may not be allowed to grow even a banana tree under the lines. CEB people come and cut those trees sometimes when they are bearing fruits.</li> <li>• Risk for lives is low. But if lines are running over houses, we may not be able to get on to the roof even for cleaning.</li> <li>• Earlier we were paid LKR3,000/-per coconut tree that was cut down. But there was no compensation for land. We too did not ask for any compensation. We cannot grow even a banana tree on that land.</li> <li>• Koskale forest reserve is close by. But the proposed line route will not affect that. Nor the temple.</li> <li>• We may not be able to grow tall trees under the lines; if lines touch the trees it can cause fires. And it would be a risk to our lives</li> <li>• It is good if lines are run over at a fairly good height</li> <li>• Can employ the labourers. Labour is available.</li> <li>• Already there are several electricity lines run over the settlements. If there are more lines, it will obviously affect our residences and commercial establishments</li> <li>• Since the lines are running close to homes or above our homes many trees will have to be cut down</li> <li>• We lost land and our cultivations for the previous electricity projects. When the lines go over the land, we may not be able to cultivate what we want. Our freedom will be restricted due to security measures. Therefore paying money alone will not be able to compensate for our losses.</li> <li>• If our land is acquired, we should be given similar land from this area itself and not in remote areas. We do not expect only cash compensation, but we need more than that for our losses.</li> <li>• The country will benefit</li> <li>• We will lose our freedom and property. Government officers think only one side – how to complete the project. They do not think about us</li> <li>• There are two different private parties willing to sell their respective lands in the open market to CEB to construct the proposed Kegalle GSS. But the land prices they quote are exorbitant.</li> </ul>
4	Padukka 220/132/33 kV GSS and associated transmission line		<ul style="list-style-type: none"> <li>• It is alright having such development projects provided they do not bring any adverse effects on people and their property.</li> <li>• We do not like lines crossing over our houses. Because if land is acquired for the project, we will lose a lot.</li> <li>• Already there are lines running over our houses. Because of this our land values decreased substantially.</li> <li>• If the lines go parallel to the existing line, we have no problem. Otherwise, people will definitely oppose.</li> <li>• This area has a very high population density. It will be difficult to implement a project here.</li> </ul>

			<p>People's safety needs to be ensured too during project implementation</p> <ul style="list-style-type: none"> <li>• We do not like another line running over our houses. We have no objection to improving the existing line.</li> <li>• So far we have not been requested to support. We will support if necessary. But only if the project does not harm us.</li> <li>• Do not change the existing line that runs over our houses. It can be further improved rather than installing a new line.</li> <li>• We do not want the project to affect our houses and other buildings.</li> <li>• We are unable to express our individual opinion. Our Pathumpura Rural Development Society will have to meet and take a collective decision.</li> <li>• It is difficult to say since we do not know exactly the line route.</li> <li>• Project should avoid having lines over play grounds, temples, business premises, schools and places where people gather.</li> <li>• We do not think our people will benefit from this project.</li> <li>• A few people may get a chance to work as labourers</li> <li>• It is good if people can find work/employment in such a project. But except for some women, most men and women in this village are employed in formal sector jobs.</li> <li>• If rubber trees are cut down, it may have an adverse impact on family economy.</li> <li>• Value of land would go down if lines run over the land.</li> <li>• There are no migrant birds in this area.</li> <li>• Streams will run out water if trees are fell down.</li> <li>• If a new line is installed, it will run over the houses. If polls are installed, it will affect our land.</li> <li>• Perhaps risks of lightening would increase. Some people say when power lines are running close to homes it can cause cancer.</li> <li>• When the existing line was installed in 1982, compensation was paid for the trees that were fell down. But not for the land.</li> <li>• We should be paid adequate compensation that is sufficient to buy a new land and build a new house.</li> <li>• No previous land acquisition. But if our properties are acquired, we need adequate compensation that would allow us to settle down in a place we like.</li> <li>• We need land or cash that allow us to live in a place that matches with our preference</li> <li>• Sometimes, the electricity supply would improve.</li> <li>• For the development of the country, these types of development projects are necessary. People would get electricity for their industries.</li> <li>• We may not benefit directly. But we are happy if the country benefits.</li> </ul>
5	Vavyunia-Kebithigollewa 33 kV System (Gantry and Line)		<ul style="list-style-type: none"> <li>• Electricity is very important for development. Our villages developed because of electricity. Similarly, other villages too should develop. We have to support such projects, if support is requested.</li> <li>• When telecom towers were installed, people did not object for that. People want development coming into their villages.</li> </ul>

			<ul style="list-style-type: none"> <li>• Our settlements are on the other side of the proposed line. So it will not affect us. We have no problem if lines are running over the government forest</li> <li>• Should avoid any harm to our property</li> <li>• Lines should avoid Kunchuttuwa school. Because it is risky for children.</li> <li>• If lines are running over forests, it will not affect houses</li> <li>• This is a flat area. There will not be any landslides or soil erosion.</li> <li>• There are a number of forest reserves around our village.</li> <li>• Risks to birds' lives can increase with lines</li> <li>• If more trees are cut down for the project it can increase the dryness in the area.</li> <li>• If forests are cut to clear the way for electricity lines, it can affect our water resources. We do not like to see that happen.</li> <li>• We expect cash compensation for any losses</li> <li>• Good if people can find work in the project. Because many people here are poor.</li> <li>• Non-electrified villages/households will receive electricity.</li> <li>• Risks of losing our property</li> <li>• We will extend our support for the project if requested</li> <li>• The land identified for the construction of the proposed distribution gantry in Kabithigollawa belongs to a private party who is willing to sell the land in the open market. No major issue has been identified.</li> </ul>
6	Anuradhapura-Kahatagasdigiliya 33 kV System (Gantry and Line)		<ul style="list-style-type: none"> <li>• We like the project because it would provide electricity for non-electrified households/areas in the country.</li> <li>• If requested, we can support the project since it is of national importance. We do not oppose any development projects.</li> <li>• We have no objection to the project provided it compensates any losses to us.</li> <li>• Project should not be harmful to people's lives, property and livelihoods</li> <li>• The lines should be installed far away from the village without harming the houses and cultivations.</li> <li>• It will not affect the houses as lines run over at a considerable height. Good if the lines can go over the forest which is located little far away from the village.</li> <li>• If the lines run across the village, it can affect tall trees like coconut trees.</li> <li>• We would like to see that the project does not damage our forests and tanks.</li> <li>• If people can get employment in the project, it would be good. Most of the villagers are dependent on agriculture. They have work only for a particular period. Consider involving local labour for forest clearing, and masonry work.</li> <li>• Males in the village are engaged in agricultural activities and hence they may not have the time to get any employment in the project.</li> <li>• We do not think our people can get employment in the project. CEB does not recruit labourers from outside. Because our people do not have the necessary training for such work.</li> <li>• We do not think the project will affect our houses as it is planned to run over forests and tanks. Project will affect only the forest reserves. But we can't say how they would be affected.</li> </ul>

			<ul style="list-style-type: none"> <li>• As the proposed line runs over paddy fields, it will not affect our houses</li> <li>• Most of the lands cultivated by people are obtained on annual permits. They do not have permanent land titles. If this land is acquired for the project, people will not be entitled for compensation. We do not think that there will be land acquisition as the lines are running at a height. And we hope that such lines may not affect paddy and maize cultivations as the lines run above them.</li> <li>• Project will not cause soil erosion/ because it will lay only the polls/towers.</li> <li>• Our only fear is whether the risks of lightening will increase.</li> <li>• When there are too many lines, it can endanger the lives of birds. If that happens, migrant bird population would decrease.</li> <li>• There are migrant birds who come to this area because of the Heenna forest. Lines can affect their lives.</li> <li>• Trees will have to be cut down to clear the ROW. That would be a loss to all of us.</li> <li>• In previous projects lines were drawn across paddy fields. But we were not paid compensation. There was no program to create awareness.</li> <li>• We should be adequately compensated for our losses</li> <li>• We prefer to get alternate land within the village [more than cash compensation] for any loss of land.</li> <li>• If a tower is installed on a paddy field, we expect LKR100,000 as compensation. We have no problem if lines run over paddy fields.</li> <li>• We have no problem if the lines run over the cultivation fields. But we should be compensated if towers are installed on the fields. Because, we can get incomes from these land for several years. Thus the land is invaluable to us.</li> <li>• We may not get any direct benefits. But it would help other people like us.</li> <li>• May get temporary employment for our people. And un-electrified households will get electricity</li> <li>• Our land values will decrease. We may not be able cultivate what we want.</li> <li>• We have no objection to the project. We do not think the project needs any special support from us</li> <li>• Since we do not have adequate information about the project, we do not know how we can support it. But there will not be any major interruptions to the project from the community.</li> <li>• The land identified for the construction of the proposed distribution gantry in Kahatagasdigiliya is vested with Divisional Secretary. It is necessary that safety issues are reviewed before the final decision is made since this land is located adjoining the playground of a school.</li> </ul>
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7	Kiribathkumbura-Galaha gantry 33 kV System (Gantry and Line)	<ul style="list-style-type: none"> <li>•</li> </ul>	<ul style="list-style-type: none"> <li>• Our communities will support the project since they want to see an improvement to electricity supply in the country. Our country still cannot meet the electricity demand. We experience frequent power failures during rainy season and voltage drops in the evenings.</li> <li>• Electricity line should be installed over mountains so that they running over houses can be minimized.</li> <li>• Project should not install lines over/close to temples which are of historical and archaeological significance.</li> <li>• Lines should be installed at a height. Existing lines are running low and touch the tall trees resulting in regular fires.</li> <li>• Our villagers would be able to provide their manual labour during project construction. There are a lot of unemployed youth in this area. They may be able to find temporary employment.</li> <li>• There is no forest land in this area except for some pinus plantations of the Forest department.</li> <li>• There are no migrant birds in this area.</li> <li>• We are unable to say anything about the impacts of the project at this stage since we do not have adequate information. Perhaps it can affect people's land and cultivations. But we need to know exactly where the lines will be installed and the height at which they would be installed.</li> <li>• If lines run over our land, land values will go down and people may not be able to sell their land; people will not be able to construct any houses or plant tall trees under the ROW.</li> <li>• This is a hilly/mountainous area. If such hills/mountains are flattened due to project, can cause both soil erosion and landslides.</li> <li>• Project should ensure safety of people. Our people believe that living closer to electricity lines and towers can increase vulnerability to lightening.</li> <li>• If people lose any property or cultivations, compensation should be paid at market value.</li> <li>• CEB is in the process of negotiating with the Land Reform Commission to acquire a plot of land for the construction of the proposed distribution gantry in Galaha. Issues with regard to this land being part of a burial ground have been resolved with the relevant community.</li> </ul>
8	Akkirapaththu-Galmadu Junction-Pothuvil 33 kV System (Gantry and Line) .		<ul style="list-style-type: none"> <li>• The project will improve the electricity supply in the country and contribute to its development.</li> <li>• We will support the project if more information is given to us.</li> <li>• Project should avoid any harm to our houses and should not disturb our day to day lives</li> <li>• People in our area will be able to find employment during project construction and sell meals for workers</li> <li>• Do not think that the project will affect any residences/structures because lines mostly run over paddy fields and far away from settlements.</li> <li>• We cannot oppose installing towers on paddy fields because most of the land is state land encroached by people</li> <li>• There were no previous land acquisitions in this area and people were not paid compensation by previous projects for installing polls/towers on private land. We may not receive compensation because we live and cultivate encroached state land.</li> <li>• Forests are situated far away from our villages.</li> <li>• If polls/towers installed on paddy lands, it will reduce our cultivable area</li> </ul>

			<ul style="list-style-type: none"><li>• We may not be able to construct any structures under the ROW.</li><li>• If fruit trees are cut down, migrant birds will disappear; it can also affect people's incomes.</li><li>• A considerable number of coconut and mango trees will be affected.</li><li>• If several trees are cut down due to project, it can cause soil erosion and water resources may evaporate. Since this is a flat land, there will not be any landslides</li><li>• We do not see any direct benefit to our communities.</li><li>• Project will benefit the country as a whole.</li><li>• We will provide our labour if the project creates such opportunities to recruit village labour. We have enough labour because we are occupied in agricultural work only for a particular period.</li><li>• The two plots of land identified for the proposed Akkaripattu and Potuvil distribution gantries belong to the Fertilizer Corporation and Land Reform Commission respectively. CEB is in the process of negotiation with the two government agencies to acquire these lands.</li></ul>
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**Details of Participants (Public Consultations)**

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
1	New Anuradhapura-Vauvnia	8	Ukkulankulama	Ukkulankulama 588	Anuradhapura	North Central	0.2km	4.4.2012	9.45 a.m.	S. Chamila Harshani K. Kusumalatha S. Rupasinghe D. Karunaratne M.S. Devika Sandamali K.A. Swarna Jayasinghe P.B. Somawathi Pakkiyam
2	New Anuradhapura-Vauvnia	11	Ukkulankulama	Ukkulankulama 588	Anuradhapura	North Central	0.1km	4.4.2012	9.00 a.m.	K.H. Padmaseeli J.A. Harishchandra W.K. Gnnawathi Samandika Jayawardena Padmini Thilakaratne K.B. Jayawathi M. Gnanawathi S.G. Sriyani K. Ramani Jayanthi Ashoka Nimali Jayani Nisansala
3	New Anuradhapura-Vauvnia	3	Kovilpuddukkulam	Kovilkulam 244 C	Vauvnia	Northern	0.1 km	6.4.2012	9.30 a.m.	Priyangani Seneviratne K. Rengar K. Somachandran
4	New Anuradhapura-Vauvnia	3	Kuda Halmillewa	Kumbugollawa	Anuradhapura	North Central	0.5 km	4.4.2012	3.00 a.m.	Samantha Kumari G. Seetha S. Saman Kumara
5	Athurugiriya-Kolonnawa	2	Godallawatte Para	Malambe	Colombo	Western	0.1 km	28.4.2012	10.00 a.m.	Sunil Premawardhana K. Pathmasiri
6	Athurugiriya-Kolonnawa	3	Polkanaththawatte	Kadjugahawatte	Colombo	Western	0.1km	28.4.2012	2.00 p.m.	K.L.G. Premachandra G. Manoj A.K. Padmawathi

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
7	Kiribathkumbura-Galaha	9	Sarasavigama	Galoya	Kandy	Central	0.5km	21.3.2012	3.00 -4.00 p.m.	S.S. Chandrasekaram C.Pushparani N. Wasantha M. Raman Siththi Sifaya Mohamed Azad F. Safana Fahim H. Tikiri Banda M. Premawathi Menike
8	Kitibathkumbura-Galaha	9	Hendeniya	Hendeniya West	Kandy	Central	0.4km	21.3.2012	10.30 a.m.	S.A. Seetha Menika H.B.M.G. Nandana Gamini Kadangama H.M. Bisomenike T.A. Gihan Wijesinghe Kusum Iddawala Y.Panidhe Annakody B. Dhanasingham
9	Kiribathkumbura-Galaha	4	Nillamba, Palledelthota	Palledelthota (Doluwa DSD)	Kandy	Central	0.5km	22.3.2012	2.30 p.m	Rev. Madahapola Anuruddha Nimal Premajayantha V. Thygaraja Kavinda Gunawardena
10	Akkaripattu-Galmaduwa	4	Galmaduwa Junction	Galmaduwa	Ampara	Eastern	1km	24.3.2012	10.00 a.m.	R.M.S. Thilina R.M. Wijesinghe R. M.A. Wijesinghe M.K. Sisira
11	Vauvnia-Kabithigollawa	5	Kunchattuwa	Kunchattuwa Thulana - 26	Anuradhapura	North Central	0.5km	5.4.2012	10.00 a.m.	P.B. Basnayake K. Kamalawathi Wasana Abeysinghe Priyantha Kumara Sumith Nadeesh

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
12	New Anuradhapura-Kahatagasdigiliya	5	Wellaragama	Wellaragama - 580	Anuradhapura	North Central	0.5km	3.4.2012		Lalitha Kumari K. Sirisena Priyanka Priyadarshani Jagath
13	New Anuradhapura-Kahatagasdigiliya		Kasamaduwa	Kasamaduwa - 568	Anuradhapura	North Central	0.3km	3.4.2012	9.30 a.m.	K. Dayawansa D. Bandaramenike Sumanadasa Bandara
14	New Anuradhapura-Kahatagasdigiliya	2	Thihogama	Rathmale -199	Anuradhapura	North Central	500 meters	2.4.2012	3.30 p.m.	W. Abeywickrema Nimal Maithree
15	New Anuradhapura-Kahatagasdigiliya	7	Diganhalmillawa	Diganhalmillawa - 229	Anuradhapura	North Central	0.5km	2.4.2012	9.45 a.m.	H.B.A. Rathnayake H.B.A Jayasena Shyama Kumari D.B.P. Menike K. Gunawardanage L.G. Shantha P. Anula
16	New Anuradhapura-Kahatagasdigiliya	6	Digan Halmillawewa	Digan Halmillawewa - 229	Anuradhapura	North Central	0.5km	2.4.2012	11.00 a.m.	Jayasinghe G. Illangasinghe R.M.K. Dayarathne P.B. Nandawathi S. Abeypala T.B. Gunadasa
17	New Anuradhapura-Kahatagasdigiliya	6	Kasamaduwa	Kasamaduwa -568	Anuradhapura	North Central	0.5km	3.4.2012	10.30 a.m.	K.B. Pemawathi Chamila Gayani Darshana Kumara J.M. Podimenike J.M. Karunaratne D.M. Bisomenike

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
18	Vauvnia - Mannar	6	Kattaladama	Madhu -128	Mannar	Northern	0.5km	7.4.2012	2.15 p.m.	Sebastiyamma A. Jude Punitharaja P. Tharseelamma P. Sinnathurai S. Robinson T. Selvam
19	Vauvnia-Mannar	3	Poomalandan Madhu Road	MN 130 Poomalandan	Mannar	Northern	0.5km	8.4.2012	11.00 a.m.	R. M. Sriyani K.P. Prabath Anuradha K.H. Priyanthi
20	Padukka- Athurugiriya	5	Pathumpura, Homagama	Ambilladeniya	Colombo	Western	0.3km	27.4.2012	10.00 a.m.	Karunasekera Sriyalatha Wijesinghe G.K.C.T. Alwis P. Nishani
21	Pannipitiya-Polpitiya	15	Thunnana	Thunnana – 444 B	Colombo	Western	0.75km	19.3.2012	9.00 a.m.	E.P. Sumanasinghe Nalini Heenatigala R.P. Dayaseeli Sriyani Ediriweera Sachini Ayesha Padmini Weerasinghe M.Chandarwathi R.P. Anura K.A. Chameer Kasun H.A. Chandra Sriyani Ediriweera P.S. Warnakulasooriya M.A.J. Udayakumara M.A.J. Udayakumara H.M.J. Niroshan
22	Pannipitiya – Polpitiya	3	Gonagamuwa	Gonagamuwa	Kegalle	Sabaragamuw a	0.5km	20.3.2012	2.00 p.m.	K.L. Somaweera D.S.N. Lankathilake K.L.Sirisena

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
23	Polpitiya – New Polpitiya	11	Batakiththa	Kalukohutenne	Kegale	Sabaragamuw a	0.5km	20.3.2012	4.30 p.m.	M.L. Ruwan Chaminda U.B. Sriyani Chandralatha I. Nilmini K.A.D. Anne Mangalika K.L. Susila Indrani Biyagama M.K. Gunapla Y.D. Chaminda G.R. Ranatunga K. Saroja Kumar S. Somaratne
24	Pannipitiya-Polpitiya	12	Kamburapola	Kamburapola	Kegalle	Sabaragamuw a	0.5km	19.3.2012	4.00 p.m.	M.A. Indrani Seetha Ranjani w. Hemalatha Amanjali M.A.J. Udekumara M.A.A. Somali K.G. Aberathne K.G.G. Karunaratne Ratnaweera Silva Jayalatha Menike R.S. Wickremasinghe Kamal Kumara
25	Pannipitiya-Polpitiya	6	Kundaluwila	Kundaluwila	Colombo	Westren	0.5km	19.3.2012	10.00 a.m.	T.I.R. Pradeep M.H. Weerawardena H. Premasiri Silva M.A. Dirukshi M.W. Gamini W.N. Asilin Nona

SN o	Name of the Component /Site	Number of Participants	Name of the Village	Name of the Gramasevaka Division	Name of the District	Name of the Province	Distance from the Project Location	Date	Time	Names of the Participants
26	Polpitiya_New Polpitiya site	8	Klaugohutenna	Yatiantota	Kegalla	Sabaragamuwa	0.5km	20.3.2012		E.S. Ediriweera K.L. Sirisena M.G. Sumanawathi G.R.Karunaratne U.V. Kusumawathi G.R.S.Chandima G.R. Wilbat D.T.Damayanthi
27	Akkariapattu- Potuvil	5	Inspector Eethan	Potuvil 10	Ampara	Eastern	0.5km	25-03-2012	10.00-11.30 a.m	S.Sithrangane T. Nirmala S.L.Utumanlebbe T. Rajeshwaree M. Murugesan
28	Thulhiriya-Kegalla	8	Thulhiriya	Thulhiriya -82A	Kegalle	Sabaragamuwa	0.1km	21.2.2012	9.00 a.m.	L.P. Yasohamy M.A. Sriyani
29	Vauvnia-Mannar	14	Kannatikanesapuram	Periyakattu	Vauvnia	Northern	0.4km	8.4.2012	11.30 a.m.	V.Jesudas J.Rajeswary K. Sellamma G. Mangayarkarasi S. Saraswathi S. Sivapakyam S. Letchchami M. Rajkumar K. Chandra Velu Sivakimar T.Pushparani P.Subakaran S. Udaya Chandran K. Elangeswari



### Details of gender consultations and findings

	ISSUES DISCUSSED	WOMEN'S VIEWS AND PERCEPTIONS
	<b>General</b>	
1	"Where do you live and how long have you lived there?"	A majority of women reported that they have been living in their respective villages since birth. And that their forefathers too had been living in the same village. However, there were other women who have migrated to the current place of residence after their marriages. In urban areas, a majority of the families were migrants from other areas who bought land and settled down.
2	"What do you like most about living in this area?"	Several women reported that they preferred living in their respective villages because they were the natural environments in which they were brought up since birth. Many women also felt safe and comfortable to live in their villages because they had their kinsmen too living in the same villages. Women in some communities, particularly those located closer to urban areas mentioned that their villages are conducive for living since they have easy access to several facilities such as employment opportunities, schools, transportation, water, electricity, health facilities, market centres etc. Some admired their villages because the area is free of communicable diseases such as dengue and natural hazards like landslides. In some communities, women mentioned that they were compelled to live in their settlements despite scarcity of water, inability to cultivate twice a year, population congestion (in a shanty) since they did not have the resources to move into a better place of living.
3	Their primary occupations?	Seasonal paddy and highland cultivations were the main source of livelihood of the dry zone rural communities consulted. Both men and women were also engaged in casual labour work during off-seasons. In the dry zone districts of Anuradhapura, Ampara and Mannar, labour work was found in paddy fields or in highland cultivations. In the wet zone districts of Kandy, Colombo, Galle and Kegalle, labour work was available in tea or rubber plantations and factories. Tea or rubber smallholdings were the source of livelihood for some families in the wet zone. A substantial number of female youth in all the communities was employed in the garment factories. A similar proportion of male youth has joined the armed services. In the urban/semi-urban settlements, a majority of both men and women were employed in the private and government sector. In low-income shanty dwellings in Colombo men mostly depended on casual labour work or petty-businesses while women worked as domestic servants or sanitary workers in government or private sector institutions.
4	How you spend your time (daily routine)? (Try to probe whether they get leisure time and what are the activities they usually do during the leisure hours.	In several communities, apart from their engagements in casual labour work several women remained as housewives. However they were not confined to household activities alone. A majority of women particularly in the dry zone villages worked in their family farms along with their husbands. Preparation of meals, accompanying children to their schools, supervising studies, washing and cleaning were the other activities performed by non-employed women. Working women from urban areas reported that they had very little free time as they had to attend to several household activities after returning from work. However, women reported that they would watch TV, chat with neighbours or do home gardening when they do not have specific activity to engage in.
	<b>Education:</b>	
5	Opinion on the importance of education for the people and specifically of the girls and women in your area.	In almost all the communities, women recognized the importance of providing equal education for both girls and boys. It was considered a right of the children to receive education. They observed that attaining higher education helps the girls to find a good job; enter into good marriage; gain a better understanding of the affairs of the society; establish her social esteem and recognition; better manage the household matters; and bring up her own children. When boys did not pursue education they have several other options like labour work, joining armed forces etc. But girls cannot engage in such activities. Therefore, it is essential that girls pursue education.

6	Educational level of community people in your locality/area.	The literacy levels in the communities consulted were substantially high. However, educational levels among the older generation were comparatively low. In some communities, there were illiterate people as well as those who have studied only upto primary level. The present generation, both men and women has attained a higher level of education and they had at least completed 10 years of schooling. 20-30 percent of the children pursued higher education and beyond GCE OL. In a majority of the villages there were people who have pursued university education. Education levels in urban/semi-urban areas were comparatively high than in rural areas. Women also observed that girls reached a higher level of education compared to the boys.
7	Types of education facilities (formal and non formal education, its distance) available in the village / neighbourhood and parent's perception on quality of education (pre-school, primary, elementary and secondary/higher secondary). Try to know access and services to the girls.	In general, all the communities had access to government schools. In urban/semi-urban areas, communities had multiple options for educational institutes as there were several government and private schools [e.g. international schools] which they could access. In all the communities, children could reach a school within a maximum range of 05Km. However, transport difficulties were reported from dry zone rural communities as they did not have a regular public transport service. When the nearest schools did not have facilities for secondary education, children who pursued higher education had to enter schools in the cities. In such situations, children were boarded in cities as they could not travel long distances daily. Almost all the villages had pre-schools. Lack of teachers and their high turn-out was reported from both dry zone villages and former conflict affected communities. Private tuition classes were located in the cities and families who could afford sent their children to these classes.
8	Reasons for non-enrolment and dropout amongst children & youth. (Male & Female)	School drop-out rate was comparatively low and almost all the children pursued at least 10 years of schooling. Of them, about 20% to 30% pursued higher education. One of the reasons for dropping out was the financial difficulties of the families. Poor families who were dependent on seasonal agriculture or labour work could not support their children to pursue higher education. Boys who saw several options [compared to girls] for them to engage in income generating activities such as labour work, trading, joining armed services etc. abandoned their studies and found employment. It was reported that drop-out rate among boys was higher than the girls. And boys hardly listened to their parents' advice. Another major reason for dropping out was the love affairs and teenage marriages, the latter being reasonably high in the dry zone communities. Addiction to alcohol and cannabis was another reason for early drop-out. In Muslim communities girls were given in early marriage and therefore they did not have much interest to pursue education. Cases of non-enrolment of children in education were hardly reported.
9	Type of engagement of children in household activities (try to know about the girls) for the (type) and extent to which they directly contribute to the earning of the household (type of occupations engaged in).	Children would help in the family farms during cultivation and harvesting periods. Some would not go to schools during such periods as the demand for family labour is quite high. It was only in the Galle district that reported children engaging in plucking tea and earning LKR350/- a day. In general, engagement of children in income earning activities was low. At household level, children [particularly the girls] helped their mothers in cooking, firewood collection, and cleaning. Girls prepared dinner when parents returned home late after work in their family farms or labour work. Boys would go to the village grocery shops to buy household needs. Parents did not want to burden the children with additional work because they wanted to ensure that children devoted their time productively for studies.
<b>Vocational Education:</b>		
10	Existing skills and traditional skills amongst the adolescent girls and women that must be revived /encouraged. (Try to probe the skills those are economically productive for the women).	It was only in one community around Polpitiya that women were traditionally engaged in juggery-making. None of the other women's groups reported having any traditional or specific skills among women and girls in their communities. Apart from a few women who engaged in dress-making, cake making, bridal dressing, etc. most of the women remained as housewives and unemployed. Others worked as labourers or were employed in the formal sector jobs. Several girls were employed in the garment factories.

11	What are the barriers in terms of resources, availability, transport, locations of trainings if any, for pursuing vocational courses by women of your community? Also probe for the barriers from the family side, (like lack of time, etc)	In the dry zone communities, people have hardly recognized the value of pursuing vocational training. Nor were they aware of the existence of such vocational training programs or the related agencies. Apart from dress-making and beauty culture courses, none of the women's groups could even mention the names of prospective vocational training programs that would help them to find a source of livelihood. One of the reasons was that government sponsored vocational training programs were located in major cities and people from remote villages hardly received information about the availability of those facilities. Financial difficulties in the families and poor transport facilities also restrained girls pursuing vocational training courses. Married women from rural areas found difficult to attend vocational trainings because of their household responsibilities. Women's groups from former conflict affected areas such as Mannar and Ampara reported that they would not be able to find adequate markets for their products even they followed vocational training and invested in some cottage industries. Some women pointed to the difficulties in getting necessary raw materials. Others mentioned the difficulties in finding employment even one received vocational training. In urban/semi-urban areas, women had better access to vocational training programs managed by both government and private sector agencies. But the women's groups consulted could not give information about whether women/girls in their settlements have followed vocational trainings as they had very little social interaction with each other. However, some women mentioned that training in computers, handicraft making, food preparation etc. would help young girls to initiate some income generating activities. But they should be provided with financial support to initiate such activities.
12	Is there any organization, government, private or NGO running any vocational courses for the adolescents and women in area. (Probe for the agencies, nature of vocational trades providing, women's participation and livelihood opportunities).	NGOs such as World Vision and Don Bosco have been conducting vocational training programs in food preparation, bakery, carpentry, masonry, welding, English and IT in some of the dry zone communities and former conflict affected communities. The government sponsored <i>gama naguma</i> program conducted training in cakes and sweets making for girls. Apart from that there were not many agencies that ran vocational training programs in the villages.
	<b>Economic Activities:</b>	
13	Do the women of the households in the community have ownerships of the property in the community, like houses, land, etc. probe for the reasons for having or not having ownership rights.	Customarily, ownership of the physical assets such as land, houses etc. vested with men. Because it was the men who earned money to buy such assets. However, if a woman had inherited property from her parents or given away as part of her dowry, ownership of such property remained with women. Also, in the case of female headed households, ownership rights vested with women but she gradually transferred the rights to her children once they grew up.
14	Please tell us what are the nature of jobs mainly performed by the women of your community? (Try to probe for besides household work their engagement in government / private sectors, small scale business, agriculture, animal husbandry).	A majority of women particularly in rural communities remained as housewives. But they would help their husbands in the family farms [paddy/highland cultivations or tea/rubber smallholdings]. Or else, they would engage in labour work available during paddy cultivations, or in tea/rubber plantations and their factories. Several girls in the communities were employed in the garment factories. Women employed in the government sector jobs were rather low in the dry zone communities. In urban settings, several women were employed in formal jobs in the government and private sector. In shanty dwellings or low income families, women worked as domestic workers or sanitary workers. Self employed women were a few in all the villages and the type of income generating activities they conducted included dress-making, food preparation, and manufacturing <i>papadam</i> and jostics.

15	Referring to the group ask if there is any form of inequality in the receipt of wages, payments, rewards, etc for the work that the women perform. (Try to understand the nature of inequalities prevailing). What are the underlying factors for this prevalence of inequalities?	In the formal sector employment, women hardly observed a disparity in the wages paid to men and women. However, in the informal sector such as casual labour work, there was a significant difference in the daily wages paid for men and women. Women were paid less and the difference ranged between LKR100/- to LKR300/-. Some women did not know as to why such a difference existed though both groups performed similar work. And in some cases it was reported that women worked harder than men. However, there were several other reasons given to explain why the men were paid a higher remuneration. In some situations, women were made to understand [by those who hired their services] that men performed more hard work and at a higher speed whereas work assigned to women was less hard; in some situations, women concluded their work around 6.00 p.m. while men continued to work until late night; in some situations it was reported that men would not come for work if they were not paid a higher wage.
16	Are the woman who are working and earning have the ultimate decision on the use of their money? (Try to probe the pattern of using the money earned, part saved, used for them, etc.)	In general, women had the freedom to decide on how they would spend their earnings. Several women's groups reported that however they would consult their husbands if a need arises as to how they should spend their money. Most women reported that their earnings were spent on household consumption or else to buy some durable household goods.
	<b>Decision Making &amp; community Participation</b>	
17	What role do the women of the household have in the decision making process of the household? Do you feel you have equal share along with the male counterpart any household decisions? Does it vary among the earning and non earning women? (How).	Responses varied in different contexts. In rural settings, women extensively relied on decisions taken by husbands on important matters and they adhered to such decisions willingly. Priority was given to husbands to make major household decisions such as matters related to education or marriage of children. Yet in some situations, women made decisions with regard to children's education whereas men took the lead in decisions on children's marriages. Women believed that men have a wider social knowledge than women to consider several factors before decisions were made. And they trusted that their husbands would never make decisions harmful to the family. However, in practice, women reported that most husbands consulted their wives before decisions were made or else the decisions were made jointly. In urban settings, joint decision-making was reported as the norm. In matters related to day to day household management, decision-making was largely the responsibility of women in both urban and rural settings. Women whose husbands were working in the armed forces and returned home only once a month had to shoulder a bigger responsibility in the management of household affairs in the absence of their husbands. Women groups also observed that such decision-making patterns have no connection with whether a woman was earning or not earning. However, they believed that earning women may draw more recognition and respect from their husbands compared to non-earning women in the decision-making processes. In situations where husbands were frequent alcohol users, women found very little space for them to enter into decision-making processes. Decisions, whether good or bad were taken by husbands. In Muslim families, decision-making rights largely rested with men. It was reported that around 10% of the families, males dominated the decision-making processes.
18	Is there any community based organization (like NGO's, SHGs, etc) for the women of your community? If yes, probe what are the activities those organizations are performing, what is the role of the women, is there any positions that they possess, like president, secretary, etc).	Except in a few communities where there were women's rural development societies, there were hardly any community based organizations that exclusively operated for women. Women participated in funeral aid societies, samurdhi societies, farmer societies and rural development societies, <i>gama naguma</i> societies along with men. However, women's participation in these CBOs was higher than the men as the latter did not find much time to attend the meetings etc. Men however supported the activities initiated by CBOs. Activities conducted by CBOs included savings and credit programs, <i>shramadanas</i> to clean roads and temples, irrigation management, community welfare programs, extending financial support for families in funerals etc. Though men held the executive positions of these CBOs, a few instances of women holding positions too were reported. Except for samurdhi societies which are government supported and funeral aid societies, not many CBOs performed a vibrant role in their communities.

19	Do the women of your community are members of any political bodies, like Pradeshiya Sabhas, Provincial Councils etc. what role actually played by them in terms of their involvement and participation. Also probe what prevent women from engaging in political process.	Except in one single community where a woman contested a Pradehiya Sabha election and won a seat, women hardly engaged in active politics. Their political participation was limited to voting and occasionally to political campaigns. Household obligations, lack of financial resources and their inability to face political violence and threats were reported as reasons for non-participation of women in active politics. Some women were of the opinion that engagement in politics is not culturally appropriate for women. The minority ethnic communities who lived among majority Sinhalese communities thought that they would not be able to get adequate votes from the majority Sinhalese even they tried to enter politics.
	<b>Health</b>	
20	General health facilities available and the perceived satisfaction on the quality of services (government and private) & affordability	In general, women consulted expressed satisfaction on the available health facilities and the services provided. They all had easy access to both government and private medical services. Both medical staff and drugs were adequately available in the government hospitals. Women were more dependent on medical services provided by government hospitals. Family health workers [midwives] made regular home visits and maternal and child care clinics had been held regularly in places convenient to women. In contrary, some communities complained of poor health services, lack of drugs and doctors. In urban areas, people were more dependent on private medical services mainly for its convenience and efficiency.
21	Types of commonly prevalent diseases among the community, is there any specific ailments affecting the women of your community? Probe for the problems and the facilities available for the treatment.	Except in some communities in the Anuradhapura district where high incidence of kidney ailments are reported and attributed to high salinity in drinking water, no major diseases were reported. However, incidence of high blood pressure and diabetics among both men and women were reported.
	<b>Social and Physical Security</b>	
22	Do the women feel safe in going outside in the neighbourhood during day time? Also probe for the situation during the night time? What are the problems or fears they perceived for their movements?	None of the women's groups reported any fears of moving out either day time or night. They felt safe walking around the village as people were known to each other. Women also did not see any need for them to go out in the nights unless a special need arises such as taking a patient to the hospital. In such situations, women were always accompanied by men. In the dry zone villages, both men and women would not go out in the nights because of the fear of threats from wild elephants.
23	Do the women in the community face any kind of domestic violence at their home? If yes probe for the reasons.	Incidence of domestic violence was prevalent in households where men were frequent alcohol users. But the number of such families was only a few. In such families, there would be fights between family members when alcoholic husbands return home. However, women reported that hardly such incidents escalate to unmanageable levels. Also, since violence within families was exclusively a private matter, they hardly come to the notice of public domain.
24	Is the system of dowry is prevalent among your community. Do the women of your community feel insecure for getting their girls married due to the	Dowry was not seen as a major constraint for marriage in the Sinhalese communities. Some people may insist on dowries while others not. Parents would give away what they could afford to when girls get married. They can be in the form of land, house, jewellery, household goods or cash. Or else, working girls would buy and collect jewellery and household goods and take them away after marriage. Working girls have a higher demand for matrimony than non-working girls. Even the families did not have any assets to give as dowry, it was no

reasons of dowry? What are the problems and challenges they perceive for this system?	longer a major barrier for a girl to enter marriage. In love marriages, dowry was not an issue at all. In Tamil and Muslim communities, dowry was still a major issue in marriage. In such communities, a woman who goes away with a man without a dowry would be subjected to physical harassment particularly when husbands were drunk. Women would be physically and/or verbally harassed for not bringing any dowry with her.
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### List of participants (Gender consultations)

Sl No	Village/Location	Date	Number of Participants	Names of the participants (Women)
1	Kovilpudukkulam [New Anuradhapura-Vauniya site]	06/04/2012	05	<ul style="list-style-type: none"> <li>• V. Idayarani</li> <li>• R. Muththulechchami</li> <li>• Kangeswari</li> <li>• C. Mageswary</li> <li>• N. Kaneshwari</li> </ul>
2	Ukkulankulama- Mihinthale [New Anuradhapura-Vauvnia]	04/04/ 2012	04	<ul style="list-style-type: none"> <li>• G.V.S. Jayathilake- farming</li> <li>• G.Podimanike- housewife</li> <li>• S.I. Amitha KUmari– student</li> <li>• S. Anojayani- student</li> </ul>
3	Ukkulankulama/Mihintale [Anuradapura –Vauniya site]	04/04/ 2012	03	<ul style="list-style-type: none"> <li>• Maheshi Lakshika – housewife</li> <li>• Priyani Baggiya – student</li> <li>• Kavindi Rasadya _ student</li> </ul>
4	Singhapura, Kolonnawa [Athurugiriya-Kolonnawa site]	28.4.2012	05	<ul style="list-style-type: none"> <li>• D. Nadeeka</li> <li>• Upendra</li> <li>• Chandralatha</li> <li>• Piyaseeli Jayalath</li> <li>• Shantha Sumanasiri</li> </ul>
5	Godallawatte Para (Malambe)	28.4.2012	03	<ul style="list-style-type: none"> <li>• K. Ranjani – Housewife</li> <li>• Chathuri Manori – Housewife</li> <li>• J. samanthi – Housewife</li> </ul>
6	Sinhapura, Kolonnawa [Athurugiriya-Kolonnawa site]	28.4.2012	06	<ul style="list-style-type: none"> <li>• Hansika T. Withana</li> <li>• W.D.R. Wasantha</li> <li>• H.P.S. Rukshani</li> <li>• H.P. Niluka</li> <li>• K.A.D.C. Baginona</li> <li>• K.A.D. Piyaseeli</li> </ul>
7	Samadiya village [Galaha / Kiribathkumbura site]	22/03/ 2012	03	<ul style="list-style-type: none"> <li>• P. Sivagannam – housewife</li> <li>• Shakila Fernando – housewife</li> <li>• Swarnalatha Silva – housewife</li> </ul>

SI No	Village/Location	Date	Number of Participants	Names of the participants (Women)
8	Halwattha [Galaha – Kiribathkumbura site]	22/03/2012	05	<ul style="list-style-type: none"> <li>• Sinnaiya Rai_ housewife</li> <li>• Muthu Arumugan_ housewife</li> <li>• Pathma Kumari Herath_ Housewife</li> <li>• K . Yogammalan_ Housewife</li> <li>• R. Lechchami</li> </ul>
9	Grama Paha - Damana [Galmaduwa- Akkarapattu ]	24/03/2012		
10	Kunchuttuwa [Kebethigollawa- Vauniya site]	05/04/2012	02	<ul style="list-style-type: none"> <li>• D.M.A Indrani – housewife</li> <li>• M. Hansamali- student</li> </ul>
11	Kunchuttuwa [Vauniya – Kebethigollawa site]	06/04/ 2012	08	<ul style="list-style-type: none"> <li>• K. Kamani</li> <li>• V.B. Dayawathi</li> <li>• C.R.Kusuma Rajapaksha</li> <li>• S.Anulawathi- retired grama niladari</li> <li>• B. Mallika- labour</li> <li>• Nishani Siriyalatha</li> <li>• Malani Jayalath- school teacher</li> <li>• P.A. Pemawathi- housewife</li> </ul>
12	Kasamaduwa [New Anuradhapura – Kahatagasdigiliya]		09	<ul style="list-style-type: none"> <li>• Renuka Deshapriya- housewife</li> <li>• D. Damayanthi Wimalasena- housewife</li> <li>• R.M Chandra Damayanthi- housewife</li> <li>• S. P. Ramyalatha- housewife</li> <li>• Dilini Ishara- Farmer</li> <li>• J. Sumenda Latha- housewife</li> <li>• P.V. Lapina- housewife</li> <li>• Kusumawathi- housewife</li> <li>• D.M. Podimanika- housewife</li> </ul>
13	Diganhalmillewa, Manelpura village [New Anuradhapura – Kahatagasdigiliya site]	04/04/ 2012	05	<ul style="list-style-type: none"> <li>• H.M. Thamara Kumari Herath</li> <li>• U.B. Leelawathi- housewife</li> <li>• S. Premawathi- housewife</li> <li>• A,Geetha- businessmen</li> <li>• Susila Kumari- housewife</li> </ul>
14	AkkaraPanaha, Nelumkanniya [New Anuradhapura-Kahatgasdigiliya site]	03/04/2012	03	<ul style="list-style-type: none"> <li>• S. Seelawathi- housewife</li> <li>• Nayana Kumari- unemployed</li> <li>• Punya- housewife</li> </ul>
15	Diganhalmillawa [New Anuradhapura – kahatagasdigiliya site]	02/04/2012	06	<ul style="list-style-type: none"> <li>• Sriyani Mangalika</li> <li>• Shanush Randika</li> <li>• A.M.Pemawathi.</li> </ul>

SI No	Village/Location	Date	Number of Participants	Names of the participants (Women)
				<ul style="list-style-type: none"> <li>• J.M.Jinadasa.</li> <li>• D.Samarathunga</li> <li>• Samaranayake</li> </ul>
16	Poomalanthan [Vauvnia-Mannar site]	08/ 04/ 2012	02	<ul style="list-style-type: none"> <li>• K. Elangeswarai</li> <li>• E. Anuradha</li> </ul>
17	Gonagamuwa [Polpitiya-New Polpitiya]	20.3.2012	02	<ul style="list-style-type: none"> <li>• C.T.J.Perera – Housewife</li> <li>• H.A.S. Perera – Housewife</li> </ul>
18	Universal Park, Oruwela [Padukka-Athurugiriya]	27.4.2012	05	<ul style="list-style-type: none"> <li>• W.A. Somapala</li> <li>• W.S.T. Ariyawansa</li> <li>• B.G. Sujeewa</li> <li>• T.G. Malini</li> <li>• P.D. Srimathi Padmalatha</li> </ul>
19	Puwakgahadeniya, Ambilladeniya [Padukka-Athurugiriya]	27.4.2012	05	<ul style="list-style-type: none"> <li>• S. Mallawarachchi</li> <li>• C. Hewage (dress-maker)</li> <li>• K. Lilinona</li> <li>• W. Ajantha</li> <li>• J.M.T. Semali (hospital attendant)</li> </ul>
20	Waknda Road –Homagama [Pannipitiya-Polpitiya site]	18 / 03/ 2012	06	<ul style="list-style-type: none"> <li>• G.P Somalatha _ Business</li> <li>• H.P. Lalitha_ Housewife</li> <li>• Tanuja Gunawardana_ Housewife</li> <li>• B.A.Pushpa. Gunawardana_ Housewife</li> <li>• G. Kusumawathi - Housewife</li> <li>• G.Sitha Sumanasili – Housewife</li> </ul>
21	Thunnana [Pannipitiya - Polpitiya site]	19/03/2012	04	<ul style="list-style-type: none"> <li>• K.L.G.Pathma _housewife</li> <li>• S.Ediruweera_ housewife</li> <li>• 24K.C.Perera_ housewife</li> <li>• W.25 Padmini_ housewife</li> </ul>
22	Wekanda Road [Pannipitiya-New Polpitiya site]	18/03/2012	06	<ul style="list-style-type: none"> <li>• R.M.S.M. Rajapaksha</li> <li>• Deepika Malkanthi</li> <li>• R.Simonona</li> <li>• A.N.W.Arangala</li> <li>• Karunalatha Arangala</li> <li>• A.D.Suneetha</li> </ul>
23	Gonagamuwa [Polpitiya-New Polpitiya site]	20/03/2012	04	<ul style="list-style-type: none"> <li>• M.G. Karunawathi- housewife</li> <li>• M.L.Sunethra - housewife</li> <li>• Kusumawathi - housewife</li> </ul>



SI No	Village/Location	Date	Number of Participants	Names of the participants (Women)
24	Inspector Echchan -Thannikulam [Akkaraipattu -Potuvil]	25/03/2012	04	<ul style="list-style-type: none"> <li>• W.D. Pushpa – housewife &amp; pensioner</li> <li>• Anoma Priyadarshani- housewife</li> <li>• K.P Anoma Gunawardana – housewife</li> <li>• K.L Chaturika Gunawardhana _ housewife</li> <li>• Nirmala Ihalagama _ housewife</li> </ul>
25	Hathnagoda, Galigamuwa DSD [Thulhiriya-Kegalle site]	21.3.2012	07	<ul style="list-style-type: none"> <li>• H.M.K. Jayalatha</li> <li>• R.A.A. Gunathilake</li> <li>• R.M. Somapala</li> <li>• L.P.A. Leelawathi</li> <li>• R.M.H.G. Rathnayake</li> <li>• H.P.R.P. Hettiarachchi</li> <li>• R.A.K. Rajamathri</li> </ul>
26	Dewalagama [Thulhiriya-Kegalle site]	21.3.2012	05	<ul style="list-style-type: none"> <li>• R.G.M.P.Karunaratne</li> <li>• M.A. Malkanthi</li> <li>• G.R. Podimenika</li> <li>• B. A.Pemawathi</li> <li>• S.A.P.Samaeaweera</li> </ul>

## Annexure 4: Brief overview on relevant policies

### 1 LAND ACQUISITION ACT 1950 ALONG WITH AMENDMENTS BY 2009

1. The law governing acquisition of land for public purposes is the Land Acquisition Act (LAA), enacted in 1950 and which has been the subject of several amendments and revisions. LAA provides the legal basis to acquire land, if required for any project including in the electricity sector. The LAA sets out the procedures for acquiring land and for payment of compensation for acquired land.
2. A notice is issued specifying that land is potentially required for a public purpose, and this permits authorised personnel to undertake investigations (surveys, boreholes, and setting out of boundaries etc) to determine suitability. If the land is deemed suitable for the public purpose a written declaration to that effect is made, and notices are issued describing the land, the intention to acquire the land, and requiring that persons with an interest in the land notify (in writing) the acquiring officer of their claim (including the expected amount of compensation)<sup>29</sup>.
3. The acquiring officer then holds an inquiry into the market value of the land, the claims for compensation, and the respective interests of the claimants, as well as any other related matters. At the conclusion of the inquiry the acquiring officer either makes a decision on the claims or refers the claims to the District Court or Primary Court.
4. Following the decision (either by the acquiring officer or the courts), the acquiring officer makes an award determining the persons who are entitled to compensation, the total amount of compensation deemed to be allowed for the acquisition, and the apportionment of the compensation between the persons with interest in the land. In the event of a dispute over the determination, it may be appealed to either Land Acquisition Board of Review (LABR) or Court of Appeal (on questions of law following a decision by LABR), provided that the appeal is lodged within 21 days of receipt of notification of the award.
5. Provided that there are no appeals, the compensation is paid (the LAA allows for an initial payment and the remainder to be paid in instalments). If the person with an interest in the land has agreed to a land exchange in lieu of cash, the transfer is put into effect at this time. After the awards are made the Minister publishes or gazettes a “vesting order” for the possession of the land, after which time occupants of any buildings located on the land to be vested are given notice to vacate.

### 2 NATIONAL INVOLUNTARY RESETTLEMENT POLICY 2001 (NIRP)

6. To ensure that people affected by development projects are treated in a fair and equitable manner, and that they are not impoverished in the process, GoSL has adopted National Involuntary resettlement Policy (NIRP) in 2001. This policy would establish the framework for project planning and implementation. Subsequently, it will be necessary to prepare guidelines on resettlement planning and implementation to be used by the PEA. In the past, project related resettlement of Sri Lanka has been guided by Land Acquisition Act of 1950, as amended from time to time. However, as it did not have adequate provisions for full social and economic rehabilitation of the people to be resettled, Sri Lanka has adopted NIRP. The policy assigns the overall responsibility of its implementation to the Ministry of Land Development, with the project approving agencies and the Central Environmental Authority too being assigned responsibilities of evaluation and implementation. In addition to the NIRP, a cabinet decision has been adopted in 2006, (as amended in 2007) specifically for the payment of compensation for families affected by land acquisition for power sector development projects and works connected with electrical undertakings. As stated earlier, no involuntary resettlement is foreseen in this project. However in case any involuntary resettlement becomes unavoidable, compensation would be paid in accordance with the NIRP and Land Acquisition and

<sup>29</sup> The acquiring officer can also request any person with an interest in the land to deliver a statement setting out the names and addresses of every other person with any form of interest (whole or partial) in the land.

## Compensation Regulations of 2008

7. The policy will apply to all development-induced land acquisition or recovery of possession by the State. A comprehensive Resettlement Action Plan will be required where 20 or more families are affected and if less than 20 families are affected the policy still applies but a plan can be prepared to a lesser level of detail. The policy will apply to all projects regardless of source of funding and. The policy will apply to all projects in the planning phase on the date this policy comes into effect, and all future projects. Some of the basic objectives of the NIRP are to (i) avoid, minimise and mitigate negative impacts of involuntary resettlement by facilitating the reestablishment of the affected people on a productive and self-sustaining basis. The policy should also facilitate the development of the project-affected people and the project; (ii) to ensure that people adversely affected by development projects are fully and promptly compensated and successfully resettled and the livelihoods of the displaced persons should be re-established and the standard of living improved; (iii) ensure that no impoverishment of people shall result as a consequence of compulsory land acquisition for development purposes by the State, (iv) to assist adversely affected people in dealing with the psychological, cultural, social and other stresses caused by compulsory land acquisition; (v) to make all affected people aware of processes available for the redress of grievances that are easily accessible and immediately responsive, (vi) to have in place a consultative, transparent and accountable involuntary resettlement process with a time frame agreed to by the PEA and the affected people.

8. The broad principles of the NIRP are as follows:

- Involuntary resettlement should be avoided or reduced as much as possible by reviewing alternatives to the project as well as alternatives within the project.
- Where involuntary resettlement is unavoidable, affected people should be assisted to re-establish themselves and improve their quality of life.
- Gender equality and equity should be ensured and adhered to throughout the policy.
- Affected persons should be fully involved in the selection of relocation sites livelihood compensation and development options at the earliest opportunity
- Replacement land should be an option for compensation in the case of loss of land; in the absence of replacement land cash compensation should be an option for all affected persons
- Compensation for loss of land, structures, other assets and income should be based on full replacement cost and should be paid promptly. This should include transaction costs.
- Resettlement should be planned and implemented with full participation of the provincial and local authorities.
- To assist those affected to be economically and socially integrated into the host communities, participatory measures should be designed and implemented.
- Common property resources and community and public services should be provided to affected people.
- Resettlement should be planned as a development activity for the affected people.
- Affected persons who do not have documented title to land should receive fair and just treatment.
- Vulnerable groups should be identified and given appropriate assistance to substantially improve their living standards.
- Project Executing Agencies should bear the full costs of compensation and resettlement.

## 3 ADB'S SAFEGUARD POLICY STATEMENT, 2009 (SPS)

9. ADB has adopted Safeguard Policy Statement (SPS) in 2009 including safeguard requirements for environment, involuntary resettlement and indigenous people. The objectives of the Involuntary Resettlement Safeguard Policy is to avoid involuntary resettlement wherever possible; to minimise involuntary resettlement by exploring project and design alternatives; to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and to improve the standards of living of the displaced poor and other vulnerable groups.

10. The involuntary resettlement safeguards covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers them whether such losses and involuntary restrictions are full or partial, permanent or temporary. The main policy principles of the Involuntary Resettlement Safeguard are:

- (i) Screen the project early on to identify past, present, and future involuntary resettlement impacts and risks. Determine the scope of resettlement planning through a survey and/or census of displaced persons, including a gender analysis, specifically related to resettlement impacts and risks.
- (ii) Carry out meaningful consultations with affected persons, host communities, and concerned non-government organisations. Inform all displaced persons of their entitlements and resettlement options. Ensure their participation in planning, implementation, and monitoring and evaluation of resettlement programs. Pay particular attention to the needs of vulnerable groups, especially those below the poverty line, the landless, the elderly, women and children, and Indigenous Peoples, and those without legal title to land, and ensure their participation in consultations. Establish a grievance redress mechanism to receive and facilitate resolution of the affected persons' concerns. Support the social and cultural institutions of displaced persons and their host population. Where involuntary resettlement impacts and risks are highly complex and sensitive, compensation and resettlement decisions should be preceded by a social preparation phase.
- (iii) Improve, or at least restore, the livelihoods of all displaced persons through (i) land-based resettlement strategies when affected livelihoods are land based where possible or cash compensation at replacement value for land when the loss of land does not undermine livelihoods, (ii) prompt replacement of assets with access to assets of equal or higher value, (iii) prompt compensation at full replacement cost for assets that cannot be restored, and (iv) additional revenues and services through benefit sharing schemes where possible.
- (iv) Provide physically and economically displaced persons with needed assistance, including the following: (i) if there is relocation, secured tenure to relocation land, better housing at resettlement sites with comparable access to employment and production opportunities, integration of resettled persons economically and socially into their host communities, and extension of project benefits to host communities; (ii) transitional support and development assistance, such as land development, credit facilities, training, or employment opportunities; and (iii) civic infrastructure and community services, as required.
- (v) Improve the standards of living of the displaced poor and other vulnerable groups, including women, to at least national minimum standards. In rural areas provide them with legal and affordable access to land and resources, and in urban areas provide them with appropriate income sources and legal and affordable access to adequate housing.
- (vi) Develop procedures in a transparent, consistent, and equitable manner if land acquisition is through negotiated settlement to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status.
- (vii) Ensure that displaced persons without titles to land or any recognisable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets.
- (viii) Prepare a resettlement plan elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.

- (ix) Disclose a draft resettlement plan, including documentation of the consultation process in a timely manner, before project appraisal, in an accessible place and a form and language(s) understandable to affected persons and other stakeholders. Disclose the final resettlement plan and its updates to affected persons and other stakeholders.
- (x) Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits. For a project with significant involuntary resettlement impacts, consider implementing the involuntary resettlement component of the project as a stand-alone operation.
- (xi) Pay compensation and provide other resettlement entitlements before physical or economic displacement. Implement the resettlement plan under close supervision throughout project implementation.
- (xii) Monitor and assess resettlement outcomes, their impacts on the standards of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Disclose monitoring reports.

#### 4 GAPS BETWEEN VARIOUS POLICIES

11. In Sri Lanka, the Land Acquisition Act of 1950 as amended from time to time only provides for compensation for land, structures and crops. It does not require the PEAs to address key resettlement issues such as (a) exploring alternative project options that avoid or minimise impacts on people; (b) compensating those who do not have title to land; (c) consulting affected people and hosts on resettlement options; (d) providing for successful social and economic integration of the affected people and their hosts, and (e) full social and economic rehabilitation of the affected people. A gap analysis of various policies has been given in Table 1

**Table 1: Comparison of ADB's policy with National Policies and Laws**

Sl. No.	ADB's Involuntary Resettlement Policy Principles (2009)	National Involuntary Resettlement Policy 2001 (NIRP)	Land Acquisition Act 1950 along with Amendments by 2009	Remarks
1	Involuntary resettlement should be avoided wherever possible	This principle is equally emphasised under NIRP 2001	No such objective is outlined	NIRP 2001 meets ADB IR Policy requirements
2	Minimise involuntary resettlement by exploring project and design alternatives	NIRP 2001 aims to minimise displacement and to promote, as far as possible, non-displacing or least-displacing alternatives	No such objective is outlined	NIRP 2001 meets ADB IR Policy requirements
3	Conducting census of displaced persons and resettlement planning	Preparation of inventory of losses including people and their properties and preparation of resettlement implementation plan were outlined under NIRP 2001	No provision or procedure specified.	NIRP 2001 meets ADB IR Policy requirements
4	Carry out meaningful consultation with displaced persons and ensure their participation in planning, implementation and monitoring of resettlement program	NIRP 2001 ensure adequate rehabilitation package and expeditious implementation of the rehabilitation process with the consultation and active participation of the affected families	No provision made	NIRP 2001 meets ADB IR Policy requirements
5	Establish grievance redress mechanism	Project involving involuntary resettlement needs to have Grievance redress mechanisms for affected people	No provision made	NIRP 2001 meets ADB IR Policy requirements
6	Support the social and cultural institutions of displaced persons and their host population.	Restoration and rehabilitation of social and cultural institutions should be provided and same facilities should be given to host families under NIRP 2001	No provision made	NIRP 2001 meets ADB IR Policy requirements

Sl. No.	ADB's Involuntary Resettlement Policy Principles (2009)	National Involuntary Resettlement Policy 2001 (NIRP)	Land Acquisition Act 1950 along with Amendments by 2009	Remarks
7	Improve or at least restore the livelihoods of all displaced persons	NIRP 2001 emphasises the same	No provision made	NIRP 2001 meets ADB IR Policy.
8	Land based resettlement strategy	Loss of asset to be compensated to the extent of actual loss	No provision made	NIRP 2001 meets ADB IR Policy.
9	All compensation should be based on the principle of replacement cost	The compensation award shall take into account the market value of the property being acquired	Market value for land and replacement value for structures should be paid according to the regulation no.1596/12 Dated 07/04/2009 of land acquisition act	NIRP 2001 meets ADB IR Policy requirements. This requirement also meets under regulation no.1596/12 07/04/2009 of land acquisition act
10	Provide relocation assistance to displaced persons	NRRP 2007 emphasises the same	In case of loss of land and structures only compensation should be paid	NIRP 2001 meets ADB IR Policy. Part of this requirement provided under regulation no.1596/12 of 07/04/2009
11	Ensure that displaced persons without titles to land or any recognisable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets.	NIRP 2001 also recognises the non-titleholders to provide same benefits as others	No provision made	NIRP 2001 meets ADB IR Policy requirements.
12	Disclose the resettlement plan, including documentation of the consultation in an accessible place and a form and language(s) understandable to affected persons and other stakeholders.	NIRP 2001 ensure this principle	No provision made	NIRP 2001 meets ADB IR Policy requirements
13	Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits.	NIRP 2001 emphasises to integrate rehabilitation concerns into the development planning and implementation process	No provision made	NIRP 2001 meets ADB IR Policy requirements
14	Pay compensation and provide other resettlement entitlements before physical or economic displacement.	Full payment of compensation as well as adequate progress in resettlement shall be ensured in advance of the actual displacement of the affected families.	No provision made. There is a provision under LAA under emergency situations land and property can be taken over for development projects without paying compensation before displaced the people under 38A of the act The compensation pays in later stage for such cases	NIRP 2001 meets ADB IR Policy requirements
15	Monitor and assess resettlement outcomes, their impacts on the standards of living of displaced persons.	The policy equally emphasises the requirement for monitoring	No provision made	NIRP 2001 meets ADB IR Policy requirements

## Annexure5: Inventory of Transmission and Distribution Lines

## TRANSMISSION COMPONENTS

## Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line.

Sl No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Plantation,	Name of crops	Types and No of Trees	No of Affected Household	IP No of affected households (if any)
	From	To													
2	0.00	0.60	0.60	Anuradhapura	Nelumkulama				Private	Agricultural (0.30km) & Home gardens (0.30km)		Paddy			
												Tal	2		
												Mango	3		
												Kohomba	1		
												Kaju	2		
												Kon	1		
												Burutha	1		
												Banana	3		
												Coconut	4		
												Jackfruit	1		
												Lemon	4		
												Teak	5		
												Palu	6		
3	0.60	1.60	1.00	Anuradhapura	Arunagama road				Private	Agricultural (0.40km), Home gardens (0.10km) & Scrublands (0.50km)		Paddy			
												Kaju	3		
												Coconut	2		
												Jackfruit	3		
												Lemon	2		
												Teak	5		
												Indi	3		
												Maha Andara	6		
												Madan	7		
												Siyambala	4		
												Kohomba	8		
												Helamba	7		
4	1.60	2.65	1.05	Anuradhapura	Kuda Kalattawa				Private	Home gardens (0.55km) & Scrublands (0.50km)		Mango	6		
												Kohomba	12		
												Kaju	3		
												Kon	2		

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N° of Trees	N° of Affected Household	N° of affected households (if any)
	From	To												
											Burutha	6		
											Coconut	6		
											Jackfruit	4		
											Madan	4		
											Siyambala	4		
											Palu	2		
											Helamba	4		
											Tal	6		
5	2.65	5.65	3.00	Anuradhapura	Tariyankulama				Private	Agricultural (0.50km), Home gardens (0.60km), Scrublands (1.25km) & Chena (0.65km)	Paddy			
											Kon	4		
											Burutha	4		
											Banana	2		
											Coconut	3		
											Jackfruit	5		
											Lemon	6		
											Siyambala	6		
											Kohomba	12		
											Helamba	5		
											Maila	10		
											Eraminiya	4		
											Andara	11		
											Welan	8		
											Daminiya	5		
											Ahala	6		
6	5.65	6.85	1.20	Anuradhapura	Iuppukanniya wawa				Private	Agricultural (0.35km), Scrublands (0.60km) &	Paddy			
											Kaju	1		
											Coconut	13		
											Jackfruit	1		
											Lemon	1		
											Palu	7		
											Kubuk	6		
											Madan	4		
											Siyambala	8		
											Kohomba	12		
											Helamba	5		



SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N° of Trees	N° of Affected Household	N° of affected households (if any)
	From	To												
											Tal	10		
											Andara	14		
											Welan	13		
											Daminiyaya	5		
											Ahala	12		
7	6.85	7.80	0.95	Anuradhapura					Private	Scrublands (0.95km)	Siyambala	6		
											Ahala	12		
											Kohomba	13		
											Helamba	5		
											Tal	10		
											Andara	16		
											Welan	3		
											Palu	7		
											Weera	4		
											Burutha	5		
8	7.80	8.65	0.85	Anuradhapura	Railway Station/ Mihintale				Private	Home gardens & Scrublands (0.50km)	Coconut	8		
											Jackfruit	6		
											Siyambala	3		
											Helamba	2		
											Maila	3		
											Eraminiya	4		
											Andara	8		
											Welan	3		
											Daminiya	2		
											Ahala	4		
											Kohomba	5		
											Burutha	1		
9	8.65	12.75	4.10	Anuradhapura	Maradankulama				Private	Agricultural (0.15km), Home gardens (2.15km), Scrublands (0.45km) & Chena (1.25km)	Paddy			
											Kon	2		
											Burutha	3		
											Banana	7		
											Coconut	12		
											Jackfruit	2		
											Lemon	4		
											Siyambala	5		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected households (if any)
	From	To												
											Kohomba	17		
											Helamba	5		
											Maila	4		
											Eraminiya	3		
											Daminiya	3		
											Ahala	5		
											Kohomba	5		
											Welan	6		
10	12.75	13.80	1.15	Anuradhapura	Ukkulankulama				Private	Agricultural (0.45km), Home gardens (0.25km), & Chena (0.45km)	Paddy			
											Tal	3		
											Mango	4		
											Kohomba	5		
											Kaju	2		
											Kon	1		
											Burutha	2		
											Banana	5		
											Coconut	6		
											Jackfruit	1		
											Kohomba	4		
											Helamba	3		
											Maila	2		
											Eraminiya	3		
											Daminiya	1		
											Palu	4		
											Weera	2		
11	13.80	15.00	1.20	Anuradhapura	Sangilikulama				Private	Home gardens & Scrublands (0.20km)	Burutha	3		
											Banana	6		
											Coconut	17		
											Jackfruit	4		
											Lemon	12		
											Siyambala	4		
											Kohomba	16		
											Helamba	5		
											Maila	4		
											Eraminiya	3		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected households (if any)
	From	To												
											Daminiya	6		
											Palu	4		
12	15.00	17.60	2.60	Anuradhapura	Rambewa				Private	Agricultural (1.00km) & Home gardens (1.30km)	Paddy			
											Tal	4		
											Mango	7		
											Kohomba	11		
											Kaju	3		
											Kon	5		
											Burutha	6		
											Banana	7		
											Coconut	15		
											Jackfruit	2		
											Wood Apple	4		
13	17.60	22.00	4.40	Anuradhapura	Pahala Ratmalgahawewa					Agricultural (2.80km), Home gardens (1.00km), Scrublands (0.10km) & Chena (0.50km)	Paddy			
											Tal	7		
											Mango	8		
											Kohomba	5		
											Kaju	6		
											Kon	7		
											Burutha	4		
											Banana	5		
											Coconut	3		
											Jackfruit	5		
											Lemon	9		
											Teak	8		
											Palu	10		
											Nabada	4		
											Helamba	5		
											Maila	6		
											Eraminiya	14		
											Daminiya	4		
14	22.00	22.60	0.60	Anuradhapura	Wahamalgollewa					Home gardens (0.60km)	Mango	5		
											Kohomba	3		
											Kaju	5		
											Kon	6		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected households (if any)
	From	To												
											Burutha	7		
											Banana	8		
											Coconut	5		
											Jackfruit	1		
											Lemon	4		
											Teak	3		
											Ahala	2		
											Kubuk	5		
15	22.60	23.10	0.50	Anuradhapura	Wahamalgotlewa					Home gardens (0.40km)	Coconut	5		
											Jackfruit	1		
											Lemon	4		
											Teak	5		
											Ahala	6		
											Kubuk	7		
											Mango	4		
16	23.10	24.85	1.75	Anuradhapura	Sangilikanadarawa					Home gardens (1.60km)	Kohomba	12		
											Burutha	3		
											Banana	10		
											Coconut	19		
											Jackfruit	3		
											Lemon	20		
											Siyambala	7		
											Teak	14		
											Palu	12		
											Wood Apple	3		
											Kaju	2		
17	24.85	25.70	0.85	Anuradhapura	Kanadarawa					Agricultural (0.45km), Home gardens (0.05km) & Scrublands (0.25km)	Paddy			
											Helamba	4		
											Maila	3		
											Eraminiya	5		
											Daminiya	2		
											Coconut	3		
											Jackfruit	1		
											Siyambala	42		
											Teak	4		

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Plantation, gardens	Name of crops	Types and N° of Trees	N° of Affected Household	N° of affected households (if any)
	From	To													
18	25.70	27.60	1.90	Anuradhapura	Katuwala/ Madawachchiya					Agricultural (0.50km), Home gardens		Mango Kohomba Kaju	4 3 1		
										(1.10km) Scrublands (0.30km) &		Kon Burutha Banana Coconut Palu Nabada Helamba Maila Eraminiya Daminiya	2 4 6 12 9 5 6 18 3 2		
19	27.60	29.40	1.80	Anuradhapura						Agricultural (1.10km), Scrublands (0.25km) &		Paddy Kohomba Helamba Maila Eraminiya Daminiya Palu Seru	3 2 4 1 3 2 3		
20	29.40	30.70	1.30	Anuradhapura	Akirikanda					Home gardens (0.70km) & Secondary forest (0.60km)		Mango Kohomba Palu Seru Burutha Kaluwara Coconut Helamba Maila Eraminiya Daminiya Ahala	7 8 12 4 6 4 12 3 16 8 5 11		
21	30.70	31.45	0.75	Anuradhapura	Akirikanda					Chena (0.75km)		Burutha Kaluwara	3 4		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected households (if any)
	From	To												
											Helamba	7		
											Maila	15		
											Eraminiya	5		
											Daminiya	6		
											Ahala	13		
											Seru	7		
											Teak	10		
											Welan	6		
22	31.45	32.80	1.35	Anuradhapura	Issenbessawagala					Scrublands (0.35km) & Secondary forest (1.00km)	Helamba	7		
											Maila	5		
											Eraminiya	8		
											Daminiya	5		
											Ahala	13		
											Eraminiya	13		
											Weera	10		
											Palu	17		
											Seru	13		
											Welan	14		
23	32.80	37.20	4.40	Anuradhapura	Udaha Hamillewa					Agricultural (1.25km), Home gardens (0.45km), Scrublands (1.50km) & Secondary forest (1.20km)	Helamba	5		
											Maila	8		
											Eraminiya	7		
											Daminiya	6		
											Ahala	4		
											Eraminiya	6		
											Daminiya	3		
											Palu	5		
											Seru	6		
											Welan	8		
24	37.20	39.60	2.40	Anuradhapura	Maha Kubukgollewa					Agricultural (1.25km), Home gardens (0.50km), Scrublands (0.25km) & Chena (0.40km)	Paddy			
											Tal	4		
											Mango	5		
											Kohomba	3		
											Kaju	6		
											Kon	2		
											Burutha	7		

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Name of crops	Types and N° of Trees	N° of Affected Household	IP N° of affected households (if any)
	From	To												
											Banana	6		
											Coconut	5		
											Jackfruit	1		
											Teak	2		
											Palu	4		
											Nabada	6		
											Helamba	7		
											Maila	8		
											Eraminiya	4		
											Daminiya	5		
25	39.60	40.00	0.40	Anuradhapura	Maha Kubukollewa					Home gardens & Scrublands (0.15km) (0.25km)	Coconut	3		
											Jackfruit	1		
											Teak	2		
											Palu	4		
											Helamba	6		
											Maila	5		
											Eraminiya	4		
26	40.00	41.00	1.00	Anuradhapura						Scrublands (0.85km)	Helamba	4		
											Maila	6		
											Palu	7		
											Daminiya	8		
											Hik	6		
											Tal	5		
											Ahala	6		
											Milla	4		
											Burutha	3		
											Weera	7		
27	41.00	42.35	1.35	Anuradhapura	Galkandegama					Agricultural (0.20km), Home gardens (0.20km) & Chena (0.95km)	Paddy	4		
											Helamba	3		
											Maila	3		
											Eraminiya	5		
											Daminiya	6		
											Coconut	8		
											Jackfruit	1		
											Siyambala	2		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Plantation,	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected households (if any)
	From	To													
												Teak	3		
												Weera	4		
28	42.35	44.35	2.00	Vavniya	Kalukundamaduwa					Agricultural (0.75km), Scrublands (0.45km) & Secondary forest (0.40km)		Paddy			
												Tal	4		
												Mango	4		
												Kohomba	5		
												Kaju	6		
												Kon	7		
												Burutha	8		
												Palu	9		
												Daminiya	5		
												Hik	6		
												Seru	4		
												Welan	6		
29	44.35	46.60	2.25	Vavniya	Kalnaddinakulama					Agricultural (0.75km), Home gardens (0.45km),		Jackfruit	1		
												Paddy			
												Tal	2		
												Mango	3		
												Kohomba	4		
												Palu	6		
												Daminiya	7		
												Hik	4		
												Coconut	5		
												Ahala	3		
												Wood Apple	1		
30	46.60	51.35	4.75	Vavniya	Samalankulam					Agricultural (1.15km), Home gardens (1.15km) & Scrublands (1.15km)		Paddy			
												Tal	4		
												Mango	5		
												Kohomba	6		
												Palu	4		
												Kon	3		
												Burutha	2		
												Daminiya	6		
31	51.35	51.60	0.25	Vavniya	Kovilkulam					Agricultural (0.25km)		Paddy			



Sl N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Plantation,	Name of crops	Types and N <sup>o</sup> of Trees	N <sup>o</sup> of Affected Household	IP of affected households (if any)
	From	To													
32	51.60	51.95	0.35	Vavniya	Kovilkulam					Home gardens (0.35km)		Tal	3		
												Mango	4		
												Kohomba	3		
												Kaju	5		
												Kon	6		
												Burutha	3		
												Coconut	8		
												Siyambala	3		
33	51.95	52.70	0.75	Vavniya	Sinnapputukkulam					Home gardens (0.65km)		Tal	3		
												Mango	4		
												Kohomba	6		
												Siyambala	5		
												Burutha	4		
												Coconut	3		
												Burutha	3		
34	52.70	54.05	1.35	Vauniya	Nedunkulam					Agricultural (0.85km), Home gardens (0.50km)		Siyambala	2		
												Paddy			
												Tal	4		
												Mango	5		
												Kohomba	5		
												Kaju	5		
												Kon	6		
												Burutha	2		
												Coconut	8		
												Palu	4		
35	54.05	54.85	0.80	Vauniya	Kurudankulama					Home gardens (0.75km) & Scrublands (0.40km)		Paddy			
												Helamba	3		
												Maila	3		
												Eraminiya	2		
												Daminiya	4		
												Coconut	6		
												Jackfruit	2		
												Siyambala	4		
												Teak	12		
												Weera	8		

*Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.*

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
1	0.00	0.90	0.90	Vauniya	Nedumkulam				Private	Home (0.50km) & gardens (0.40km) Chena	Coconut	11		
											Tal	4		
											Teak	8		
											Jackfruit	2		
											Mango	5		
											Halmilla	4		
											Andara	14		
											Palu	7		
											Seru	5		
											Ehela	6		
2	0.90	2.60	1.70	Vauniya	Poonthoddam road				Private	Agricultural (0.40km) & Chena (0.95km)	Paddy			
											Siyambala	4		
											Halmilla	6		
											Andara	9		
											Palu	6		
											Seru	5		
											Ehela	7		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
3	2.60	5.80	3.20	Vauniya	Kokeliya (Thandikulam)				Private	Home gardens (0.30km) & Agricultural (2.70km)	Kohomba	9		
											Weera	4		
											Coconut	6		
4	5.80	.10	0.30	Vauniya	Thandikulam				Private & Government	Agricultural (0.10km) & Scrubland (0.20km)	Tal	4		
											Kohomba	6		
											Paddy			
											Siyambala	3		
											Gansooriya	9		
											Ehela	5		
											Kohomba	8		
											Tal	6		
											Paddy			
5	6.10	8.00	1.90	Vauniya	Ganeshapuram				Private	Agricultural (1.15km) & Home gardens (0.20km)	Welan	7		
											Palu	6		
											Mee	4		
											Edi	5		
											Kumbuk	7		
											Tal	11		
											Siyambala	5		
											Cocunut	18		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Mango	9		
											Kohomba	14		
											Andara	15		
											Palu	6		
											Seru	7		
6	8.00	8.90	0.90	Vauniya	Tampanaikkulam				Private	Home (0.90km) gardens	Paddy			
											Kohomba	6		
											Tal	9		
											Siyambala	4		
											Cocunut	12		
											Mango	6		
7	8.90	10.70	1.80	Vauniya	Tampanaikkulam				Private & Government	Home (0.60km), Scrubland (0.40km) & Agricultural (0.50km) gardens	Coconut	12		
											Tal	5		
											Teak	12		
											Jackfruit	3		
											Mango	9		
											Halmilla	5		
											Andara	10		
											Palu	5		
											Seru	5		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Ehela	6		
											Kohomba	9		
8	10.70	11.40	0.70	Vauniya	1 <sup>st</sup> lane Katpakapuram				Private	Agricultural (0.70km)	Paddy			
9	11.40	12.40	1.00	Vauniya	4 <sup>th</sup> lane Katpakapuram				Private	Home (1.00km) gardens	Coconut	13		
											Mango	6		
											Kohomba	7		
											Jackfruit	3		
											Teak	7		
											Burutha	7		
											Lemon	6		
											Wood Apple	5		
10	12.40	14.20	1.80	Vauniya	Katpakapuram (at 9.2 km of Vauniya road)				Private & Government	Home (1.10km), Plantation (0.40km) & scrubland (0.30km) gardens	Coconut	23		
											Mango	12		
											Kohomba	13		
											Jackfruit	3		
											Palu	5		
											Weera	4		
											Helamba	4		
											Andara	9		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Acacia	5		
											Welan	3		
11	14.20	15.35	1.15	Vauniya	Near student hostel of Vauniya campus				Private	Agricultural (0.10km) & Chena (1.05km)	Paddy			
											Weera	4		
											Helamba	7		
											Andara	8		
											Palu	9		
											Seru	8		
											Ehela	7		
											Kohomba	9		
											Welan	6		
											Kumbuk	4		
12	15.35	16.60	1.25	Vauniya	7 km post Sopalapuliankulam				Private & Government	Home gardens (0.75km), Agricultural (0.25km) & Scrublands (0.25km)	Paddy			
											Coconut	11		
											Jackfruit	2		
											Halmilla	5		
											Palu	6		
											Tal	12		
											Teak	4		
											Siyambala	3		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
											BoraDaminiyaya	4		
											Weera	6		
											Kumbuk	5		
											Kaluwara	3		
											Kone	5		
											Kohomba	5		
13	16.60	17.50	0.90		Sopalapuliankulam				Private	Home gardens (0.45km) & Agricultural (0.25km)	Paddy			
											Coconut	5		
											Palu	3		
											Murunga	4		
											Jackfruit	1		
											Halmilla	5		
											Bannana	6		
											Mango	3		
											Tal	5		
											Siyambala	1		
											Teak	6		
											Weera	5		
											Burutha	4		
											Godakaduru	4		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
14	17.50	17.90	0.40	Vauniya	Pavaikulam				Government	Scrubland (0.35km)	Dunumadala	4		
											Helamba	3		
											Palu	4		
15	17.90	21.00	3.10	Vauniya	Poovvarasankulam				Private & Government	Home gardens (0.25km), Agricultural (0.80km) & Scrublands (1.85km)	Weera	5		
											Tal	3		
											Siyambala	4		
											Burutha	3		
											Helamba	5		
											Seru	2		
											Lolu	1		
											Nabada	3		
											Paddy			
											Palu	12		
16	21.00	21.40	0.40	Vauniya	Poovvarasankulam				Private & Government	Home gardens (0.25km), Agricultural (0.80km) & Scrublands (1.85km)	Godakirilla	6		
											Maila	14		
											Milla	5		
											Kohomba	16		
											Ehela	13		
											Wood Apple	5		
17	21.40	21.80	0.40	Vauniya	Poovvarasankulam				Private & Government	Home gardens (0.25km), Agricultural (0.80km) & Scrublands (1.85km)	Mee	4		



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To									Tal	11		
											Mango	6		
											Siyambala	3		
16	21.00	21.75	0.75	Vauniya	Kanthankulam				Private	Agricultural (0.75km)	Paddy			
17	21.75	22.80	1.05	Vauniya	Kundikulam				Private	Agricultural (0.30km) & Chena (0.75km)	Paddy			
											Siyambala	1		
											Mango	6		
											Kohomba	7		
											Tal	5		
											Palu	7		
											Maila	9		
											Seru	10		
											Lolu	11		
											Nabada	6		
18	22.80	23.40	0.60	Vauniya	Kurukkalpudukkulam				Private & Government	Home gardens (0.10km), Agricultural (0.25km) & Scrublands (0.25km)	Paddy			
											Siyambala	1		
											Mango	2		
											Kohomba	3		
											Tal	2		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
19	23.40	24.10	0.70	Vauniya	Kurukkalpudukkulam				Private & Government	Home (0.20km) & gardens Chena (0.50km)	Palu	3		
											Maila	4		
											Seru	3		
											Lolu	4		
											Mango	3		
											Teak	2		
											Coconut	3		
											Tal	4		
											Maila	2		
											Helamba	3		
											Kumbuk	5		
											Siyambala	1		
											Palu	7		
											Welan	2		
											Seru	3		
											Lolu	4		
											Nabada	3		
											Paddy			
											Weera	6		
											Palu	7		
20	24.10	27.10	3.00	Vauniya	Pandisurichchan				Private & Government	Agricultural (1.20km), Scrublands (1.40km) & Chena (0.40km)				

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Tal	6		
											Kohomba	8		
											Maila	5		
											Ehela	6		
											Andara	12		
											Welan	10		
											Daminiya	5		
21	27.10	28.15	1.05	Vauniya					Private	Agricultural (1.05km)	Paddy			
22	28.15	30.15	2.00	Vauniya	Piramanalankulam				Private & Government	Scrublands (1.80km) & Agricultural (0.20km)	Paddy			
											Weera	5		
											Siyambala	6		
											Palu	7		
											Helamba	8		
											Tal	6		
											Andara	5		
											Welan	7		
											Daminiya	5		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To									Ehela	4		
23	30.15	32.15	2.00	Vauniya	Pulukkulam				Government	Scrublands (2.00km)	Maila	12		
											Tal	5		
											Kohomba	13		
											Weera	8		
											Siyambala	3		
											Palu	12		
											Andara	16		
											Welan	14		
											Daminiya	8		
											Ehela	5		
											Acacia	13		
24	32.15	34.45	2.30	Vauniya	Marakaranpalaikulam				Private & Government	Secondary forest (0.75km) & Scrublands (1.30km)	Weera	10		
											Tal	12		
											Helamba	5		
											Maila	8		
											Kumbuk	6		
											Kohomba	7		
											Eraminiya	5		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
											Siyambala	4		
											Palu	3		
											Dunumadala	4		
											Lolu	5		
											Burutha	3		
25	34.45	35.75	1.30	Vauniya	Periyakaltu				Private & Government	Home gardens (0.40km) & Scrublands (0.75km)	Coconut	6		
											Tal	6		
											Murunga	5		
											Maila	4		
											Kumbuk	7		
											Kohomba	6		
											Jackfruit	1		
											Siyambala	1		
											Palu	8		
26	35.75	39.00	3.25	Vauniya	Paraiyanalankulam				Private & Government	Agricultural (1.00km), Scrublands (1.50km) & Chena (0.50km)	Paddy			
											Maila	13		
											Kumbuk	10		
											Kohomba	17		
											Palu	11		
											Acacia	16		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
27	39.00	39.90	0.90	Vauniya	350 m from Paraiyanalankulam				Private & Government	Agricultural (0.10km) & Scrubland (0.80km)	Weera	7		
											Paddy			
											BoraDaminiyaya	6		
											Welan	7		
											Acacia	7		
											Weera	3		
											Ficus	2		
											Lolu	2		
											Siyambala	4		
											Weera	6		
28	39.90	41.55	1.65	Vauniya	Pumalaruttan				Private & Government	Agricultural (0.25km) & Secondary forest (1.40km)	Paddy			
											Tal	12		
											Maila	20		
											Helamba	6		
											Kumbuk	5		
											Kohomba	9		
											Palu	11		
											Acacia	13		
											Weera	3		
											Ficus	2		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Lolu	4		
											Siyambala	4		
											BoraDaminiyayaya	5		
29	41.55	44.30	2.75	Mannar	Madu road				Private & Government	Home gardens (0.75km) & Secondary forest(2.00km)	Mango	5		
											Teak	12		
											Coconut	10		
											Tal	5		
											Maila	17		
											Helamba	8		
											Kumbuk	7		
											Kohomba	13		
											Palu	10		
											Acacia	3		
											Weera	6		
30	44.30	53.70	9.40	Mannar	Kaddaidampan				Private & Government	Agricultural (3.50km) & Secondary forest (1.00km) Scrubland (4.50km) & Home gardens (0.40km)	Paddy			
											Kumbuk	7		
											Andara	16		
											Maila	15		
											Helamba	9		
											Ficus	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Lolu	12		
											Siyambala	3		
											BoraDaminiyaya	14		
											Helamba	13		
											Weera	9		
											Kohomba	11		
											Palu	13		
											Acacia	11		
											Tal	9		
31	53.70	54.50	0.80	Mannar	57 km post in A14 road				Private & Government	Agricultural (0.5km) & Secondary forest (0.30km)	Paddy			
											Tal	6		
											Maila	13		
											Helamba	8		
											Kumbuk	10		
											Kohomba	13		
											Palu	7		
											Acacia	5		
32	54.50	56.30	1.80	Mannar	Iraddaikulam				Private & Government	Abandoned clay field (1,30km) & Agricultural (0.50km)	Kumbuk	8		
											Andara	10		
											Maila	12		



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
33	56.30	56.75	0.45	Mannar	Fatkadanthakulum				Private	Home (0.45km) gardens	Helamba	6		
											Ficus	2		
											Lolu	6		
											Murunga	2		
											Coconut	5		
											Kohomba	6		
											Palu	1		
											Tal	2		
											Para	1		
											Wood Apple	1		
											Jackfruit	1		
											Bannana	4		
34	56.75	58.20	1.45	Mannar	Chundikkuli				Private	Agricultural (1.45km)	Paddy			
35	58.20	59.65	1.45	Mannar	Murunkankulam				Private	Agricultural (1.10km) & Home gardens	Paddy			
											Tal	4		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) (0.35km)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Coconut	5		
											Bannana	4		
											Mango	3		
											Kohomba	4		
											Siyambala	2		
36	59.65	62.20	1.55	Mannar	Mahaviankerni				Private	Agricultural (1.00km) & Home gardens (0.10)	Paddy			
											Tal	4		
											Mango	3		
											Siyambala	2		
											Kohomba	1		
											Lemon	4		
											Murunga	1		
											Katupila	2		
											Wood Apple	1		
37	62.20	64.55	2.35	Mannar	Maliapity				Private	Agricultural (2.20km)& home gardens(0.15km)	Paddy			
											Siyambala	2		
											Mango	4		
											Kohomba	6		
											Tal	4		
											Lemon	3		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops		Number of trees under , cutting/ triminmg	No of Affected Household	No of affected IP households (if any)
	From	To													
38	64.55	66.85	2.30	Mannar	Illangamodai/ Uyirtharasankulam				Private	Agricultural (2.30km)	Paddy				
39	66.85	67.65	0.80	Mannar	Vannamodai				Private	Agricultural (1.80km)	Paddy	Burutha	2		
												Bannana	6		

#### 4.1.1 Construction of 132 kV 10km double circuit (2xZebrar) Polpitiya-New Polpitiya transmission line.

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under , cutting/ triminmg	No of Affected Household	No of affected IP households (if any)
	From	To												

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
1	0.00	0.50	0.50	Nuwara Eliya	Polpitiya					Home (0.50km) gardens	Coconut	4		
											Durian	2		
											Rambutan	4		
											Avocado	5		
											Jackfruit	3		
											Breadfruit	2		
											Embaralla	1		
											Areca nut	6		
2	0.50	1.75	1.25	Nuwera Eliya	Kalugala 43 km post (A7)					Home (1.25km) gardens	Alstonia	4		
											Rambutan	5		
											Jackfruit	3		
											Coconut	4		
											Kala del	2		
											Breadfruit	3		
											Embaralla	4		
											Areca nut	9		
											Avocado	6		
											Kaju	3		
											Na-imbul	1		
3	1.75	2.10	0.35	Nuwera	Kalugala					Home gardens	Jackfruit	2		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
				Eliya	42 km post (A7)					(0.35km)	Coconut	3		
											Rambutan	4		
											Embaralla	1		
											Areca nut	6		
4	2.10	4.80	2.70	Nuwera Eliya	Belilena road					Plantation (2.70km)	Rubber	1800		
											Mahogany	12		
											Alstonia	6		
											Weralu	2		
											Mango	1		
											Rathkaliya	4		
5	4.80	5.80	1.00	Kegalle	Malwatte road/ Kithulgala					Home gardens (1.00km)	Alstonia	5		
											Rambutan	5		
											Jackfruit	1		
											Coconut	13		
											Karabu	5		
											Mahogany	2		
											Embaralla	1		
											Areca nut	12		
											Mango	5		
											Alstonia	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
6	5.80	8.00	2.20	Kegalle	Gonagamuwa, Bibili Oya					Agricultural (0.20km) & Plantation (2.00km)	Siyambala	1		
											Mangus	2		
											Avocado	3		
											Paddy			
											Rubber	2000		

#### 4.1.2 Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the exiting Pannipitiya grid substation.

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
1	0.00	2.60	2.60	Kegalle	Ganepalle road, Teligama					Plantation (2.60km)	Rubber	2100		
											Kala-del	4		
											Astonia	6		
											Rath keliya	8		
2	2.60	4.55	1.95	Kegalle	Ganepalle Estate,					Home gardens (0.10km), Agricultural (0.150km) & Plantation (1.70km)	Paddy			
											Rubber	1800		
											Kala-del	5		
											Astonia	7		
											Na ebul	3		
											Mahogany	6		
3	4.55	7.40	2.85	Kegalle	Hakbellawaka					Home gardens (0.15km), & Plantation (2.70km)	Rubber	1850		
											Kala-del	4		
											Astonia	3		
											Coconut	1		
											Kithu	1		
											Karabu	1		
											Mahogany	6		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
4	7.40	12.05	4.65	Kegalle	Kanangama					Home gardens (0.15km), & Plantation (4.50km)	Na-ebul	7		
											Rambutan	3		
											Astonia	8		
											Mango	1		
											Nangus	3		
											Avocado	3		
4	7.40	12.05	4.65	Kegalle	Kanangama					Home gardens (0.15km), & Plantation (4.50km)	Rubber	2350		
											Coconut	20		
											Rambutan	1		
											Mahogany	2		
											Weralu	1		
											Gaduguda	1		
											Mangus	1		
											Kala-del	1		
											Lunumedella	1		
											Sapu	1		
5	12.05	13.80	1.75	Kegalle	10 km post (A7)					Home gardens (1.75km),	Rubber	45		
											Coconut	12		
											Rambutan	6		
											Mahogany	5		



SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
6	13.80	15.35	1.55	Kegalle	Moragahahena					Home gardens (1.05km), & Plantation (0.50km)	Sapu	1		
											Astonia	6		
											Mango	3		
											Kala-del	2		
											Alstonia	12		
											Hora	2		
											Kala-del	4		
											Coconuut	13		
											Kithul	3		
											Rubber	350		
7	15.35	17.15	1.80	Kegalle	Kamburapola road/ Ehala Thalduwa					Home gardens (1.30km), Agricultural (0.30km) & Plantation (0.20km)	Rath-keliya	3		
											Sapu	4		
											Rambutan	6		
											Durian	1		
											Avocado	2		
											Paddy			
											Rambutan	6		
											Gaduguda	4		
											Breadfruit	3		
											Jackfruit	3		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
8	17.15	19.05	1.90	Kegalle	Ammithirigala road/ Weralupitiya						Coconut	15		
											Emberella	3		
											Mango	6		
											Areca nut	20		
											Rubber	150		
	19.05	20.95	1.90	Kegalle	Ammithirigala road/ Weralupitiya					Home gardens (0.30km), Agricultural (0.20km) & Plantation (1.40km)	Rubber	1000		
											Coconut	34		
											Rambutan	2		
											Mahogany	4		
											Na-ebul	1		
											Astonia	5		
											Mango	6		
											Kala-del	3		
											Murutha	4		
											Sapu	2		
											Paddy			
											Rath-kaliya	3		
											Areca nut	12		
											Ruk	2		
9	19.05	20.95	1.90	Kegalle	Kudagama road					Home gardens	Paddy			

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names (Sithawaka BOI zone)	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
										(0.10km), Agricultural (0.30km) & Plantation (1.50km)	Rubber	1200		
											Coconut	45		
											Rambutan	3		
											Mahogany	4		
											Na-ebul	1		
											Astonia	12		
											Mango	4		
											Jackfruit	1		
10	20.95	24.55	3.60	Colombo	Eswatta					Home gardens (3.35km), & Agricultural (0.25km)	Coconut	18		
											Durian	4		
											Rambutan	7		
											Avocado	4		
											Jackfruit	5		
											Breadfruit	4		
											Embaralla	4		
											Areca nut	16		
											Paddy			
											Rubber	150		
											Mahogany	6		
11	24.55	27.35	2.80	Colombo	Alubodala					Forest (0.30km), Home	Rathkaliya	4		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
										gardens (0.70km), Palntation (1.50km) & Agricultural)	Walla	2		
											Gaduba	6		
											Hora	4		
											Keballa	4		
											Ruk	2		
											Na-ebul	1		
											Durian	1		
											Rambuttan	4		
											Avocado	4		
											Jackfruit	2		
											Breadfruit	1		
											Embaralla	1		
											Areca nut	10		
											Rubber	1300		
											Coconut	25		
											Acacia	5		
											Paddy			
12	27.35	29.95	2.60	Colombo	Kosgama					Home gardens (1.00km), & Agricultural (1.60km)	Coconut	7		
											Durian	1		
											Rambuttan	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
13	29.95	33.15	3.20	Colombo	750m away from Kaluaggala Junction towards Awissawella					Home gardens (2.50km), & Agricultural (0.70km)	Avocado	4		
											Jackfruit	1		
											Breadfruit	1		
											Embaralla	3		
											Gaduguda	2		
											Alstoniya	5		
											Mahogany	4		
											Paddy			
											Mango	4		
											Rambutan	3		
											Coconut	19		
											Dodam	2		
											Jackfruits	5		
											Weralu	2		
											Durian	4		
											Gaduguda	2		
											Avocado	4		
											Jackfruit	1		
											Breadfruit	1		
											Embaralla	4		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
14	33.15	33.80	0.65	Colombo	500m away from Kaluaggala Junction towards Labugama					Home (0.65km) gardens	Alstoniya	6		
											Mahogany	4		
											Coconut	6		
14	33.15	33.80	0.65	Colombo	500m away from Kaluaggala Junction towards Labugama					Home (0.65km) gardens	Durian	1		
											Rambuttan	4		
											Avocado	3		
											Jackfruit	2		
											Breadfruit	1		
											Embaralla	1		
											Gaduguda	1		
											Alstoniya	2		
											Mahogany	3		
15	33.80	36.20	2.40	Colombo	Pahathgama					Marsh (0.20km), Home gardens (1.60km) & Agricultural (0.60km)	Coconut	19		
											Durian	3		
											Rambuttan	8		
											Avocado	2		
											Jackfruit	4		
											Breadfruit	1		
											Embaralla	3		
											Areca nut	12		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
16	36.20	40.95	4.75	Colombo	Batawala					Marsh (0.30km), Scrub lands (0.45km), Home gardens (3.15km) & Agricultural (0.85km)	Alstoniya	7		
											Mahogany	6		
											Kaduru	6		
											WelAttha	14		
											Para	16		
											Alstoniya	10		
											Mahogany	8		
											Kaduru	4		
											WelAttha	19		
											Para	18		
											Gaduba	7		
											Kaballe	6		
											Rath-kaliya	5		
											Avocado	4		
											Jackfruit	3		
											Breadfruit	2		
											Embaralla	1		
											Coconut	13		
											Rambutan	4		
17	40.95	43.25	2.30	Colombo	Jalthara road					Home gardens	Mahogany	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
										(0.70km), Agricultural (1.10km) & Industrial Estate (0.50km)	Alstonia	4		
											Mango	3		
											Coconut	17		
											Ahala	2		
											Rabutan	5		
18	43.25	45.45	2.20	Colombo	Habarakada					Home gardens (0.10km), Agricultural (1.10km) & Industrial Estate (1.00km)	Coconut	13		
											Paddy			
											Siyabala	1		
											Mahogany	5		
											Alstonia	3		
											Gaduba	4		
19	45.45	46.55	1.10	Colombo	Habarakada					Home gardens (1.10km)	Mango	3		
											Rambutan	4		
											Coconut	6		
											Dodam	1		
											Jackfruits	2		
											Weralu	1		
											Jambu	3		
											Avocado	4		
											Nangus	1		



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
20	46.55	48.20	1.65	Colombo	Galawelawatta road/ Homagama					Agricultural (1.10km)	Paddy			
21	48.20	49.20	1.00	Colombo						Home gardens (0.90km), Agricultural (0.10km)	Paddy			
											Mango	5		
											Rambutan	3		
											Coconut	6		
											Dodam	4		
											Jackfruits	4		
											Mangus	1		
22	49.20	50.55	1.35	Colombo	Malapalla					Home gardens (0.55km) & Agricultural (0.80km)	Paddy			
											Mango	4		
											Rambutan	3		
											Coconut	8		
											Jambu	1		
											Mahogani	3		
23	50.55	51.90	1.35	Colombo	Rukmale road					Home gardens (0.35km) & Agricultural (1.00km)	Paddy			
											Mango	2		
											Rambutan	1		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
											Coconut	4		
											Dodam	1		
											Jackfruits	1		
24	51.90	55.25	3.35	Colombo	Pannipitiya Railway Station					Home gardens (0.45km) & Agricultural (2.90km)	Paddy			
											Coconut	5		
											Mango	3		
											Rambutan	2		
											Jackfruits	2		
											Breadfruits	1		
25	55.25	56.50	1.25	Colombo	Pannipitiya GSS					Home gardens (0.45km) & Agricultural (0.80km)	Paddy			
											Coconut	10		
											Mango	4		
											Rambutan	5		
											Jackfruits	3		

*Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.*

	SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
		From	To												
	1	0.00	1.10	1.10	Colombo	Walpita					Agricultural (1.10km)	Paddy			
	2	1.10	2.35	1.25	Colombo	Pokunuhena					Agricultural (0.80km) & Home garden (0.45km)	Paddy			
												Mahogany	3		
												Coconut	8		
												Breadfruit	2		
												Rubber	48		
												Areca nut	10		
												Mango	6		
												Alstonia	8		
	3	2.35	3.50	1.15	Colombo	Near Manungala temple/ Dadigamuwa					Agricultural (1.15km)	Paddy			
	4	3.50	4.95	1.45	Colombo	Maha wela/ Welikadaowita					Agricultural (1.45km)	Paddy			
	5	4.95	6.40	1.45	Colombo	Oruwala					Agricultural (1.45km)	Paddy			
	6	6.40	7.15	0.75	Colombo	Gamunu Mawattha.					Agricultural (0.75km)	Paddy			
	7	7.15	7.65	0.50	Colombo	Galwarusawa/ Oruwala					Home gardens	Kale-Del	1		

	SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
		From	To												
											(0.40km) & Agricultural (0.10)	Ruk Alsastonia Hal Nadun Lunuannkenda Kenda	2 2 1 1 2 2		
												Areca nut Coconut Mango Iriya Dawata Rathkaliya Malla	3 2 1 1 1 2 1		
	8	7.65	9.25	1.60	Colombo	M.D.H. Jayawardane road					Agricultural (1.00km) & housing Scheme (0.60km)	Paddy Mango Coconut Rambutan	 3 10 3		
	9	9.25	10.05	0.80	Colombo	Athurugiriya GSS					Agricultural (0.80km)	Paddy			

*Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.*

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow)	Plantation,	Name of crops	Number of trees under cutting/trimming*	No of Affected Household	No of affected IP households (if any)
	From	To													
1	0.00	1.25	1.25	Colombo	Godallawatte para/ Pothuwarawa				Private	Home (0.35km) Agricultural (0.90km)	gardens &	Paddy			
												Coconut			
												Mango			
												Rambutan			
												Weralu			
												Jackfruit			
												Pihibiya			
2	1.25	1.75	0.50	Colombo	Malabe				Private	Home (0.50km)	gardens	Coconut			
												Mango			
												Rambutan			
												Pihimbiya			
												Anoda			
												Ambaralla			
												Jackfruit			
												Kottamba			
3	1.75	4.20	2.45	Colombo	Talahena				Private	Home (2.20km) Agricultural	gardens &	Paddy			
												Mango			

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow) (0.25km)	Name of crops	Number of trees under cutting/ trimming*	No of Affected Household	No of affected IP households (if any)
	From	To												
4	4.20	4.55	0.35	Colombo	Near School/ Talahena				Private	Home gardens (0.35km)	Rambutan			
											Weralu			
											Jackfruit			
											Pihibiya			
											Ambaralla			
											Avocado			
											Kathurmuringa			
5	4.55	5.15	0.60	Colombo	Dutugamunu Mawatta				Private	Home gardens (0.60km)	Coconut			
											Mango			
											Rambutan			
											Pihibiya			
											Amberalla			
6	5.15	6.85	1.70	Colombo	Walpola/ Angoda				Private	Home gardens	Coconut			

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, barren/fallow) & Plantation,	Name of crops	Number of trees under cutting/trimming*	No of Affected Household	No of affected IP households (if any)
	From	To												
7	6.85	8.05	1.20	Colombo	Walikada road, Thalagaha Junction				Private	(1.60km) Agricultural (0.10km)	Mango			
											Rambutan			
											Mahogany			
											Siyambala			
											Avocado			
											Araliya			
											Dodam			
											Kottamba			
									Private	Urban area / Home gardens (1.20km)	Coconut			
											Mango			
											Rambutan			
											Mahogany			
											Ehala			
											Avocado			
											Pera			
											Dodam			
8	8.05	9.50	1.45	Colombo	Gothatuwa/ Mulleriyawa New Town				Private	Home gardens (1.45km)	Coconut			
											Mango			

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming*	No of Affected Household	No of affected IP households (if any)
	From	To												
9	9.50	11.80	2.30	Colombo	Wellampitiya				Private	Marsh (0.05km), agricultural (0.50km) & Home gardens (1.75km)	Ambaralla			
											Jackfruit			
											Mangus			
											Rambutan			
											Araliya			
9	9.50	11.80	2.30	Colombo	Wellampitiya				Private	Marsh (0.05km), agricultural (0.50km) & Home gardens (1.75km)	Wel aththa			
											Para			
											Coconut			
											Mango			
											Ambaralla			
											Jackfruit			
											Mangus			
											Rambutan			
											Avocado			
											Delum			
10	11.80	12.40	0.60	Colombo	Vihara Mawatha/ Kolonnawa GSS				Private	Urban area / Home gardens (0.60km)	Coconut			
											Mango			
											Jambu			
											Rambutan			



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops		Number of trees under , cutting/ trimming*	Nº of Affected Household	Nº of affected IP households (if any)
	From	To													
											Pihimblya				
											Laulu				

\* - existing towers are used for reconductering, cutting of trees not required

*Construction of 132 kV 14 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line*

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	No. of Trees under cutting/trimming	N <sup>o</sup> of Affected Household	IP N <sup>o</sup> of affected households (if any)
	From	To												
1	0.00	0.25	0.25	Kegalle	Thulhiriya/ Rathnapala road				Private	Agricultural & residential	Paddy			
											Coconut	25		
2	0.25	1.00	0.75	Kegalle	Thulhiriya/ Pansal mawatha				Private	Agricultural (0.75km)	Paddy			
3	1.00	1.40	0.40	Kegalle	Hunuwala, Nangalla				Private	Agricultural (0.35km)	Paddy			
4	1.40	1.75	0.35	Kegalle	Hunuwala,				Private	Home gardens (0.35km)	Mahogany	15		
											Jackfruit	6		
											Coconut	26		
											Mango	5		
											Goraka	1		
											Halmilla	1		
											Areca nut	4		
											Kithul	1		
										Agricultural (0.05km)	Paddy			

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	No. of Trees under cutting/ trimming	N <sup>o</sup> of Affected Household	IP N <sup>o</sup> of affected households (if any)
	From	To												
5	1.75	2.75	1.00	Kegalle	Hunuwala kanda, Thalawattha Rubber Estate				Private	Agricultural (1.00km)	Paddy			
6	2.75	4.15	1.40	Kegalle	Ragala, Kahabiliyawala				Private	Agricultural(0.25km) & Plantation (1.15km)	Paddy			
											Rubber	1250		
7	4.15	6.15	2.00	Kegalle	Katukurunnda				Private	Agricultural(0.80km) & Plantation (1.20km)	Paddy			
											Coconut	45		
											Rubber	1300		
8	6.15	6.85	0.70	Kegalle	Talgama/ Matiyagane/ Weniwalwattha Rubber Estate				Private	Agricultural(0.30km) & Plantation (0.40km)	Paddy			
											Coconut	12		
9	6.85	7.20	0.35	Kegalle	Galkatiya Junction				Private	Agricultural (0.35)	Paddy			
10	7.20	8.90	1.70	Kegalle	Weragoda				Private	Agricultural(0.50km) & Plantation (1.20km)	Paddy		-	-
											Rubber	1300		
11	8.90	11.65	2.75	Kegalle	Jeewana/ Dewalegama				Private	Agricultural(1.85km) & Plantation (0.95km)	Paddy			
											Coconut	18		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	No. of Trees under cutting/ trimming	Nº of Affected Household	IP Nº of affected households (if any)
	From	To									Rubber	1282		
12	11.65	12.25	0.60	Kegalle	Halloduwa				Private	Agricultural (0.60)	Paddy			
13	12.25	12.85	0.60	Kegalle	Dewalegama				Private	Agricultural (0.20km)	Paddy			
										Home gardens (0.40km)	Coconut	20		
											Mango	4		
											Jak fruit	8		
											Mahogany	12		
											Alstonia	10		
											Areca nut	11		
											Kaju	3		
14	12.85	14.05	1.20	Kegalle	Walagama				Private	Agricultural (1.20km)	Paddy			
15	14.05	15.60	1.55	Kegalle	Siyabalapitiya (near temple)				Private	Agricultural(0.850km) & Plantation (0.70km)	Paddy			
											Rubber	900		
16	15.60	17.30	1.70	Kegalle	Pussella				Private	Home gardens (1.70km)	Mango	6		
											coconut	27		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	No. of Trees under cutting/ trimming	Nº of Affected Household	IP Nº of affected households (if any)
	From	To												
											Mahogany	11		
											Jak fruit	8		
											Rambutan	7		
											Siymbala	3		
											Weralu	2		
											Areca nut	11		
17	17.30	18.50	1.20	Kegalle	Kurunduhinna				Private	Agricultural (1.00km)	Paddy			
18	18.50	19.95	1.45	Kegalle	Puwakdeniya				Private	Agricultural (0.55) & home gardens (0.95km)	Paddy			
											Coconut	19		
											Jakfruit	7		
											Rambutan	8		
											Mahogany	11		
19	19.95	21.20	1.25	Kegalle	Molagoda Kawdaulla road				Private	Agricultural (0.60) (1.00km) & home gardens (0.65km)	Paddy			
											Mango	12		
											Coconut	25		
											Mahogany	10		
											Jakfruit	8		
											Rambutan	4		
20	21.20	22.45	1.25	Kegalle	Molagoda				Private	Agricultural (1.10km)	Paddy			

	Sl Nº	
	From	Kilometre
	To	
	Distance (km)	
	Nº of Districts and Names	
Annasigala road	Nº of villages and names	
	Nº of Towers	
	Area of tower m <sup>2</sup>	
	Area under the ROW m <sup>2</sup>	
	Ownership of Land (Private, Government, Forest)	
	Use of Land (Agricultural, Plantation, barren/fallow)	
	Name of crops	
	No. of Trees under cutting/ trimming	
	Nº of Affected Household	
	Nº of affected IP households (if any)	

*Vayunia-Kebithigollewa (33 kV).*

Sl No	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/ triminmg	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
1	0.00	0.70	0.70	Vavuniya	Nedunkulam				Private	Home gardens (0.70km)	<div>Kohomba</div> <div>Jackfruit</div> <div>Teak</div> <div>Coconut</div> <div>Tal</div> <div>kaju</div>	<div>3</div> <div>2</div> <div>6</div> <div>5</div> <div>6</div> <div>4</div>		
2	0.70	1.70	1.00	Vavuniya	Nedunkulam (1.5km from Horowpattana road)				Private	Agricultural (1.00km)	Paddy			

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	IP of affected households (if any)
	From	To												
3	1.70	3.00	1.30	Vavuniya	Ambalangodalla				Private	Agricultural (1.30km)	Paddy			
4	3.00	4.20	1.20	Vavuniya	Near Madukanda wewa				Government & private	Agricultural (1.00) & Home gardens (0.20km)	Paddy			
											Mango	2		
											Coconut	4		
											Thal	6		
											Kon	2		
											Nebada	3		
											Kumbuk	5		
											Damba	2		
											Kohomba	4		
											Andara	6		
5	4.20	5.50	1.30	Vavuniya	Madukanda				Government	Secondary Forest & scrub land (1.3km)	Godakaduru	2		
											Kuratiya	2		
											Thammanna	2		
											Thal	4		
											Palu	6		
											Kohomba	5		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
6	5.50	6.40	0.90	Vavuniya	(4 km post) Kuda Kachchakudiya				Government	Scrub land & secondary forest (0.90km)	Andara	9		
											Milla	4		
											Eraminiya	3		
											Burutha	1		
											Hulanhik	2		
											Seru	1		
											Lolu	3		
7	6.40	7.50	1.10	Vavuniya	Kuda Kachchakudiya				Government	Open area (abandoned paddy fields) & scrub land	Palu	3		
											Burutha	2		
											Kohomba	3		
											Damba	1		
											Siyambala	1		
8	7.50	8.80	1.30	Vavuniya	Etabagaskada				Government	Scrub land &secondary forest (0.90km)	Weera	6		
											Palu	7		
											Kon	3		
											Godakaduru	3		



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Dunumadala	2		
9	8.80	11.60	2.80	Anuradhapura	Dutuwewa				Government	Forest (2.8km)	Milla	4	-	-
											Weera	8		
											Palu	10		
											Kon	3		
											Godakaduru	5		
											Dunumadala	1		
											Ehala	4		
											Thimbiri	2		
10	11.60	12.60	1.00	Anuradhapura	Dutuwewa				Government	Forest (1.00km)	Milla	4		
											Kon	2		
											Godakaduru	4		
											Dunumadala	3		
											Ahala	5		
											Thibiri	1		
											Milla	2		
											Weera	6		
11	12.60	13.80	1.20	Anuradhapura	Dutuwewa				Government	Forest (0.95km) & agricultural	Palu	4		
											Godakaduru	1		
											Dunumadala	1		

SI No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) (0.25km)	Number of trees under cutting/trimming	Types and No of Trees	No of Affected Household	No of affected IP households (if any)
	From	To												
12	13.80	14.30	0.50	Anuradhapura	Dutuwewa				Government & private	Home gardens (0.10km) & Scrub (0.40km)	Ehala	3		
											Thimbiri	2		
											Milla	3		
											Weera	6		
											Palu	7		
											Nuga	1		
											Paddy			
13	14.30	14.80	0.50	Anuradhapura	Kale-Puliyankulama				Private	Agricultural (0.50km)	Paddy			
											Teak	3		
											Weera	1		
											Palu	2		
											Kohomba	2		
14	14.80	17.40	2.60	Anuradhapura	Ralapanawa				Government & private	Scrub land (2.15km) & home gardens (0.45km)	Ehala	1		
											Paddy			
											Milla	2		
											Jackfruit	1		
											Teak	7		
											Siyambala	2		
											Kohomba	6		
											Burutha	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
15	17.40	18.20	0.80	Anuradhapura	Kunchuttuwa				Government	Secondary Forest (0.65km)& home gardens (0.15km)	Mango	8		
											Godakaduru	2		
											Dunumadala	4		
											Ehala	2		
											Thimbiri	1		
											Milla	1		
16	18.20	19.30	1.10	Anuradhapura	Wihara- Halmillawa				Government	Scrub land, secondary forest (0.15km) & Agricultura (0.65km)	Mango	3		
											Dunumadala	1		
											Ehala	2		
											Thimbiri	4		
											Milla	5		
											Weera	2		
17	19.30	19.80	0.50	Anuradhapura	Wihara- Halmillawa				Government & private	Secondary Forest (0.30km) & Agricultural (0.2km)	Palu	5		
											Halmilla	2		
											Teak	4		
											Kaju	3		
											Kohomba	1		
											Mango	1		
18	19.80	22.40	2.60	Anuradhapura	Padaweya road				Government &	Secondary	Palu	1		
											Jackfrut	1		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names  1.1km from Kebitigollewa	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)  private	Use of Land (Agricultural, Plantation, barren/fallow)  Forest (2.40km &)	Number of trees under cutting/trimming	Types and Nº of Trees	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Siyabala	2		
										home gardens (0.20km)	Kohomba	10		
											Burutha	4		
											Mango	3		
											Teak	13		
19	22.40	23.00	0,60	Anuradhapura	Kebithigollewa				Government & private	Secondary Forest (0.40km) & home gardens (0.20km)	coconut	2		
											Jackfruit	2		
											Teak	4		
											Siyambala	1		
											Kohomba	4		
											Mango	1		

*Anuradhapura-Kahatagasdigiliya 33 kV.*

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
1	0.00	0.75	0.75	Anuradhapura	Pansala road/ Pahala Keerikkulama				Private	Home gardens	Coconuts	12		
											Jackfruit	3		
											Kohomba	4		
											Dlum	2		
											Mango	5		
											WoodApple	3		
											Nelli	1		
											Teak	8		
											Orange	1		
2	0.75	1.00	0.25	Anuradhapura	Keerikkulama				Private	Agricultural (0.15km) & Chena (0.10)	Paddy			
											Maila	2		
											Katakalla	1		
											Welan	1		
											Ehala	2		
											Kohomba	3		
											Siyambala	1		
											Palu	4		
3	1.00	3.30	2.30	Anuradhapura	Kawarakkulama				Private	Agricultural	Paddy			

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
										(1.00km) Scrubland (1.30km) &	Maila	12		
											Ketakela	4		
											Welan	8		
											Ahala	6		
											Kohomba	7		
											Siyambala	6		
											Palu	12		
											Hik	5		
											Kon	8		
4	3.30	5.00	1.70	Anuradhapura	Wewa road Weweldigiliya				Private & Government	Home gardens (0.50km), Agricultural (0.80km) & Scrubland (0.40km)	Coconuts	4		
											Jackfruit	1		
											Kohomba	3		
											Kon	2		
											Mango	2		
											WoodApple	1		
											Burutha	2		
											Teak	6		
5	5.00	6.10	1.10	Anuradhapura	Weweldigiliya				Private	Home gardens (0.80km) & Agricultural (0.30km)	Paddy			
											Coconuts	12		
											Jackfruit	2		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
6	6.10	7.05	0.95	Anuradhapura	Karuwalagaswewa				Private & Government	Agricultural (0.25km) & Scrubland (0.70km)	Kohomba	8		
											Mango	4		
											Tal	9		
											Palu	13		
											Siyambala	3		
	7.05	7.45	0.4	Anuradhapura	Wellaragama				Government	scrubland	Paddy			
											Maila	2		
											Ketakela	3		
											Welan	4		
											Ehala	3		
											Kohoba	5		
											Siyambala	1		
											Palu	4		
											Hik	2		
											Kon	1		
											Boradamiya	1		
											Godakirilla	1		
											Ficus	2		
											Burutha	2		
7	7.05	7.45	0.4	Anuradhapura	Wellaragama				Government	scrubland	Kohomba	2		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
8	7.45	10.45	3.00	Anuradhapura	Maradankalla					(0.40km)	Siyabala	1		
											Palu	1		
											Hik	2		
											Kon	1		
											Boradaminiya	1		
											Godakirilla	1		
											Ficus	1		
											Burutha	1		
											Lolu	1		
											Maila	12		
											Katakalla	3		
											Welan	5		
											Ehala	6		
											Kohomba	9		
											Siyabala	4		
											Palu	15		
											Hik	3		
											Kon	3		
											Boradaminiya	4		
											Godakirilla	6		



SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N° of Affected Household	N° of affected IP households (if any)
	From	To												
9	10.45	11.85	1.40	Anuradhapura	Nochchikulama				Government		Ficus	3		-
											Burutha	5		
											Lantana	13		
											Lolu	4		
											Seru	1		
											Kotadimbula	6		
											Andara	12		
											Mallotus	3		
											Teak	14		
											Palu	5		
										Secondary forest (0.20km), scrubland (1.00km) &	Hik	2		
											Kon	2		
											Boradaminiya	3		
											Godakirilla	5		
											Ficus	4		
											Burutha	6		
											Lantana	14		
											Lolu	6		
											Seru	2		
											Andara	10		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
10	11.85	12.30	0.45	Anuradhapura	Nochchikulama				Private & Government	Agricultural (0.25km) & scrubland (0.20km)	Mallotus	3		
											Kotadimbula	5		
											Paddy			
11	12.30	13.40	1.10	Anuradhapura	Tirappane				Private & Government	Home gardens (0.50km) & scrubland (0.45km)	Palu	10		
											Hik	2		
											Kon	2		
											Boradamiya	2		
											Godakirilla	1		
											Ficus	1		
											Burutha	3		
											Coconuts	6		
											Jackfruit	2		
12	13.40	15.55	2.15	Anuradhapura	Near Tirappane				Private	Home gardens	Kohomba	5		
											Kon	2		
											Mango	3		
											Palu	4		
											Hik	1		
											Kon	1		
											Boradamiya	3		
											Paddy			

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
					wewa/ Tirappane				&Government	(0.95km), Agricultural (0.35km) scrubland (0.75km)	Coconuts	14		
											Jackfruit	3		
											Kohoba	13		
											Kon	4		
											Mango	5		
											Palu	8		
											Hik	4		
											Kon	4		
											Boradamiya	5		
											Mee	2		
											Nabada	7		
											Karada	4		
											Welan	6		
											Burutha	3		
											Kubuk	9		
13	15.55	17.05	1.50	Anuradhapura	Kasamaduwa				Private & Government	Agricultural (0.75km) scrubland (0.75km)	Paddy			
											Palu	5		
											Hik	6		
											Kon	3		
											Boradamiya	1		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
14	17.05	19.45	2.40	Anuradhapura	Near Kasamaduwa wewa/ Kasamaduwa				Private & Government	Home gardens (0.20km), Agricultural (1.00km) & scrubland (0.80km)	Burutha	2		
											Kumbuk	5		
											Kohomba	4		
											Kon	4		
											Mango	5		
											Palu	3		
											Hik	3		
											Kon	4		
											Paddy			
											Coconut	12		
											Teak	4		
											Tal	5		
											Nelli	2		
											Boradaminia	5		
											Burutha	6		
15	19.45	21.80	2.25	Anuradhapura	Galenbindunuwewa				Private & Government	Home gardens (0.10km), Agricultural (0.90km) & scrubland	Kumbuk	7		
											Kohomba	8		
											Kon	4		
											Mango	10		
											Palu	16		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
										(1.25km)	Hik	3		
											Coconut	12		
											Paddy			
											Ehala	4		
											Teak	14		
											Tal	5		
16	21.80	22.00	0.20	Anuradhapura	Galenbindunuwewa				Private	Chena (0.20km)	Palu	3		
											Hik	2		
											Kon	2		
17	22.00	23.25	1.25	Anuradhapura	Tihogama				Private & Government	Home gardens (0.15km), secondary forest (0.75km) & Chena (0.35km)	Coconut	4		
											Teak	5		
											Tal	3		
											Mango	1		
											Kumbuk	3		
											Nabada	4		
											Kon	2		
											Godakaduru	2		
											Palu	4		
											Weera	5		
18	23.25	23.60	0.35	Anuradhapura	Tihogama				Private	Agricultural	Paddy			

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
										(0.20km), Chena (0.15km)	Palu	4		
											Weera	2		
											Welan	2		
19	23.60	23.80	0.20	Anuradhapura	Tihogama				Private	Agricultural (0.20km)	Paddy			
20	23.80	24.25	0.45	Anuradhapura	Rathmale				Private	Agricultural (0.20km)	Paddy			
21	24.25	27.10	2.85	Anuradhapura	Nelugollakada				Private & Government	Agricultural (0.70km), Chena (0.65km) scrubland (1.50km) &	Paddy			
											Palu	4		
											Hik	3		
											Kon	2		
											Boradaminiya	1		
											Godakirilla	4		
											Ficus	1		
											Burutha	3		
											Lantana	4		
											Lolu	3		
											Seru	1		
											Andara	10		
											Mallotus	4		
											Weera	3		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
22	27.10	27.95	0.85	Anuradhapura	Nelugollakada				Private & Government	Agricultural (0.60km) & scrubland(0.20km)	Paddy			
											Ficus	1		
											Burutha	3		
											Siyambala	4		
											Palu	2		
											Weera	3		
											Andara	7		
											Acasia	4		
23	27.95	29.30	1.35	Anuradhapura	Digan Halmillewa				Private	Home gardens (0.30km), Agricultural (1.05km)	Paddy			
											Coconuts	3		
											Jackfruit	1		
											Kohomba	3		
											Teak	4		
											Mango	3		
											WoodApple	1		
24	29.30	29.95	0.65	Anuradhapura	Digan Halmillewa				Private	Home gardens (0.40km), Agricultural (0.25km)	Paddy			
											Coconuts	5		
											Jackfruit	1		
											Kohomba	3		
											Teak	4		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
											Mango	4		
											Burutha	3		
25	29.95	32.35	2.40	Anuradhapura	Paluketuwewa				Private & Government	Agricultural (0.60km), & Chena (1.30km) scrubland(0.50k m)	Paddy			
											Coconuts	4		
											Jackfruit	3		
											Kohomba	5		
											Teak	6		
											Mango	4		
											Burutha	2		
											Palu	8		
											Andara	6		
											Welan	4		
26	32.35	32.75	0.40	Anuradhapura	Kuda Messallewa				Private	Chena (0.40km)	Palu	5		
											Tal	3		
											Andara	2		
											Welan	6		
27	32.75	33.50	0.75		Kahatagasdigiliya				Private	Agricultural (0.75km),	Paddy			



*Kiribathkumbura-Galaha gantry 33 kV*

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	IP affected (if any)
	From	To												
2	0.00	0.50	0.50	Kandy	Elugoda				Private	Home gardens (0.50km)	Alstonia	6		-
											Coconut	7		
											Mahogany	8		
											Sadikka	6		
3	0.50	1.05	0.55	Kandy	Daulagala road				Private	Home gardens with Tea lands (0.55km)	Alstonia	4		-
											Coconut	5		
											Mahogany	6		
											Sadikka	4		
											Avocado	2		
											Rabutan	1		
4	1.05	1.45	0.40	Kandy	Hendeniya/ Yalegoda road				Private	Home gardens (0.20km) & Agricultural (0.20km)	Paddy			-
											Alstonia	5		
											Coconut	6		
											Mahogany	4		
											Sadikka	2		
											Jackfruit	3		
											Sapu	2		
5	1.45	2.70	1.25	Kandy	Meewathura				Private	Agricultural (1.25km)	Paddy			-

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
6	2.70	3.20	0.50	Kandy	Anngunawala				Private	Home gardens & Agricultural (0.45km)	Paddy			-
											Alstonia	4		
											Coconut	6		
											Mahogany	3		
										(0.05km)	Sadikka	2		
											Jackfruit	1		
											Sapu	4		
7	3.20	3.55	0.35	Kandy	Kuruduwatta				Private	Home gardens (0.45km)	Paddy			-
											Alstonia	4		
											Coconut	5		
											Mahogany	3		
											Sadikka	2		
											Jackfruit	3		
											Mango	4		
											Rabutan	2		
											Avocado	1		
8	3.55	4.10	0.55	Kandy	Hindagala				Private	Home gardens & Agricultural (0.45km) (0.05km)	Paddy			-
											Alstonia	5		
											Coconut	6		
											Mahogany	3		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
9	4.10	4.30	0.20	Kandy	Galaha road/Hindagala				Private	Home gardens (0.20km)	Sadikka	4		-
											Jackfruit	1		
											Sapu	1		
											Coconut	4		
											Mahogany	3		
											Sadikka	4		
											Jackfruit	5		
											Sapu	3		
											Avocado	5		
											Mango	5		
											Avocado	4		
10	4.30	4.70	0.40	Kandy	Mowbray tea state/ Mahakandda				Private	Home gardens & Scrublands (0.30km)	Weralu	1		-
											Arecanut	7		
											Durian	2		
											Karabu	4		
											Sadikka	3		
											Alstonia	4		
											Coconut	4		
											Mahogany	4		
											Sadikka			

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N° of Affected Household	N° of affected IP households (if any)
	From	To												
11	4.70	5.95	1.25	Kandy	Haloya colony/ Sarasavigama				Private	Home gardens (0.20km), plantation (0.85km) & Forest plantation (0.20km)	Tea	3		-
											Sadikka	2		
											Alstonia	5		
											Coconut	13		
											Mahogany	4		
											Pinus	15		
											Acacia	13		
											Sapu	3		
											Avocado	6		
											Mango	7		
12	5.95	7.05	1.10	Kandy	Watagoda				Government & private	Forest plantation (1.10km) &	Alstonia	6		
											Lunumiddella	4		
											Sabukku	22		
											Eucalyptus	25		
											Pinus	70		
13	7.05	8.45	1.40	Kandy	Wariyagala				Private	Tea plantation (0.60km) & Forest plantation (0.80km)	Tea	5		
											Pinus	56		
											Rath kaliya	4		
											Mara	2		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Nº of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	Nº of Affected Household	Nº of affected IP households (if any)
	From	To												
14	8.45	9.85	1.40	Kandy	Nillamba				Private Private	Home gardens (0.25km) & Forest (1.15km)	Na-lbul	3		
											Acacia	4		
											sabukku	3		
											Coconut	5		
											Mahogany	6		
											Sadikka	3		
											Jackfruit	1		
											Sapu	4		
											Na-lmbul	5		
											Acacia	4		
15	9.85	10.10	0.25	Kandy	Nillamba				Private	Home gardens (0.25km)	sabukku	6		
											Pinus	19		
											Avocado	4		
											Rambutan	5		
											Coconut	4		
											Mahogany	3		
											Sadikka	2		
											Jackfruit	1		
											Sapu	4		
											Avocado	5		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
16	10.10	11.00	0.90	Kandy	Halwatte				Private	Home gardens & Scrublands (0.25km) & (0.65km)	Alstonia	4		
											Coconut	3		
											Mahogany	2		
											Sadikka	1		
											Jackfruit	4		
											Weralla	4		
											Kekilla	13		
											Dawata	4		
											Walsuriyak-antha	12		
											Acacia	3		
											Pinus	13		
											Sabukku	1		
17	11.00	12.00	1.00	Kandy	Palle Delthota				Private	Home gardens & Agricultural (0.60km)	Karabuneti	4		
											Sadikka	3		
											Alstonia	5		
											Coconut	12		
									Private	(0.40km)	Mahogany	4		
											Mango	5		
											Jackfruit	4		
											Paddy			

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	N° of Affected Household	N° of affected IP households (if any)
	From	To												
											Areca nut	12		
18	12.00	13.2	1.20	Kandy	Palle Delthota				Private	Home gardens & Agricultural (0.80km) (0.40km)	Alstonia	5		
											Lunumiddella	2		
											Sabukku	10		
											Eucalyptus	8		
											Pinus	7		
											Sadikka	2		
											Jackfruit	2		
											Paddy			

*Galmadu Junction-Akkaraipaththu- Pothuvil 33 kV.*

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N <sup>o</sup> of Affected Household	IP N <sup>o</sup> of affected households (if any)
	From	To												
1	0.00	3.05	3.05	Ampara	Waripathanchanai				Private	Agricultural (2.85km) & Home garden (0.20km)	Paddy			
											Kohomba	3		
											Coconut	2		
											Mango	4		
											Siyambala	1		
2	3.05	6.20	3.15	Ampara	9th Mile post, Ilukhena				Private	Agricultural (2.95km) & Home garden (0.20km)	Paddy			
											Kottamba	1		
											Arcea nut	2		
											Pullun	1		
											Mango	1		
											Siyambala	1		
											Kohomba	4		
											Coconut	2		
3	6.20	7.40	1.20	Ampara	8th Mile post, Ilukhena				Private	Agricultural (1.00km) & Home garden (0.20km)	Paddy			
											Kapok	1		
											Mango	1		
											Siyambala	1		
											Kohomba	4		



SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimmng	N° of Affected Household	IP N° of affected households (if any)
	From	To									Tal	2		
4	7.40	8.25	0.85	Ampara	Sinhapura				Private	Agricultural (1.20km)	Paddy			
5	8.25	9.75	1.50	Ampara	8th Mile post, Mohinipura				Private	Agricultural (1.50km)	Paddy			
6	9.75	14.60	4.85	Ampara	Mottalakattu				Private	Agricultural (4.85km)	Paddy			
7	14.60	15.40	0.80	Ampara	3.5 km away from Akkaraipattu town				Private	Agricultural (0.80km)	Paddy			

**33 kV 42 km Distribution Line from Akkaraipattu to Pothuvil**

Sl No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	No of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	No of Affected Household	No of affected IP households (if any)
	From	To												
1	0.00	3.90	3.90	Ampara	Kannakipuram				Private	Agricultural (3.8km) & Marshland (0.10km)	Paddy			
2	3.90	8.45	4.55	Ampara	Near start point of Alikambe road				Private	Agricultural (4.50km) & Marshland (0.05km)	Paddy			
3	8.45	9.15	0.70	Ampara	Sagamam				Private	Agricultural (0.55km) & Rock out crops (0.15km)	Paddy			
											Kohomba	2		
											Himmbutu	1		
											Milla	5		
											Welan	4		
4	9.15	10.65	1.50	Ampara	Sagamam				Private	Agricultural (1.50km)	Paddy			
5	10.65	14.20	3.55	Ampara	Karaikalapu				Private	Agricultural (3.55km)	Paddy			
6	14.20	15.70	1.50	Ampara	Kannchirankuda				Private	Agricultural (1.50km)	Paddy			

Sl N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
7	15.70	19.05	3.35	Ampara	Kannchirankuda				Private	Agricultural (3.30km)	Paddy			
8	19.05	20.60	1.55	Ampara	In front of Thandiedi kalapu				Private	Agricultural (1.05km) & Scrubland (0.50km)	Paddy			
											Kohomba	3		
											Hibutu	1		
											Milla	2		
											Welan	3		
											Araminiya	3		
9	20.60	22.25	1.65	Ampara	Kanchikudichchiaru				Government	Scrubland (1.45km)	Kohomba	3	-	-
											Hibutu	2		
											Milla	5		
											Welan	4		
											Araminiya	2		
											Ficus	2		
											Weera	2		
											Ehala	4		
											Wood Apple	3		
											Ahala	2		
											Ranawara	1		

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	N <sup>o</sup> of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming	N <sup>o</sup> of Affected Household	N <sup>o</sup> of affected IP households (if any)
	From	To												
											Tal	4		
											Radaliya	4		
											Lolu	3		
											Hik	6		
											Teak	4		
10	22.25	28.65	6.40	Ampara	Near Komari Kalapu				Government & Private	Agricultural (1.05km) & Scrubland (5.35km)	Paddy			
											Hibutu	3		
											Milla	2		
											Welan	4		
											Araminiya	2		
											Ficus	1		
											Weera	1		
											Ahala	3		
11	28.65	33.70	5.05	Ampara	Near Ureni Kalapu				Government	Marshland (0.75 km) & Scrubland (4.30km)	Palu	1		
											Kohomba	9		
											Hibutu	12		
											Milla	13		
											Welan	16		
											Araminiya	9		
											Ficus	3		

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	N° of Towers	Area of tower m <sup>2</sup>	Area under the ROW m <sup>2</sup>	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming	N° of Affected Household	N° of affected IP households (if any)
	From	To												
											Weera	4		
											Ahala	8		
											Wood Apple	2		
											Palu	2		
											Ranawara	3		
											Radaliya	5		
											Lolu	6		
12	33.70	34.95	1.25	Ampara	Rotai wewa housing scheme				Government & Private	Agricultural (1.00km) & Scrubland (0.25km)	Paddy			
											Ahala	4		
											Ranawara	1		
											Radaliya	2		
											Lolu	1		
											Tal	3		
											Kohomba	3		
13	34.95	39.15	4.20	Ampara	Near tamarakulam Wewa				Private	Agricultural (4.20km)	Paddy			
14	39.15	39.85	0.70	Ampara	300m away from Police station				Government & Private	Agricultural (0.70km)	Paddy			

## **A 14. Annex 14: Summary of Initial Environment Examination Report**

### **1.0 The Project**

1. ADB is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement with a focus to identify the transmission and distribution projects for evacuation of renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.
2. The project components are provided in Section 3.1 of the main report.

### **1.1 Transmission Projects**

3. The selected lands for New Politipitiya, Padukka and Kegalle GSS are located in private rubber plantation and paddy fields respectively. These lands will be purchased at market rates and acquisition of land will not be required from the surrounding communities. The proposed Mannar and Kegalle GSS lands are paddy fields, there is no need for removal of trees involved; however, for New Politipitiya and Padukka GSS, the rubber plantation at the site will need to be cut. The Mannar GSS land which is a paddy field that belongs to the Irrigation department. Larger extent of proposed transmission line from Politipitiya-New Politipitiya (10 km), New Politipitiya to Pannipitiya line (58.5 km), Athurugiriya-Padukka (12.5 km) as well as the Kegalle to Thulhiriya GSS (14 km) runs through paddy fields, rubber cultivated lands, uncultivated lands and a lesser extent runs through human settlements. Athurugiriya to Kolonnawa (15 km) will be rebuilt on the same existing route and runs through populated areas. Larger extent of proposed transmission line from Mannar to Vavuniya (70 km), Vavuniya to New Anuradhapura (55 km) runs through paddy fields, forest areas, cultivated/uncultivated lands and with very small section through human settlements. Some section of Vavuniya-Mannar line passes outside the boundary of the Giant Tank Sanctuary, skirts through the boundary (2 km long) of the Madhu Road Sanctuary and forest reserves parallel to the existing road network. All the forest reserve areas traversed by the line are degraded forests, which were cleared during the conflict period.

### **1.2 Distribution Projects**

4. The selected 250 sq. m. plot of land required for gantry based switching stations for Kahatagasdigiliya, Galaha, Akkaraipaththu and Pothuvil will be based on government lands. Whereas, the Kebithigollewa land is private which will be purchased at market rates and acquisition of land will not be required from the surrounding communities. The Vavuniya-Kebithigollewa 33 kV line (23 km) passes two forest reserves (Kapundkalipulam and Padaviya), home gardens, paddy fields and crosses the Sinnapuluk Kulam and Dutuwewa dry zone tanks. The Kiribathkumbura-Galaha 33 kV line (15 km) is based in hilly region through home gardens, tea gardens, paddy, pinus and rubber plantations; New Anuradhapura to Kahatagasdigiliya (31 km) 33 kV passes through paddy fields, home gardens, chena lands, scrub jungle and secondary forests; the Galmadu Junction-Akkaraipaththu 33 kV line (18 km) passes through densely populated area, home gardens, paddy fields, and degraded lands; whereas the Akkaraipaththu-Pothuvil 33 kV line (42 km) passes through paddy fields, home gardens, edge of tanks (Komari and Paladi), scrublands and degraded lands. All the forest reserve areas traversed by the lines are degraded forests which were cleared during the conflict period.

### **1.3 Rooftop Solar Projects**

5. The government buildings identified for the purpose of developing solar rooftop power generation pilot subprojects include some key universities, including those with engineering departments, namely University of Moratuwa (Colombo, Western province), University of Peradeniya (Kandy, Central province), and University of Ruhuna (Galle, Southern province). Besides the above, three subproject sites are proposed at Jaffna include Central Hospital, Jaffna Hospital Building and one Hostel for Medical Students; and the other two on private buildings - Damro Showroom and Sri Nathiya Commercial Building in Jaffna (Jaffna, Northern province). The expected solar power generation capacity to be developed at each of these locations would be around 50 kW. The subprojects would be developed based on the net metering concept. The subprojects in universities of Moratuwa and Peradeniya may be extended for solar power research.

### **2.0 Assessment of Legal Framework and Policy**

6. A large number of recurrent and non-recurrent activities under establishment of power

transmission/distribution lines, sub-stations and solar rooftop PV generation units are presently not covered by the National Environmental Act (NEA). Applicable laws and regulations, which are necessary for the proposed project activities, are listed in the project's IEEs.

7. Based on the CEA (Central Environmental Authority) guidelines of GoSL, the proposed transmission projects are categorised as “prescribed”, whereas the distribution projects are categorised as “unprescribed”. The IEE reports are prepared for the transmission projects for which CEB will seek Terms of Reference (ToR) for preparing the EIA in prescribed format from CEA for seeking approval and the environmental clearances for the transmission projects from relevant PAA. Distribution projects do not require such permissions from the CEA. The rooftop solar project involves only installation of solar panels on existing buildings, there is no impact associated with this component. In accordance with the ADB’s Safeguard Policy Statement 2009 (SPS 2009), the proposed project is categorised as category B. Thus, a full Environmental Impact Assessment (EIA) for the project is not required.

### **3.0 Anticipated Environmental Impacts**

8. Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed project development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

9. The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- Significant improvement of the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact.
- Removal of trees for maintaining the safety clearance from the transmission/distribution lines is the main negative impact to the proposed project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.
- There may be loss of agricultural productivity due to obstruction and reduction of the land of paddy fields, coconut trees, rubber plantations, and tea gardens.

10. Benefits far outweigh negative impacts - The proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to both the local areas and regions will boost economic development of the area by strengthening the power transmission infrastructure. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

11. Potential adverse environment impacts associated with transmission/distribution lines have been avoided or minimised through careful route selection. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignments passes through scrublands, cultivated paddy fields, rubber cultivations, rubber plantations, tea cultivations etc. The lines will also pass through degraded forest areas but avoid any national park or sanctuary. For transmission, minor alignment passed through outskirts of the proposed Madhu Road Sanctuary extension. For distribution, land will only be purchased/acquired for one gantry based switching station but no land will be required for placing distribution towers on private land. The alignments in this project have also avoided marshy lands and geologically unstable areas, which can also pose foundation related problems. No land acquisition is required for placing transmission/distribution towers on private land. However, any damage to the crops during the construction phase of the project will be compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will not be lost permanently at the base of the tower. After construction, agricultural land within the transmission/distribution corridors can be used again for farming purpose except for growing trees, which

are above 3m in height.

12. Various mitigation measures to be taken prior to the project activities are listed in the project's IEEs. This SIEE (Summary Initial Environmental Examination) summarises the following two IEEs and one Environmental due diligence report prepared for the three components of the project:

- IEE Report for power transmission development component, 07 June 2012,
- IEE Report for distribution system improvement component, 03 June 2012, and
- Environmental due diligence report for roof top solar component, June 09, 2012.

### **3.1 Environmental Issues associated with design and pre-construction stage**

#### **Impacts on Temporary Use of Land**

13. The mobilisation of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labour camps for human resource to avoid environmental impact and public inconvenience. These locations must comply with the local laws and regulations and need approval from authorities to utilise these facilities (access roads, telecommunication, and pipe borne water supply etc.). It is important that selection of temporary lands is at least 500 m away from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats, and residential areas. Removal of trees and green cover vegetation should be minimised during preparation of access road and other facilities.

#### **3.2 Environmental Issues Associated with Construction and Operation Stage**

14. The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to line erection. For substation, it will involve excavation for building and equipment foundations, civil works and erection of equipment. During the operation phase, most of the construction phase impacts will get stabilised and the impacts will be restricted only to the operation and maintenance of the project.

##### **3.2.1 Impact on Topography**

15. The most prominent impact on the surface topography will be due to the removing of the trees at the tower erection site and all along the Right of Way (RoW) for construction facilitation. This will lead to change in the surface features only. The impact will be irreversible, as the present features along the RoW will be changed due to presence of the transmission line.

16. No topographical changes are envisaged during the operation phase of the transmission/distribution line, GSS, distribution gantry, and solar rooftop. The existing access routes will be utilised during the operation and maintenance of the transmission/distribution lines.

##### **3.2.2 Impact on Climate**

17. The study area along the RoW is predominantly tea/coconut/rubber/paddy plantation and home gardens in the project area. However, impact on the climate conditions from the proposed projects both during the construction and operation phases will not be significant.

##### **3.2.3 Impact on Air Quality**

18. During the construction phase, the activity would involve excavation for the tower erection, movement of transporting vehicles carrying the construction materials etc. along the haul road (through un-built roads, but not maintained). At majority of locations, movement of heavy vehicle is not possible; from approach road to construction site material will be taken in smaller vehicles. All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site which although will be transitory in nature. Sprinkling of water during excavation will reduce the dust emission to a great extent.

19. The construction of lines, GSS, distribution gantry, and solar rooftop panels will have a temporary negligible impact on the air quality of the region during the operation phase.

##### **3.2.4 Impact on Noise Levels**

20. During the construction phase, the major sources of noise pollution are movement of vehicles transporting the construction material and equipment to the site. Most of the access roads along the alignment are motor able. The major work of the construction is expected to be carried out during the daytime. The noise produced during the construction will have negligible impact on the residents, as the



predominant land use along most part of the alignment is plantations area. There will be very limited presence of population being exposed to noise generated during the construction phase.

21. Various mitigation measures to keep noise and vibration to an acceptable level during construction phase are listed in the project's IEEs.

22. During the operation phase of the project, there may be corona noise from the conductors which will be felt only up to 15 to 30 m area, hence the ambient noise level meets the CEA standard for residential areas during daytime and night time.

### **3.2.5 Impact on Surface Water Quality**

23. The construction and operation of the power lines will not have any major impact on the surface and ground water quality in the area. Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site joining the water body. There may be increase in the turbidity levels temporarily where the proposed alignment is crossing and if the surface runoff during construction meets the river. This can be avoided by careful selection of the tower site and the access roads so that the surface runoff does not meet the river.

24. Proposed activities will create temporary impacts to the existing drainage system in the area including irrigation canals, natural flow paths, and line drains. Thus, it will create temporary inundation closer to the above locations during rainy season. Stagnation of water will create temporary breeding sites to mosquitoes, which will have direct impact on public health. Various mitigation measures to minimise anticipated impact due to obstruction of natural flow paths and existing drainage are listed in the project's IEEs.

25. Care shall be taken to locate the temporary construction worker sheds away from the water bodies. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

### **3.2.6 Impact on Ground Water Quality**

26. Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. For transmission line construction activity, no chemical substance or oil is used hence there is no impact on ground water quality. The silt discharge from the earthwork around water bodies, oil, grease, and fuel release from the construction vehicles/equipment and spoil from construction, and other construction related activities such as raw sewerage from worker accommodation sites will mix with runoff water. This situation will increase during the rainy season and have a critical impact on surface and ground water. Various mitigation measures to prevent deterioration of water from the construction and construction related activities are listed in the project's IEEs.

### **3.2.7 Impact on Soil and Geology**

27. Project activities including excavation, cut and fill operations, removal of trees and green cover vegetation etc., will enhance the soil erosion during the rainy season. Removal of trees and green cover vegetation will reduce infiltration rate of rainwater. The impact on soils will be due to the soil erosion at the tower construction sites along the access routes. The excavation activity and land clearance the erosion prone areas have been minimised while conducting the site selection for towers. Levelling and stabilisation of tower construction sites will be done after completion of construction activity. It will also increase acceleration of surface runoff and damage to the topsoil. Various mitigation measures to minimise the impact associated with landslides due to excessive erosion and other civil works are listed in the project's IEEs.

### **3.2.8 Impact on Ecological Resources**

28. Although Mannar-Vavuniya transmission line avoids the Giant Tank Sanctuary, the line traverses the outskirts of the proposed extension of Madhu Road Sanctuary, and few forest reserves. However, for other lines, GSSs, distribution gantry and solar rooftop, none of the declared environmentally sensitive areas is located within the project-affected area. The ecological impacts are briefly described in the following sections.

#### **Effect on Flora and Fauna**

29. The study area for route alignment has forest and plantations areas. Considerable amount of trees will be removed from the project area for right of way (RoW) - 35 m for 220/132 kV transmission line and 20 m for 33 kV distribution line. It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. However, noise, vibration and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner. Except the removal of trees for ROW, the impacts related to above activities are temporary and various mitigation measures are listed in the project's IEEs.

#### **Impact on Terrestrial Ecology**

30. There is no sensitive ecological area crossing the proposed route alignment. The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimised through adoption of mitigation measures like paving and surface treatment and water sprinkling.

#### **Removal of Trees**

31. Approximately 4,100 forest and 26,600 fruit/non-fruit/plantation trees will be removed during the construction of transmission/ distribution lines. The initial construction works along the alignment involving land clearance, cutting, filling and levelling may cause loss of vegetation. This will be an irreversible impact. Care has been taken to avoid the thick plantations/vegetation as far as possible and tower locations are selected at plain paddy fields where the vegetation is thin. This will minimise the tree loss. Compensation will be paid to the tree owners in the private areas as per GoSL norms. Clearing of plantations and forest area is involved along the route alignment; hence, the compensatory afforestation is required for forest areas for which clearance will be obtained from the forest department.

32. During operation phase, corridor along the alignment will be chopped of vegetation and lopping of trees will be done for maintenance purpose. This will also reduce the chances of fires due to electric sparks.

#### **Effect on Local Road Network**

33. Transformers, tower material, substation equipment, iron bars, concrete materials, solar panels, other equipment will be transported through the provincial and local road network to the project site. Transporting of large quantities of materials using heavy vehicles could exceed the carrying capacity of the road. This would lead to physical damages to local road network. Thus, it will be necessary to obtain consent from Road Development Authority (RDA) or Provincial Road Development Authority (PRDA) to use local roads prior to transportation. In addition, the contractor should properly maintain all road sections, which will be utilised for the construction related activities.

#### **Disposal of Debris**

34. Because of construction related activities, spoil and debris will be generated during the construction stage. Improper disposal of the debris will have an impact on the surrounding ecology, public health and scenic beauty. Various mitigation measures to minimise the impacts associated with disposal of debris are listed in the project's IEEs.

#### **Wild Life**

35. For selecting the route alignment, wild life travel routes have been avoided as far as possible, although the elephant corridors exist in Mannar, Vavuniya areas along the route alignment of transmission/distribution lines.

#### **Impact on Aquatic Ecology**

36. No significant impacts on aquatic ecology of the river are envisaged, as there will be careful selection of the tower sites near the river, to avoid the river pollution and disturbance to the aquatic fauna of the area.

### **3.2.9 Health and Safety**

37. Health and safety impacts will be in terms of risk of accidents. Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor. Personal protective equipment like safety gloves, helmet, mufflers etc. will be provided during construction period and during

the maintenance work. First aid facilities will be made available with the labour gangs and doctors called in from nearby towns when necessary. Workers are also covered by the statutory workmen compensation as per GoSL laws by the contractor.

38. Project activities may create accidental damage to public and the construction workers. Therefore, contractors should take necessary action to enhance personal safety during the construction. Various mitigation measures are listed in the project's IEEs.

#### **Agriculture**

39. Permanent and temporary loss of agricultural land occurs due to tower location in the agricultural field and loss of crop for access route etc. There will not be any land acquisition for the tower erection. As far as possible, the prime agricultural land will be avoided and the construction will be done after crop harvesting. For GSS and distribution gantry, private and government lands will be used, thereby reducing some area for cultivation. Mannar and Kegalle GSS and some distribution gantries will be situated on paddy lands whereas the others will be on plantation area.

#### **3.2.9 Socio-Economics**

40. Construction of power infrastructure will generate local employment, as number of unskilled labour (men/women) will be required at the time of construction activities. Local employment during this period will increase socio-economic standards.

#### **Temporary Outage of the Electricity**

41. Temporary disconnection of power supply will occur during the construction activities. Thus public and the industrial places, which are located in project-affected area, will face inconvenience for short periods of time. Various mitigation measures are listed in the project's IEEs.

#### **Resettlement and Rehabilitation**

42. For the construction of transmission line, the lands required to be used for the GSS do not displace any resident and will be purchased on market prices. Since the land shall be purchased at market price, no land acquisition procedure would be required, hence there is no resettlement and rehabilitation involved in the project.

#### **Cultural Sites**

43. The New Anuradhapura-Vavuniya line passes 900 meter from the Mihintale Preservation Area in Anuradhapura. There are no archaeological, historical or cultural important sites along the route alignment of all other lines, GSS, distribution gantries, Solar rooftop, hence the impacts on these sites are not envisaged.

#### **Traffic and Transport**

44. During the construction phase, traffic disturbance needs to be minimised by avoiding high-density areas, using proper traffic signs, ensuring proper access roads and avoiding road blockage.

#### **Interference with Other Utilities and Traffic**

45. As per regulations enacted by GoSL, it is mandatory for CEB to seek clearance prior to construction from railways, telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of lines. The transmission lines affect nearby telecommunication circuits by causing electrical interference and induced voltage that may occur to nearby telecom circuit and suggested necessary protection measures will need to be adopted.

#### **Solid Waste Disposal**

46. The solid waste generation will be at the location of the tower erection site which will include metal scraps, wooden packing material etc. Wooden waste and metal scrap will be collected and disposed of in compliance with applicable regulations and rules.

#### **Sanitary Waste Disposal at Construction Sites and Labour Camps**

47. The labour camps at the site of tower erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labour will be staying will be near hamlets which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities, and drainage in the temporary sheds of the construction workers should be provided to avoid surface water pollution. Provision of adequate washing

and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

48. Unacceptable solid waste disposal practices such as open dumping of solid waste and poor sanitation facilities will lead to pollution of surrounding environment, contamination of water bodies and increase adverse impact to the aquatic; terrestrial lives and general public inhabited in the area. Surrounding of labour camps, garbage disposal sites and material storage yards provide favourable habitats for vectors of diseases such as mosquitoes, rats and flies. There should be proper solid waste disposal procedure to enhance sanitation of workers who stay in camps, thereby reducing possibilities of infecting water borne diseases or vector borne diseases (Parasitic infections). Various mitigation measures are listed in the project's IEEs.

#### **Liquid Waste Disposal**

49. There will be no oil or chemical waste generated during the construction of line, GSS, distribution gantry and solar rooftop panels, hence no mitigation is required.

#### **Electric Shock**

50. This may lead to death or injury to the workers and public in the area. This can be minimised or avoided by security fences around GSS, distribution gantry, and solar panels, establishment of warning signs; and careful design using appropriate technologies to minimise hazards.

#### **Noise Generation**

51. Nuisance to the community around the site can occur during the project implementation stage. Provision of appropriate noise barriers will be essential in this regard.

#### **Maintenance**

52. Possible exposure to electromagnetic interference could occur during these activities. Design of transmission/distribution line, GSS and gantry should comply with the limits of electromagnetic interference.

#### **Oil Spillage**

53. Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident. Substation transformers are normally located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities will be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season.

### **4.0 Environmental Impact Management for Project Activities**

54. The summary environmental impact matrix and the mitigation measures are given in the following table:

<b>Project Stage/Anticipated Impact</b>	<b>Mitigation Measures</b>
<b>A. Physical Resources</b>	
Topography Change in the surface features and present aesthetics due to the construction of the project.	The compensatory afforestation to be paid to Forest Department by CEB to minimise the impact of loss of vegetation as per existing norms under the Felling of Trees (Amendment Act N° 01 of 2000 and Act to Amend felling of trees control)
<u>Climate</u> No impacts on the climatic conditions	No impact on the climatic conditions, hence no mitigation is required
<b>B. Environmental Resources</b>	
<u>Air Quality</u> Project will have marginal impact on air quality during the construction period due to increase in the dust emission.	Watering at construction site, limited bare soils, maintenance of vehicles etc.
<u>Noise</u> Noise due to general construction activities. Noise from erection of rooftop solar panels.	Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers etc.
Noise arising from corona noise from conductors	

Project Stage/Anticipated Impact	Mitigation Measures
<u>Surface and Ground Water quality</u> Runoff from the construction site Domestic wastewater from construction sites	Monitoring of possible corona noise to identify and correct problems  Careful siting of towers and access roads Domestic waste treatment by providing septic tank/soak pits
<u>Soils and Geology</u> Soil erosion due to tower erecting and clearing of vegetation in the RoW and access roads.  Damage due to seismic activity	Avoiding sites, which are prone to the soil erosion. Levelling of tower construction sites. Use of few access roads. Rehabilitation and stabilisation of disturbed land. Site selection and proper tower foundation design considering the geological conditions and seismicity of the area
<b>C. Ecological Resources</b>	
Terrestrial Ecology Loss of vegetation       <u>Terrestrial Fauna</u> Disturbance to the local fauna during construction  Disturbance to the local fauna during operation	Transmission: Location of towers at the forest and plantation area. Selection of few access roads. Compensation to the tree owners. The tree planting of equivalent amount of the trees cleared along the route alignment would be undertaken as per the directives/requirements of the Forest Department, and financed by CEB. Distribution: Compensation to the tree owners. Afforestation equivalent amount of the trees cut along the route alignment would be undertaken as per the directives/requirements of the Forest Department, and financed by CEB.  Wildlife routes and their habitats have been avoided as far as possible during the route selection. Monitoring of line especially for bird strikes during the operation and use of deflectors if required.
<u>Aquatic Ecology</u> No significant impacts envisaged	No mitigation required.
<b>D. Human Environment</b>	
Fires, explosion and other accidents at the route alignment of transmission line    <u>Health and Safety</u> Exposure to electromagnetic fields	Use of personal protective equipment during construction. By lopping and chopping of trees, fire hazards due to sparking will be avoided during maintenance period. Regular inspection of lines for faults prone to accidents.  Transmission: Alignment route away from the settlement. No mitigation required Distribution: MV lines do not cause too much EM fields.
<u>Agriculture</u> Permanent and temporary loss of agriculture land due to tower erection and due to access routes	Avoid prime agriculture land. Assessment of land required and compensation. Construction activity after crop harvesting and selection of few access routes
<u>Socio-economics</u> Beneficial impacts from rural and urban electrification. Job opportunities during construction phase Resettlement of the house falling along the RoW	Unskilled labour and indirect benefits. Overall economic growth of the region Route alignment is selected in such a way that there is no resettlement issue
<u>Cultural sites</u> No archaeological, historical or cultural important sites	No archaeological, historical or cultural important sites

Project Stage/Anticipated Impact	Mitigation Measures
are affected by the construction of the lines	are affected, hence no mitigation required
<u>Traffic and Transportation</u>	
Traffic congestion due to movement of construction vehicles	Avoid high density traffic areas, proper traffic signs at the construction site, ensuring proper access roads
<u>Solid Waste Generation</u>	
Probability of surface and ground water pollution	Separated wooden and scrap will be collected and disposed of in compliance with applicable regulations and rules

## 5.0 Environmental Management Plan Costs

55. The indicative estimated costs for EMP implementation of these components has been taken as 2-4% (which are project specific) of the total base project cost which has been included by CEB in their proposals to ADB.

### 5.1 Associated Power Generation Facilities

56. The transmission lines evacuate power from the Laxpana and Mahaweli Hydro electric power (HEP) complexes which have been the main backbone for electric power generation in Sri Lanka since the early 1960's and late 1980's consecutively. The Laxapana HEP complex consists of following power plants - Canyon (2 x 30 MW), Wimalasurendra PS (2 x 25 MW), Old Laxapana (3 X 8.33 MW+ 2 x 12.5 MW), New Laxapana (2 x 50 MW), and Polpitiya (2 x 37.5 MW). From Laxapana HEP complex, following main existing transmission lines evacuate power – i). Polpitiya–Kollonnawa 132 kV Line 1 and 2, 3, and 4, ii). Laxapana–Balangoda–Galle line 132 kV line 1 and 2, Balangoda–Embilipitiya–Hambantota 132 kV line 1 and 2, and Laxapana–Badulla 132 kV line 1 and 2 and Badulla Ampara 132 kV line 1. The Mahaweli HEP complex consists of following power plants, Victoria PS (3 x 70 MW), Kotmale PS (3 x 67 MW), Randeinigala (2 x 61 MW), Rantambe (2 x 24.5 MW), Ukuwela (2 x 19 MW) and Bowathanna (1 x 40 MW). From Mahaweli HEP complex following main existing transmission lines evacuates the power- i). Kotmale–Anuradhapura 220 kV line, ii). Kotmale–Biyagama 220 kV line, iii). Randenigala Badulla 132 kV line, whereas Randenigala–Mahiyangana 132 kV line, and Mahiyangana–Vaunativu–Ampara 132k V line are committed projects.

57. Mul Oya (5 MW) mini hydro power (MHP) project is currently under construction as per the GoSL policies for MHPs in Sri Lanka being administered by Sri Lanka Sustainable Energy Authority (SEA).

### 6.0 Institutional Arrangements and Responsibilities

58. According to the National Environmental Act (NEA), there exists a mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for any kind of power plants of prescribed capacity and transmission lines over 50 kV in capacity, and above 10 km in length. In most cases, Central Environmental Authority (CEA) designates the Ministry of Power and Energy as the PAA for the environmental approval process for transmission line. Therefore, the Ministry of Power and Energy has established an environment cell in the Planning Division to implement the requirements of NEA. CEB has set up a Design & Environment Division (D&ED) for dealing with environmental issues at the corporate level to monitor and implement environmental good practices.

59. The D&ED will be responsible for implementing safeguard issues associated with the Project through the Project Implementation unit (PIU). During the construction and operation phase of this project, the monitoring of the environmental aspects shall be done by D&ED. During the construction phase, the contractor should ensure that activities like handling of earth works clearing work, access road construction, putting traffic signals is done properly to have minimum impact. This in turn should be monitored by the Engineer-in-Charge of the individual transmission line/substation project.

60. For the solar rooftop component, the projects on the public buildings/universities will be developed on a (public private partnership) PPP mode through allocation of an investment grant portion by the government for installing solar rooftop power generation on selected university buildings. The financing of by private sector solar rooftop projects will be undertaken by providing credit to eligible private developers from a credit line as part of the project loan. SEA will be supported by project management consulting services to ensure effective implementation and monitoring of the pilot project and contribute to capacity building in SEA. It is proposed to finance these consulting services (one national consultant for



24 person-months) from the grant proceeds.

**61. Environmental Monitoring Plan (EMoP)**

62. In addition to the EMP, to ensure that project would not be generating a negative impact to the overall environment quality, an EMoP will be prepared. The monitoring activities of the project include site supervision, verification of permits, monitoring of water quality, soil, noise and air. Monitoring of the quality of water, soil, air and noise during the construction stage is a responsibility of the contractor by the approved government agency. PIU and Environmental and Social staff will supervise the contractor. The environmental monitoring report will be submitted by the PIU to the PMU, which will include the result of environmental monitoring into its environmental report.

63. As per ADB's safeguards Policy 2009, ADB requires the borrower to retain external qualified experts or qualified NGOs to verify monitoring reports of the projects with significant impacts and risks. This external monitoring report will be on a semi-annual basis directly to ADB to verify whether sound environmental management practices are applied, and the set environment targets are achieved. In case the implementation of EMP measures is not satisfactory, this external monitoring experts/NGO will recommend actions to enhance environmental compliance.

**7.0 Public Consultation and Information Disclosure**

64. In line with National Environmental Act (2002) in Sri Lanka, public consultation and information disclosure will be undertaken through public notice prior to the approval by CEA for the relevant projects. According to ADB SPS 2009, public consultation and information disclosure is to be during the initial stages by the client itself. This activity supports the view to understand the public's perception of the project and respond to their concerns and suggestions during the early stages of the project design. Incorporation on the environmental concerns to the decision making process through the public consultation will avoid or minimise conflict situation during the implementation process.

65. Public consultations were conducted in project-affected area between 15 March to 10 May 2012. The community aired their opinions freely on the project, its impact, and suggestions for mitigating adverse impacts. People participated in voluntary public consultation sessions to express their views about the proposed project.

**8.0 Grievance Redress Mechanism**

66. The community should be informed about the Grievance Redress Mechanism (GRM), procedure for making complaints, including the place and the responsible person to contact which is already established by the Public Utilities Commission of Sri Lanka (PUCSL). Almost all the stakeholders related to the GRM will also be aware of the established grievance process, the requirement of grievance mechanism, goals, benefits, relevant laws regulations etc. PUCSL Act lays down procedures for Grievance Redressal for activities of an industry overseen by PUCSL. This mechanism will remain active throughout the life cycle of the project. PUCSL's mission is to regulate all the utilities within the purview of the PAAs, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner.

67. Grievances not settled as per the above PUCSL's standard mechanism will be brought to the Grievance Redress Committee (GRC). The GRC will have representatives from APs, CEB, MoPE, Divisional Secretary, Land Officer under each divisional secretary, field level staff, and local community – where necessary. The main responsibilities of the GRC will be to: (i) provide support to APs on problems arising from land/property acquisition, if any; (ii) record AP grievances, categorize, and prioritise grievances and resolve them; (iii) immediately inform the EA/IA of serious cases; and (iv) report to APs on developments regarding their grievances and the decisions of the GRC and the PIU. The GRCs will continue to function during the life of the Project loan including the defects liability period.

## A 15. Annex 15: IEE - Power Transmission Development Component

### Executive Summary

ADB is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement with a focus to identify the transmission and distribution projects for evacuation of renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.

The transmission components of the Clean Energy and Network Efficiency Improvement project include:

- Component A: Transmission Projects.
- Transmission System Strengthening in Mannar region.
- New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.
- Padukka 220/132/33 kV GSS and associated transmission line.
- Construction of 132/33 kV GSS at Kegalle.
- Installation of reactive power compensation devices.

The selected lands for New Politipitiya, Padukka and Kegalle GSS are all located in private rubber plantation and paddy respectively. The Mannar GSS land partly belongs to the Irrigation department. These lands will be purchased at market rates and acquisition of land will not be required from the surrounding communities. For Mannar and Kegalle lands are paddy fields, there is no need for removal of trees involved; however, for New Politipitiya and Padukka GSS, the rubber plantation at the site will need to be cut. Larger extent of proposed transmission line from Politipitiya-New Polipitiya (10 km), New Politipitiya to Pannipitiya line (58.5 km), Athurugiriya-Padukka (12.5 km) as well as the Kegalle to Thulhiriya GSS (14 km) runs through paddy fields, rubber cultivated lands, uncultivated lands and lesser extent runs through human settlements. Athurugiriya to Kolonnawa (15 km) will be rebuilt on the same route and run through populated areas. Larger extent of proposed transmission line from Mannar to Vavuniya (70 km), Vavuniya to New Anuradhapura (55 km) runs through paddy fields, forest areas, cultivated/uncultivated lands and with very small section through human settlements. Some section of Vavuniya-Mannar line passes outside the boundary of the Giant Tank Sanctuary, skirts through the boundary (7 km) long to the Madhu Road Sanctuary and forest reserves parallel to the existing road network. All the forest reserve areas traversed by the line are degraded forests, which were cleared during the conflict period.

Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed project development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts, that could not be specified or identified at this stage, are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- Significant improvement of the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact.
- Removal of trees for the transmission line is the main negative impact to the proposed project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.
- There will be loss of agricultural productivity due to obstruction and reduce the land of paddy fields as well as cutting of home gardens of coconut and rubber trees which will be compensated based on established rates by CEB.



Benefits far outweigh negative impacts - The proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to both the local areas and regions will boost economic development of the area by strengthening the power transmission infrastructure. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

Various mitigation measures to be taken prior to the project activities are listed in the project's IEEs. Potential adverse environment impacts associated with transmission lines has been avoided or minimised through careful route selection. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignment passes through scrublands, cultivated paddy fields, rubber cultivations, rubber plantations, tea cultivations etc. The lines will also pass through degraded forest areas but avoid any national park or sanctuary. Minor alignment passed through outskirts of the proposed Madhu Road Sanctuary extension. The alignments in this project have also avoided wetlands and geologically unstable areas, which can also pose foundation related problems. No land acquisition is required for placing transmission towers on private land. However, any damage to the crops during the construction phase of the project will be compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will not be lost permanently at the base of the transmission tower. After construction, agricultural land within the transmission corridors can be used again for farming purpose.

Since the project does not involve activities that have significant adverse impact, an initial assessment been done to determine the extent of impact as per the ADB's Safeguard Policy Statement 2009 guidelines. Accordingly, the environmental classification for the sub-project component is "Category B". The IEE report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>30</sup> and the ADB Safeguard Policy Statement 2009.

## 1 INTRODUCTION

1. Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces. Asian Development Bank's (ADB) focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka.

2. The power sector has undergone significant policy level and structural changes in the recent past:

- Sri Lanka Electricity Act passed in parliament in 2009;
- Assumption of the role of electricity regulator in April, 2009 by the Public Utilities Commission of Sri Lanka (PUCSL);
- Creation of Functional Business Units (FBU's) within the CEB with one unit each for generation and transmission and 4 geographical units for distribution function; and
- All FBU's have been issued licenses by the Public Utilities Commission of Sri Lanka (PUCSL) and they have been filing the tariff petitions since 2010.

3. In January 2011, ADB approved the Sustainable Power Sector Support Project with focus on Clean Energy and Access Improvement Project with focus on transmission system strengthening, rural electrification and distribution improvement, energy efficiency and renewable energy development etc.

4. ADB's involvement in the Power Sector Development Program has been consistent with its country partnership strategy for Sri Lanka which focuses on:

- Funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources,
- Improving energy efficiency and reliability by strengthening the transmission network,
- Expanding access to electricity by improving connectivity for the poor, and

<sup>30</sup>

ADB 2003: *Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines*, Manila.

- Mitigating climate change by financing clean energy projects and supporting energy efficiency initiatives.

5. ADB is proposing to extend USD 130 Million loan to Sri Lanka's power sector for clean energy and network efficiency improvement. The specific focus of this assistance is to identify the transmission and distribution projects which could be funded through the proposed loan. The projects identified for the ADB financing are focused on evacuation projects for renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.

6. Sri Lanka's electricity industry is managed by the Ministry of Power & Energy (MoPE). All electricity utilities remain under direct or indirect state ownership, whereas, there is significant private sector participation in power generation. The institutions listed in Table 1 are active in the electricity industry whereas Table 2 lists the regulatory and facilitation agencies in Sri Lanka.

**Table 1: Institutions in the energy supply industry**

Institution	Functions and other information
<b>Government</b>	
Ministry of Power and Energy (MOPE)	Energy policy, project implementation and monitoring, supervision of state-owned electricity utilities.
Ministry of Petroleum and Petroleum Resource Development (MOPPRD)	Petroleum industry project implementation and monitoring, supervision of state-owned petroleum corporation, petroleum resource development and exploration.
<b>Electricity utilities</b>	
Ceylon Electricity Board (CEB)	State-owned corporation, engaged in power generation (one license, 23 power plants), transmission (one license), and distribution (four licenses, about 4.5 million customers).
Lanka Electricity Company (Pvt) Ltd (LECO)	State-owned company, engaged in power distribution (one license, 450,000 customers) along western and southern coastal regions.
<b>Independent Power Producers (IPPs)</b>	
Ten thermal IPPs to grid, two thermal IPPs in Jaffna mini-grid	Each IPP an individual company, eight diesel power plants and two combined cycles on the main grid, two diesel power plants on the Jaffna mini-grid.
About 100 small renewable energy IPPs (also known as Small Power Producers, SPPs)	Each SPP an individual company, small hydro (about 95), rice-husk (2), and waste-heat (1).
About 300 community small hydro-based distribution cooperatives	About 5000 households are served, in total.
About 120,000 solar home systems	Serving an equal number of households.

**Table 2- Regulatory and Facilitation Agencies**

Institution	Functions and other information
Sri Lanka Sustainable Energy Authority (SEA)	Policy, promotion and regulatory functions of (i) renewable energy (ii) energy efficiency, and (iii) energy planning, (iv) energy fund management.
Public Utilities Commission of Sri Lanka (PUCSL)	Infrastructure regulatory commission presently empowered to regulate (i) electricity industry (ii) bunker and lubricating oil industries. In future, Petroleum Industry regulation is likely to be assigned to PUCSL.

7. Ceylon Electricity Board (CEB) is a corporate body established for development and coordination of the generation, transmission, and distribution of electrical energy in Sri Lanka. It holds six separate licenses for these activities. The license for generation division caters for 66% of the power to the grid. The transmission network consists of 55 GSS (132/33 kV, 220/132/33 kV, 220/132 kV and 132 /11 kV) and 2,236 km of HV Lines (both 220 kV and 132 kV) approximately.

8. The island is divided into four regions for power distribution, supply and sales, where each distribution division holds a license. These distribution licenses cover more than 97% of the geography of Sri Lanka. Lanka Electricity Company Ltd. (LECO), which is a subsidiary of CEB, covers the remaining areas catering to 478,500 customers. Electricity Distribution Network of CEB consists of MV lines (33 kV and 11 kV), primary substations (33 kV/11 kV), distribution substations (33 kV/400 V and 11kV/400V), and LV lines (400V).

9. The proposed project will assist GoSL to develop a least-cost project implementation of the following project components: (i) transmission system strengthening to further improve its energy efficiency and enable rural electrification; (ii) distribution system improvement to expand access for the poor and rural household connection; and (iii) solar roof top and renewable energy component. The transmission component will include strengthening of the system in the Central, Eastern, and Northern parts of the country. It will also enable to address post-conflict electricity needs and bring cheaper

hydropower to the population in the Northern and Eastern parts of the country from the North, Northern Central, Colombo and Central Provinces through various transmission lines and substations.

### 1.1 Background

10. The Northern and Eastern Provinces are in urgent need of improving the infrastructure facilities and supporting services, which are prerequisites for accelerated development. The list of potential projects, which could be financed, has been finalized in discussion with CEB and MoPE. The criterion for shortlist of projects has been finalized in consultation with ADB and the benefits from identified projects established based on evacuation of clean energy (Solar, Wind, Small Hydro) and network efficiency improvement (loss reduction, voltage improvement, etc). The technical feasibility of the shortlisted projects has been evaluated based on CEB's long-term transmission plan as well as additional load flow studies conducted by transmission planning wing. Also, according to SEA's report "Renewable Energy Resource Development Plan 1/2012", a total wind capacity of 1010 MW is likely to be available for grid electricity generation in Sri Lanka by the Year 2020. In order to harness the wind power potential in Mannar and other regions, a Wind Integration Study has been carried out by Grontmij A/S Denmark under World Bank TA. The objective of the study was to analyse the operational implications and cost associated with integrating the maximum prudent level of wind power penetration that the Sri Lankan electricity system can absorb up to year 2020. The final report, prepared in October 2011 recommends maximum prudent level of wind power capacity up to the year 2020 as 643 MW. A detailed review of the transmission sector projects which are currently under implementation as well as those which have been completed in recent past were studied to understand the key issues related to technical, project monitoring, time and cost overruns concerning the implementation of these projects. There are no technical issues concerning the implementation of the projects as CEB has fairly well established guidelines for implementation process.

### 1.2 Scope of Work and Methodology Adopted

11. The broad scope of the Environmental Assessment study is:

- i. To conduct field visits to collect data relevant to the study area and also collect secondary data so as to establish the baseline environmental status of the study area;
- ii. To assess the impacts on environmental attributes due to the location, design, construction and operation of the proposed project;
- iii. To prepare a mitigation plan outlining the measures for protecting the environment including institutional arrangement and environmental monitoring;
- iv. To identify critical environmental attributes required to be monitored subsequent to the implementation of the proposed project;
- v. To carry out consultation with local people so as to identify the public perception of the project; and
- vi. To establish the Environment Monitoring Plan (EMoP) for the CEB to submit environmental monitoring reports to ADB at regular intervals.

12. This report is prepared on the basis of survey, field study and with the help of available secondary data. The alignment of line may slightly vary after the exact demarcation of tower location. Accordingly, the field surveys were undertaken to assess physical and biological environment. Detailed assessment of the baseline environment has been conducted for the distance up to 500 m on the either side of proposed alignment and data collection from secondary source has been done to support the findings of the field survey. The field studies were supported by data collected from secondary sources such as internet, forest atlas.

13. The IEE report comprises baseline data on existing physical, ecological, economic, and social condition, together with the anticipated environmental impacts and proposed mitigation measures. Observations were made through transect walk along the proposed transmission line tower locations, as well as in and around the proposed premises for new GSSs from 15 March to 10 May 2012. Public consultations were held with the project affected communities, stakeholders, and government officers that relate to existing environmental conditions around the proposed transmission lines and substations and the potential impacts that could happen due to project implementation. In addition, secondary data was collected from published data from GoSL documents, 2001 population census statistics data, as well as from authorities such as CEB, MoPE and other departments.

14. Based on the CEA (Central Environmental Authority) Guidelines of GoSL, the proposed transmission projects are categorised as "prescribed". CEB will seek ToR for preparing the EIA in prescribed format from

CEA for seeking approval and the environmental clearances for the transmission projects from relevant PAA. An initial assessment has been done in this report to determine the extent of impacts as per the ADB's Safeguard Policy Statement 2009. This IEE report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>2</sup> and the ADB Safeguard Policy Statement (SPS) 2009. Accordingly, the environmental classification for the sub-project component is "Category B" and does not require an Environment Impact Assessment (EIA).

### 1.3 Applicable Environmental and other Legislations

15. A large number of recurrent and non-recurrent activities under establishment of transmission lines and substations are presently not covered by the National Environmental Act (NEA). Annexure 1 indicates the applicable laws and regulations, which are necessary for the proposed project activities.

## 2 DESCRIPTION OF THE PROJECT

### 2.1 The Project

16. The Transmission Components of the Clean Energy and Network Efficiency Improvement Project include:

Component A: Transmission Projects.

- I. Transmission System Strengthening in Mannar region.
- II. New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.
- III. Padukka 220/132/33 kV GSS and associated transmission line.
- IV. Construction of 132/33 kV GSS at Kegalle.
- V. Installation of reactive power compensation devices.

#### 2.1.1 Component A.I Transmission System Strengthening in Mannar region

17. SEA has conducted a preliminary wind resource assessment for the northern region. There is a requirement to evacuate upto 200 MW of the wind power generation in near future. Also, considering the rehabilitation of displaced population and some of the development plans envisaged for the region, there is likely to be an exponential growth in demand in near future. The existing demand in the Mannar region is fed by Lynx double circuit 33 kV lines with Reinforced Concrete (RC) poles from Vavuniya to Mannar. Accordingly, the proposed system would improve the voltage profile in the area as well as evacuate upto 200 MW of wind power from the region in future. The sub-project components include:

- I.1 Extension of 220 kV New Anuradhapura GSS.
- I.2 Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line on 220 kV tower line but charged on 132 kV.
- I.3 Augmentation of Vavuniya GSS.
- I.4 Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.
- I.5 Construction of 132 kV/ 33 kV Mannar GSS (1 x 31.5 MVA).

18. The 70 km Vavuniya-Mannar transmission line traverses outside the boundary of Giant's tank Sanctuary, outskirts of the proposed Madhu road Sanctuary extension and two forest areas (Puvarasenathikulam and Tonigala). It crosses paddy lands and home gardens close to the A30 and A14 highways towards Mannar Island in the Vauniya and Mannar districts. It also runs close to other habitats such as dry zone tanks, paddy lands, and home gardens, one stream to the Giant's tank and several irrigation canals. The proposed 2 Ha. Mannar GSS site is located in a paddy land that belongs to the Irrigation Department near the Giant Tank.

#### 2.1.2 A-II. New Polpitiya 220/ 132 kV GSS and associated transmission line.

19. The Laxapana complex and the Mahaweli Complex Hydropower plants have a combined installed capacity which exceeds 1000 MW.

20. Delivery of Clean energy from Laxapana Hydropower complex: The existing four circuits of 132 kV transmission lines from Polpitiya hydropower station to Kolonnawa Grid Substation evacuate power generated from Laxapana Hydropower Complex to the load centers in and around Colombo. However,

these lines are more than 40 years old and have severe limitations in the current carrying capacity. There is an urgent need to replace all the four circuits between Polpitiya and Kolonnawa to reduce shortages and excessive losses.

21. Delivery of Clean energy from Mahaweli Hydropower complex: Kotmale is the key hydropower plant in the Mahaweli complex. The Kotmale - Biyagama 220 kV transmission line evacuates power generated from hydropower stations in Mahaweli Complex to load centers in Colombo. The proposed New Polpitiya - Pannipitiya 220 kV transmission line would provide (i) a higher capacity interconnection between the Laxapana complex and the load centre, effectively replacing the older lines thereby improving the system reliability, and (ii) an alternative route to the Kotmale-Biyagama 220 kV transmission line, to deliver hydropower to the load centers in the Western province. Development of the New Polpitiya GSS will facilitate extension of the 220 kV transmission system to the Southern Province (SP) at a future date, which resolves most of the under voltage problems and line overloading problems in the southern transmission network. The sub-project components include:

- II.1 Construction of 220/132 kV New Polpitiya GSS which is about 10 km away from the existing Polpitiya GSS.
- II.2 Construction of 132 kV 10 km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.
- II.3 Provision of 2x220kV double bus transmission bays to connect New-Polpitiya-New Galle 220 kV transmission line.
- II.4 Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the exiting Pannipitiya grid substation.
- II.5 Augmentation of Pannipitiya GSS (2x220kV DB transmission line bays).

22. The proposed New Polpitiya GSS is situated within a rubber tree estate in Gonagamuwa village. The 10 km transmission line to New Polpitiya GSS traverses the rubber lands, home gardens, and secondary forests. The 58.5 km transmission line from New Polpitiya GSS to Pannipitiya GSS through Padukka traverses through urban areas near Pannipitiya, rubber lands, paddy fields, home gardens and some marshy area. No wildlife sanctuary, national parks or ecologically sensitive areas are present in the nearby area of RoW. The Peak Wilderness Sanctuary (22,379 ha) is about 10 km away from the line. The proposed alignment is crossing A4, A7 highways and B188, B189 and B408 roads.

#### **2.1.3 A-III. Padukka 220/132/33 kV GSS and associated transmission line.**

23. Hydropower from Laxapana complex would be evacuated through the new 220 kV line to Pannipitiya. Load centers presently served by Athurugiriya GSS and the Kolonnawa switching station would now have to be served from Kelanitissa thermal power plants. 132 kV Kolonnawa Switching Station serves major loads in Colombo area. The New Polpitiya – Pannipitiya 220 kV transmission line passes through Padukka. A 132 kV double circuit twin zebra line is proposed from the proposed Padukka GSS to existing Kolonnawa switching station via existing Athurugiriya GSS to transmit power generated at Laxapana hydropower complex to Kolonnawa Switching Station. The proposed line route from Padukka to Athurugiriya is 12.5 km long. For the Athurugiriya-Kolonnawa sector, it is proposed to use the rebuild existing 132 kV line 15 km right-of-way. The proposed sub-project components include:

- III.1 Construction of 220/132/33 kV Padukka Grid Substation.
- III.2 Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.
- III.3 Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.

24. The proposed New Padukka GSS site is located 2 Ha land (both rubber and private) in the Village of Batawala. The nearest wild life sanctuary is Bellanwila-Attidiya Wildlife Sanctuary (60 ha) which is situated about 23 km away from the substation site. The 12.5 km transmission line from Athurugiriya GSS to Padukka GSS mainly traverses through paddy fields (90% of the length), home gardens, and a housing scheme near Aturugiriya. The proposed alignment is crossing several B grade roads e.g. Homagama-Kaduvela road (No. 698), Athurugiriya- Kaduvela road etc. No wildlife sanctuary, national parks, or ecologically sensitive areas are present in the nearby area of RoW.

#### **2.1.4 A-IV. Construction of 132/33 kV GSS at Kegalle.**



25. This sub-project will meet the load growth demand in Kegalle, Mawanella, Polgahawela and Rambukkana areas and thereby relieve loading of Thulhiriya and Kiribathkumbura Grid Substations. Proposed GSS will also improve the voltage profile of 33 kV distribution systems and reduce distribution losses thus improving the quality of supply in and around Kegalle, Mawanella, Polgahawela and Rambukkana areas. This new GSS will connect to the national power system. The sub-project consists of the following components:

IV.1 Construction of 132/33 kV GSS at Kegalle.

IV.2 Installation of 15 MVAR (3x5 MVAR) capacitor banks including 33 kV BSC bays at Kegalle 33 kV Bus Bar to control load PF.

IV.3 Construction of 132 kV 22.5 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.

IV.4 Augmentation of Thulhiriya GSS with 2 nos. of 132 kV line bays.

26. The proposed Kegalle GSS will be situated on paddy land (1.6 ha) and no forest compensation is required as these lands are either uncultivated or commercial plantation lands. The nearest wildlife sanctuary, Kurulu Kele in Kegalle is about 6.5 km away from the proposed sites. The 22.5 km transmission line from Thulhiriya GSS to Kegalle traverses through paddy fields (12.6 km), home gardens, and rubber estates (9.9 km). A large number of rubber trees and home garden trees in the RoW have to be removed for which CEB will have to pay compensation. No wildlife sanctuary, national parks, or ecologically sensitive areas are present in the nearby area of RoW.

#### **2.1.5 A-V. Installation of reactive power compensation devices**

27. Most major loads in and around Colombo and Gampaha are fed from Biyagama, Sapugaskanda, Veyangoda, Kolonnawa GSS's. Proposed installation of capacitors will improve the voltage profile of the 33 kV distribution systems and thereby improve the quality of supply in the areas. Since reactive power requirement is supplied at the load center, it contributes to the reduction of system losses. The installation of the reactors shall be done at:

V.1 50MVAR at Biyagama 33 kV BB (10x5MVAR including BSC bays).

V.2 50MVAR at Sapugaskanda 33 kV BB (10x5MVAR including BSC bays).

V.3 30MVAR at Kolonnawa-new 33 kV BB (6x5MVAR including BSC bays).

V.4 30MVAR at Kolonnawa-old 33 kV BB (6x5MVAR including BSC bays).

## **2.2 Type of Project**

28. The project implementation will lead to development of transmission projects, which involve evacuation of power from clean energy sources (wind, solar, small hydro) and overall network efficiency improvement. CEB's transmission planning wing has identified a list of projects, based on the Long term Transmission Development Plan 2011-2020, which are critical for the overall development of the power system. Considering the requirements of Sri Lanka's power system with medium to long term, the prioritization of projects for the proposed loan has been undertaken based on following principles for sequence of preference criteria for transmission projects:

- Transmission projects associated with evacuation of clean energy, specifically from the wind and solar projects/ proposed parks have been given the highest preference
- Augmentation of transmission capacities associated with renewable park evacuation projects
- Transmission projects required for network efficiency improvement – loss reduction, etc.

## **2.3 Justification of the Project**

29. Due to the fast emerging energy demand from the area, there is a distinct necessity for strengthening and expanding the transmission network in the northern and eastern region. Under the adopted standards, the forecast loading of each GSS is compared with the firm capacity and the necessary transformer augmentations as well as construction of new substations. It is a standard adopted by CEB that, loading of each transformer should not exceed 120% of its capacity under single transformer outage conditions.

30. The proposed 132 kV D/C transmission line from Mannar to Vavuniya and the new 220 kV Vavuniya - New Anuradhapura line and the 132kV Vavuniya to Anuradhapura line (on 220 kV tower line but charged on 132 kV) has been proposed as part of system to evacuate upto 200 MW of wind power from the region. The existing 132 kV Polpitiya - Kolonnawa transmission lines and with proposed New Polpitiya - Pannipitiya 220 kV transmission line would reduce the transmission losses and the New Polpitiya GSS will facilitate extension of the 220 kV transmission system to the Southern Province at a future date.

31. The New Polpitiya – Pannipitiya 220 kV transmission lines passes through Padukka. A 132 kV double circuit twin zebra line is proposed from the Padukka GSS (proposed) to Kolonnawa switching station (existing) via Athurugiriya GSS (existing) to transmit power generated at Laxapana hydropower complex to Kolonnawa Switching Station. Padukka 220/132/33 kV GSS and Padukka-Athurugiriya-Kolonnawa 132 kV transmission line are required to be implemented together with New Polpitiya-Pannipitiya 220 kV transmission line. The proposed GSS at Padukka will improve the voltage profile of the 33 kV distribution systems and reduce distribution losses in and around Padukka, Panagoda, Talagala, Labugama, Handapangoda and Pahathgama areas.

32. 132/33 kV Kegalle GSS with two 31.5 MVA transformers and eight 33 kV feeders is proposed to meet the load growth demand by 2012 in Kegalle, Mawanella, Polgahawela and Rambukkana areas and thereby to relieve loading of Thulhiriya and Kiribathkumbura GSS's. This new GSS is proposed to connect to the national power system by constructing a 14km double circuit Zebra conductor, 132 kV transmission line from Thulhiriya GSS. The loading of Thulhiriya and Kiribathkumbura substations presently exceeds 104% and 131% respectively under outage of one transformer. Further, Kiribathkumbura GSS will get overloaded by year 2015 and Thulhiriya GSS will get overloaded by year 2018.

33. Most of the major loads in and around Colombo and Gampaha are fed from GSS in Biyagama, Sapugaskanda, Veyangoda and Kolonnawa. There are regular complaints from industries regarding low voltage situations on the Biyagama 33 kV feeders. Bolawatta GSS is located in Puttalam district and Pannala GSS is located in Kurunegala district in North Western Province. Mainly Negambo, Naththandiya, Kuliapitiya, Bingiriya and Chilaw areas are fed from the GSS. The reactive power requirement of the above important industrialized areas of the country is increasing. The proposed installation of capacitors will improve the voltage profile of the 33 kV distribution systems and thereby improve the quality of supply in the areas. Since reactive power requirement is supplied at the load centre it contributes to the reduction of system losses.

## 2.4 Location

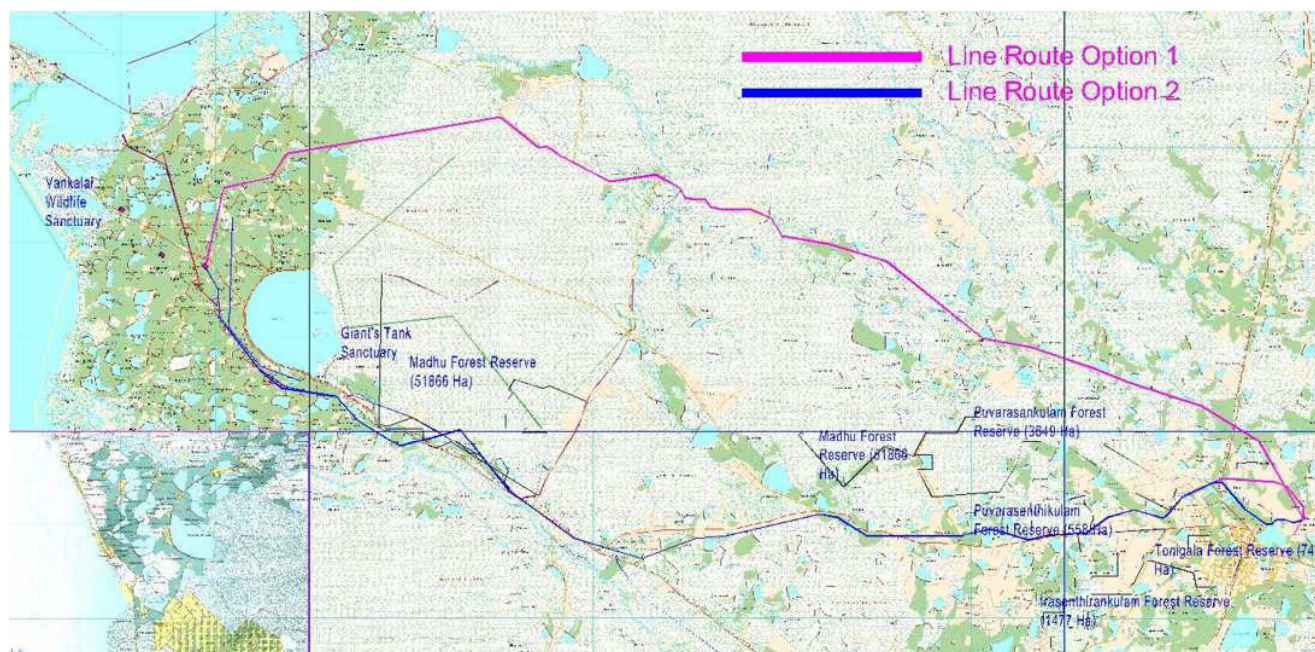
34. The proposed sub-projects are located in different area of the country including Northern, Northern Central, Central, and Colombo provinces. Table 1 indicates details of the proposed sub-project locations:

**Table 1: Different locations of proposed subprojects.**

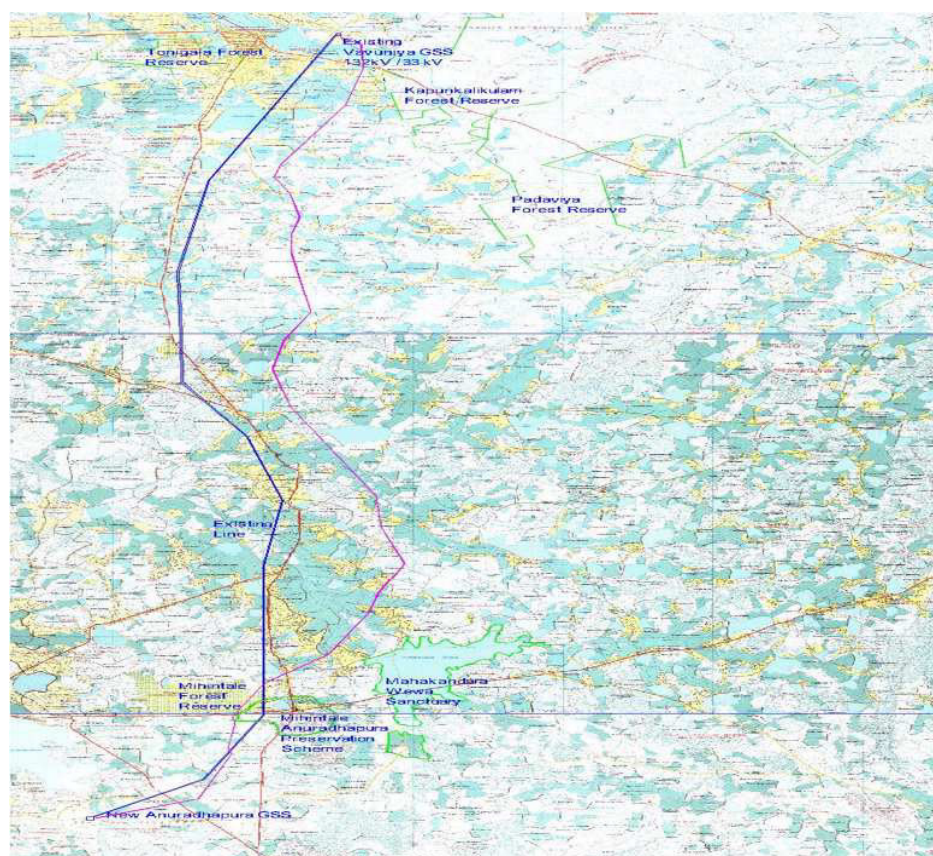
Sub-project	DS division	District	Province
Transmission System Strengthening in Mannar region	Mannar, Nanaddan, Vengalcheddikulam, Vavuniya, Vavuniya South (Tamil) Division, Vavuniya South (Sinhala) Division, Kebettigollewa, Medawachchiya, Rambewa, Mihintale, Nuwaragam Palatha	Mannar, Vavuniya, Anuradhapura	Northern, North Central
New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.	Homagama, Maharagama, Hanwell, Dehiowita, Yatiyantota, Gangalhala Korale	Nuwara Eliya, Kegalle and Colombo	Central, Western
Padukka 220/132/33 kV GSS and associated transmission line.	Homagama, Kaduwela, Kolonnawa	Colombo	Western
Construction of 132/33 kV GSS at Kegalle	Warakapola, Galigamuwa, Kegalle, Rambukkana	Kegalle	Central
Installation of reactive power compensation devices.	Biyagama, Kolonnawa, Sapugaskanda	Colombo	Western

35. Figures 2-5 provides the topographical maps (1:50,000 scale) which show the proposed transmission line routes for i). Transmission system strengthening in Mannar region, ii). New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line, iii). Padukka 220/132/33 kV GSS and associated transmission line, and iv). Construction of 132/33 kV GSS at Kegalle.



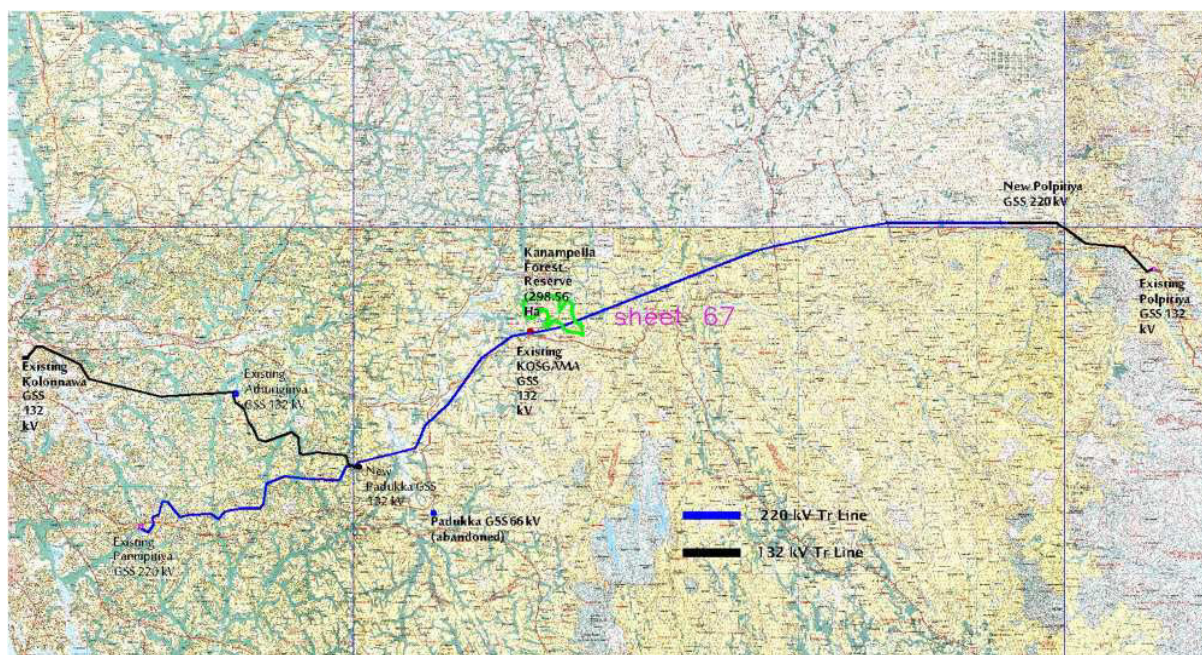


**Figure 2: Mannar Vavuniya 132 kV Transmission line (on 220 kV towers) and Proposed 132 kV Grid Substation at Mannar**

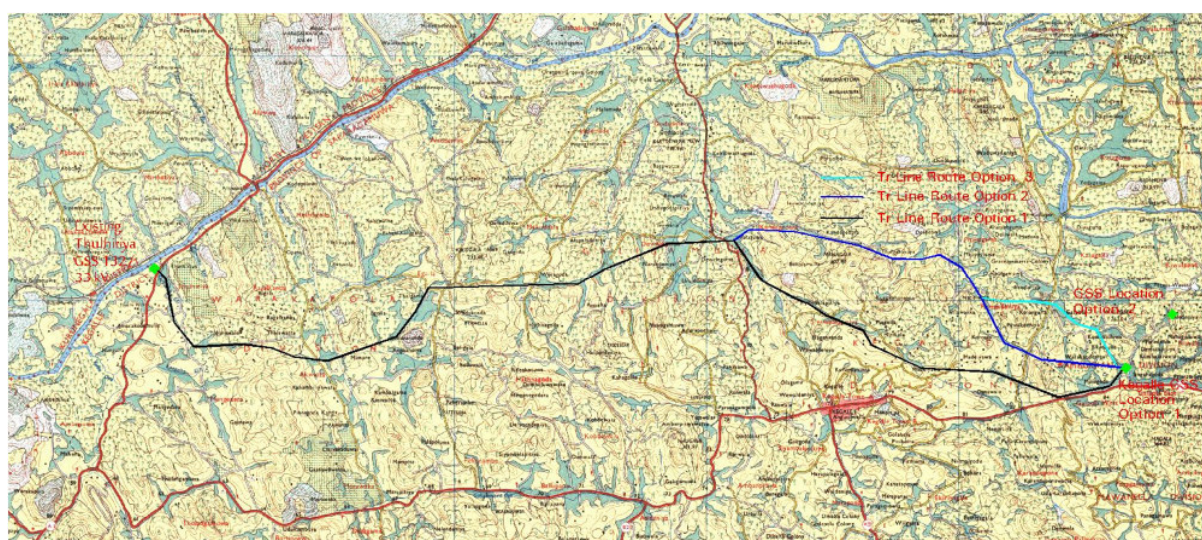


**Figure 3: New Anuradhapura-Vavuniya 132 kV Transmission Line (on 220 kV tower line)**





**Figure 4: New Polipitiya – Pannipitiya 132 kV Transmission Line**  
**Padukka 132 kV Grid Substation and New Polipitiya 132 kV Grid Substation**



**Figure 5: Thuliriya-Kegalle 132 kV Transmission Line and 132/33 kV Kegalle GSS**

## 2.5 Size and Magnitude of the Operation

### 2.5.1 Component A.I Transmission System Strengthening in Mannar region

36. The sub-project components include:
- I.1 Extension of 220 kV New Anuradhapura GSS.

- Extension of 2 nos. 132 kV double bus line bays.
- Space for the bays are within the existing GSS.
- This component shall be carried out under another project.

I.2 Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line on 220 kV towers but charged on 132 kV.

- Approximately the line has 167 nos. of 220 kV lattice tower line but charged on 132 kV.
- The Conductors shall be single Zebra per phase.

I.3 Augmentation of Vavuniya GSS.

- Extension of 2 nos. 132 kV double bus line bays.
- Space for the bays are within the existing GSS.
- This component shall be carried out under another project.

I.4 Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.

- Approximately the line has 167 nos. lattice towers.
- The Conductors shall be single Zebra per phase.

I.5 Construction of 132/33 kV Mannar GSS (1 x 31.5 MVA).

- 1 no, 31.5 MVA, 132/33 kV transformers.
- 132 kV single bus-bar arrangement including bus section.
- 33 kV single busbar arrangement including bus section.
- 4 nos. 132 kV single busbar transmission line bays.
- 1 No, 132 kV single busbar transformer bay.
- 1No, 33 kV transformer bay.
- 4 nos., 33 kV feeder bays.

## **2.5.2 A-II. New Polpitiya 220/ 132 kV GSS and associated transmission line.**

37. The sub-project components include:

- II.1 Construction of 220/132 kV New Polpitiya GSS which is about 10 km away from the existing Polpitiya GSS.
  - 2 nos., 250MVA 220/132 kV transformers.
  - 220 kV double busbar arrangement including bus coupler.
  - 132 kV single busbar arrangement including bus section.
  - 2 nos., 220 kV double busbar transformer bays.
  - 4 nos., 220 kV double busbar transmission line bays.
  - 2 nos., 132 kV single busbar transformer bays.
  - 2 nos., 132 kV single busbar transmission line bays.
  - Provision for 2x220 kV double busbar transmission line bays to connect New-Polpitiya- New Galle 220 kV transmission line.
  - Land required for GSS is about 3 to 4 Ha.

II.2 Construction of 132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.

- Approximately the line has 34 nos. lattice towers.
- The Conductors shall be single Zebra per phase.

II.3 Provision of 2x220kV double bus transmission bays to connect New-Polpitiya-New Galle 220 kV transmission line.

- For this provision only space and bus arrangement shall be kept for the construction of the bays

II.4 Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the existing Pannipitiya GSS

- Approximately the line has 180 nos. lattice towers
- The Conductors shall be single Zebra per phase
- At Pannipitiya end Approach Tubular Pole Structure to be designed to overcome the Congestion.

II.5 Augmentation of Pannipitiya GSS (2x220kV DB transmission line bays).

- Extension of 2 nos. 220 kV double bus line bays.



- Space for the bays is within the existing GSS.

### **2.5.3 A-III. Padukka 220/132/33 kV GSS and associated transmission line.**

38. The proposed sub-project components include:

#### **III.1 Construction of 220/132/33 kV Padukka GSS.**

- 2x250 MVA Transformers.
- 220 kV double busbar including bus coupler.
- 132 kV single busbar including bus section.
- 33 kV single busbar arrangement including bus section.
- 4x220kV double busbar transmission line bays.
- 2x220kV double busbar transformer bays.
- 2x132kV single busbar transformer bays.
- 2x132kV single busbar transmission line bays.
- 4x33 kV feeder bays.
- 2x33kV S/B T/F bays.
- Provision for 2x220kV double busbar transmission line bays to connect Kirindiwela-Padukka 220 kV transmission line.
- 100MVar capacitor banks at 132 kV busbar.

#### **III.2 Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.**

- Approximately the line has 39 nos. lattice towers.
- The Conductors shall be single twin zebra per phase.

#### **III.3 Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.**

- This line is strengthening of the existing Kolonnawa Athurugiriya 132 kV Line and the existing line shall be dismantled to construct the enhanced twin Zebra line.
- Approximately the line has 49 nos. lattice towers.

### **2.5.4 A-IV. Construction of 132/33 kV GSS at Kegalle**

39. The sub-project consists of the following components:

#### **IV.1 Construction of 132/33 kV grid substation at Kegalle.**

- 2 nos., 31.5 MVA, 132/33 kV transformers.
- 132 kV single busbar arrangement including bus section.
- 33 kV single busbar arrangement including bus section.
- 2 nos., 132 kV single busbar transmission line bays.
- 2 nos., 132 kV single busbar transformer bays.
- 8 nos., 33 kV feeder bays, 2x33kV transformer bays.

#### **IV.2 Installation of 15 MVar (3x5 MVar) capacitor banks including 33 kV BSC bays at Kegalle 33 kV Bus Bar to control load PF.**

- Space for the bays are within the existing GSS.

#### **IV.3 Construction of 132 kV 22.5 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.**

- Approximately the line has 45 nos. lattice towers.
- The Conductors shall be single twin zebra per phase.

#### **IV. 4 Augmentation of Thulhiriya GSS with 2 nos. of 132 kV line bays.**

- Extension of the 132 kV Single Bus Bar.
- 2 nos., 132 kV single busbar transmission line bays.
- Space for the bays are within the existing GSS.

### **2.5.5 A-V. Installation of reactive power compensation devices**

40. The installation of the reactors shall be done at:

#### **V.1 50MVar at Biyagama 33 kV BB (10x5MVar including BSC bays).**

#### **V.2 50MVar at Sapugaskanda 33 kV BB (10x5MVar including BSC bays).**

#### **V.3 30MVar at Kolonnawa-new 33 kV BB (6x5MVar including BSC bays).**

V.4 30MVAR at Kolonawa-old 33 kV BB (6x5MVAR including BSC bays).

## 2.6 Implementation Plan

41. The construction of substation involves private land purchase option or land acquisition in Kegalle, New Polipitiya, whereas the land belongs to Irrigation department in Mannar. In case of construction of new transmission line, the project would involve survey work, forest work and clearance, design and engineering of plant equipment, floating tenders for procurement, civil work related to 220/132 kV line and 220/132/33 kV GSS testing and commissioning. Total project work is expected to complete in 30 months. The most optimal project route alignment is shown in the Figures 1-5.

## 3 DESCRIPTION OF ENVIRONMENT

### 3.1 Nuwara Eliya District

#### Physical Resources

##### Topography, Geology and Soil

42. Nuwara Eliya district lies in the Central Province of Sri Lanka, between longitudes 80° 24'5" and 80° 57'8" East and latitudes 7°16' 5" and 6°45' 02" North. It is land locked by 4 districts, Kandy to the North, Kegalle district to the North-West, Ratnapura district to the South-West and Badulla district to the East. The land elevation varies from 3,000' to about 8,000' and has variety of complex landform features like mountain ranges, mountain summits, denuded plateaus, plains, parallel ranges and slopes.

43. The district belongs to the highest peneplain in this Island. The southern margin of this peneplain stretches for more than 80 km from Adam's Peak on the West and rising from around 1000' to more than 5000' as at the World's end running northwards from the southern margin are the highest plateau regions and the high plains stretching from Kirigalpotha to Piduruthalagala. This bare, gently undulating, grassland includes Horton plains, Elk plains, Moon plains and Kandepola -Sitya Eliya plains are at an average elevation of 6,000-7,000 feet. On the East of these high plains are Hakgala and Totupola. On the west is the Hatton plateau a deeply dissected area with strong relief having an average level of elevation between 3,500 feet and 4500 feet. The remarkable appearance of flatness in the Horton plateau is largely due to the rising of thousands of feet in sheer rock walls, common particularly in the Hatton area.

44. The Nuwara Eliya district belongs to the Highland series of the Precambrian Complex of Sri Lanka. The major rock types found are haonokites, quartzite, marbles, granites, granulitic quartzites. Charnockites, the predominant rock type are generally confined to the mountains with the less resistant rocks at the valley bottoms. Quartzites found around Nuwara Eliya, Hatton, Norton Bridge and Maskeliya form Parallel. The quartzites form prominent escarpments and ridges. Most of the Dimbulla valley is made of charnockities gneiss and this is clearly noticed on the road from Dimbulla to Nanuoya. Calcium carbonate from solution caves is found at Ella and two other caves in the Norton bridge area.

##### Climate

45. Annual average rainfall of the Nuwara Eliya district is above 1,500 mm. The climatological data indicates that Nuwara Eliya at an elevation of 1800 m receives low intensity rainfall while the intensity increases around lower elevations towards Nawalapitiya that lies on the windward slopes of the Central Mountains. Unlike the wet zone of the district that receives rainfall during the main four seasons, the intermediate zone receives rainfall only during the North-East monsoon and the two inter-monsoonal months. Unreliable rainfall and frequent dry spells is a common feature in the intermediate zone. Relative humidity of Nuwara Eliya district varies 63 - 88 % in day time and 68 -95 % at night.

##### River and Streams

46. The Kotmale Oya, one of the seven major tributaries of Mahaweli formed by its several head streams arise in the core of the central highlands. The Dambasatalawa Oya originating in Ambewela hills flows into Agar Oya and joins Nanu Oya to meet Kotmale Oya. Pundalu Oya has its source in Great Western and Ramboda Mountain and Punna Oya in Kikiliyamana Mountain. The many other tributaries of the Kotmale Oya are Ganthera Oya, Devathuru Oya, Hyimal Oya, Nidahaskotuwa Oya and Niyangandara Oya. The district is basically suited for the development of water power, the only source of indigenous energy in Sri Lanka. The tributary of Maskeliya Oya with catchments of 129.5 km<sup>2</sup> was dammed at Mousakelle to detain 123 million m<sup>3</sup> to generate hydro-power at Polpitiya. The tributary of Kehelgama has been fully

tapped with a 48 m<sup>3</sup> million reservoir at Castlereagh and a small reservoir at Norton and the second to another plant at Laxapana.

### **Ecological Resources**

47. Nuwara Eliya offers a combination of attractions, such as healing climate, scenic beauty, wooded wilderness, flowery meadows, and its high plateau. Nuwara Eliya is an oval shaped mountain valley, the plateau being 6,240 feet above the sea level.

48. Horton Plains, its surroundings forests and the adjoining Peak wilderness, constitute Sri Lanka's most important catchments area of almost all major rivers. The plains are also of outstanding scenic beauty and conservation importance, containing most of the habitats and endemic plants and animals representatives of the country's wet and montane zones. The Western slopes support the most extensive area of montane cloud forest surviving in the country. This lies 32 km south of Nuwara Eliya in the Central Highlands of Central Province. Horton Plains comprises a gently undulating highland plateau at the Southern end of the Central mountain mass of Sri Lanka. It is dominated to the north by Mount Totupola kanda (2,357m) and to the West by Mount Kirigalpotta (2,389m), Sri Lanka's third and second largest peaks, respectively. Horton Plains is well recognised for its rich biodiversity, its flora given to a high level of endemism. 5% of the species are found to be endemic to Sri Lanka. The town is a base for visits to Horton Plains National Park. This is a key wildlife area of open grassy woodland. Species found here include Leopard, Sambar, and the endemic Purple-faced Languor. Endemic highland birds include Dull-blue Flycatcher, Sri Lanka White-eye, and Yellow-eared Bulbul. The park also has a well-visited tourist attraction at World's End, a sheer precipice with a 1050 m drop. Various species of birds include the Indian Blue Robin, Pied Thrush or Scaly Thrush lurking in the denser undergrowth. Kashmir Flycatcher is another attractive bird species found in the park. Galway's Land Bird Sanctuary, close to Lake Gregory, is another wildlife site of 0.6 km<sup>2</sup>.

### **Economic Development**

49. Agriculture plays a dominant role in the economy of the district. A high percentage of 77.6 % of the employed are engaged in agriculture occupations. In Hanguruketha, Walapane and Kothmale DSDs 17%, 12% and 6% respectively of the cultivated land are under paddy. Paddy is cultivated in the comparatively flatter lands at the bottom of the valleys adjoining streams etc, and on sloping lands where terracing is done. In Hanguranketha and Walapane DS divisions paddy cultivation is done mainly by minor or major irrigation systems. Nuwara Eliya produces tea in unique flavor. The air is scented with the fragrance of the cypress trees that grow in abundance and mentholated with the wild mint and eucalyptus. It is a combination of all these factors that produces a tea that is recognised by connoisseurs of tea in the world. The tea when brewed is light but has an exquisite flavor and aroma. The total cultivated land areas consist 49,828 ha of tea, 22 ha of rubber and 1,043 ha of coconut in Nuwara Eliya district according to census data of 2002. Vegetable cultivation is carried out extensively by encroaching on to crown land especially reservations as there is a scarcity of arable land in the district. Potato cultivation is the most lucrative agricultural activity of recent times. The principal form of land use in the past has been chena cultivation mostly confined to the undulating lands. Coconut and rubber are cultivated on a small scale in the intermediate zones. Coconut cultivation is carried out in Hanguranketha and Ambagamuwa. In Hanguranketha 1.5 % of the total land area is under coconut cultivation. In 1989, there was 833 hectares of land under coconut in the district.

### **Social and Cultural Development**

#### **Population and Community**

50. A total of 5 DS divisions located within the Nuwara Eliya district representing all ethnic and religious groups in the country. From the total population distributed in the district 40.2% Sinhalese, 6.5% Sri Lankan Tamil, 50.6% Indian Tamil, 2.4% Sri Lankan Moor, 0.1 % Burgher and 0.2% Malay. Mainly five religious groups are represented in the district as follows: 37.9% Buddhist, 51% Hindus, 2.7% Muslims, 5.0 % Catholics, and 1.5% other Christians and 0.1% other.

#### **Health and Educational Facilities**

51. A total of 47 hospitals are situated in different locations of the district. These include a single district general hospital, single base hospitals Type A, single base hospital Type B, 11 district Hospitals, 2 peripheral units, 7 rural hospitals, 4 central dispensary and maternity homes and 20 central dispensary.

District general hospital located at Nuwara Eliya and single base hospitals Type A at Dickoya and base hospital Type B at Rikillagaskada.

52. Within the district, altogether 527 schools including 518 national schools, 2 private non fee-levying schools and 7 private fee schools are distributed. Generally, the education level of the district is considerably high. The literacy rate of the district is 82.6 %. The educational level of the people within the district is shown in Table 3.

**Table 3: Educational level of the people distributed in Nuwara Eliya district**

No schooling	Attending grade 1	Passed grade 1-5	Passed grade 6-10	Passed GCE(O/L)NCGE/SSC	Passed HNCE/HSC	GCE(A/L)	Degree and Above	Not started
13.2	11.3	28.5	35.5	12.1		4.6	0.4	2.2

### Sites of Cultural, Archaeological and Historical Significance

53. There are a few places in Nuwara Eliya, which are interesting, though they are not popular attractions. One is a gravestone of one British governor located in the very corner of the golf grounds. Folklore in Nuwara Eliya says that in every year this gravestone is struck by a lightning shock. Another place related to folklore is the Hindu Temple called "Seetha Kovil" (Hanuman Kovil). It is found on the way to Badulla from Nuwara Eliya before reaching the Haggala Botanical garden. The temple is located in the village called "Seetha Eliya". The folklore about this area is related to the Ramayana in Hinduism.

## 3.2 Mannar District

### Physical Resources

#### Topography, Geology and Soil

54. Mannar District is located in north-western Sri Lanka. It is one of five administrative districts of the Northern Province. The district covers 2,002 sq. km, approximately 3% of the total land area of Sri Lanka. A major part of this division is an island connected to the mainland by a 3-mile causeway and a bridge. The land use is shown in the Figure 6:

55. Geographically the bulk of Mannar is on the mainland within the arid and dry zone. High temperatures and low rainfall characterize the climate. The monthly temperatures range between 26.5°C and 30.0°C with highs normally recorded between May and August. Mannar receives nearly 60% of its rainfall during the northeast monsoon, which lasts from October through December. The land area is relatively flat and sits at low elevations. Towards the interior, the terrain is gently undulating, favouring the storage of rainwater in tanks that provide the majority of the irrigation

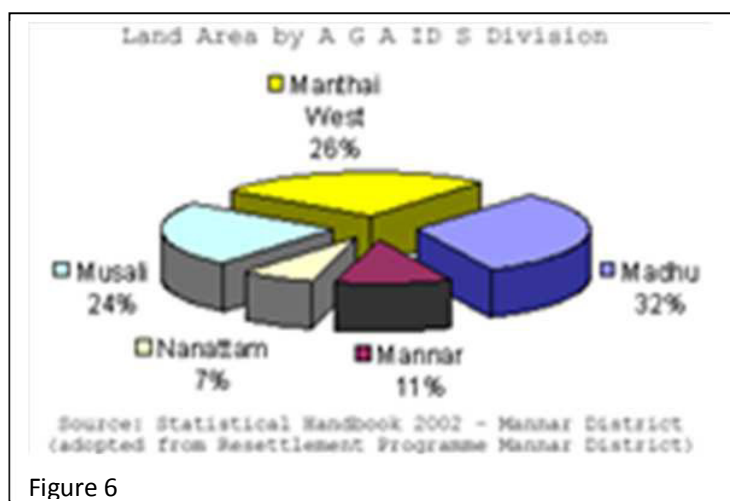


Figure 6

for the district's arable land. The primary economic activities in Mannar are crop cultivation (mainly paddy), fisheries, and animal husbandry. Employment opportunities in the district are highly seasonal, and there are no institutional facilities for tertiary education.

56. The conflicts in Northern and Eastern region for last 20 years have compelled the displacement and destruction of the large segment of the Mannar district. It has destroyed the infrastructure and the displacement has left communities without maintenance and jungle has swallowed formerly populated areas. Now, the displaced populations are returning to their places of origin.

### Climate

57. Western part of the district, including the Mannar Island forms a part of Sri Lanka's Arid Zone while the rest of the areas of the district falls within the dry zone of Sri Lanka, where tropical dry climate is

prevalent. The area covered by the district receives somewhat low rainfall throughout the year. Annual rainfall in the western part of the district, including the Mannar Island, is less than 1000 mm while that in rest of the district is between 1000 –1250 mm. The area experiences heavy rains from October to December, during NE monsoonal season. In comparison, amount of rainfall received during the rest of the months is extremely low. The highest average monthly temperature is recorded in the months of June, July & August (36°C) while the lowest is encountered in the months of January and December (25°C). The mean annual temperature is about 30-34°C. Physiographically, the area covered by Mannar district belongs to the lowest peneplain of Sri Lanka. Variations in topography are less pronounced within the district. Coastal plain exists as 10 – 15 km wide and north-south trending belt in the entire western part of the district. Towards further east, topography gradually increases and forms a gently undulating terrain with elevations rising up to 65 m average mean sea level.

### Rivers and Irrigation

58. Perennial river systems are absent within the Mannar district. However, a number of main streams drain through the district in their matured stages and discharges to sea within the North Western coastal zone of the district, between northern boundary zone of Wilpattu National Park and Vellankulam. These streams get dried up during the period of July to September. The “Aruvi Aru” (Malwatu Oya) is the most prominent as it is second longest river in the country. The other significant streams within the district are, Kal Aru, Parangi Aru, Pali Aru and Modaragam Aru. In addition, Nay Aru and Uppu Aru are also the noteworthy streams within the district. The existence of a number of irrigation tanks within micro-catchments allows efficient local water use. The Giant’s Tank in the southeast part of the district is the largest irrigation tank in the area fed by a tributary of “Aruvi Aru”.

### Ecological Resources

#### Forests

59. Forest covers (1989) 50% of land area in the Mannar district. Depletion of forests is a serious environmental problem. The average density of population is 58/sq km in the forest areas.

#### National Parks and Sanctuary

##### The Giant’s Tank Sanctuary

60. The Giant’s Tank Sanctuary in (N 8°51’ and E 80° 02’) is one of the popular sanctuaries in Mannar district, which holds one of the largest tanks in the island and it was built by King Dhatusena (459-477) by damming the Malwatu-oya, later known as Manawatuwewa. The tank is fed by an ancient canal, recently restored, which carries water from the Malwatu Oya River. The Giant’s Tank sanctuary is situated about 25 km southeast of Mannar in the Mannar district in a semi-arid zone. A part of the sanctuary bund is located along the Madawachchiya - Mannar Road. The water from this tank is fed to 162 smaller tanks downstream and irrigates about 11,000 hectares of paddy land. The Giant’s Tank Sanctuary was declared as sanctuary on 1954/09/ 24 and it spread over 4330.1 hectares. This sanctuary comes under dry and arid lowland floristic zone and arid zone bioregion and is categorized as an important bird area. Birds species recorded in The Giant’s Tank Sanctuary are *Gallus lafayetii* (Sri Lanka Junglefowl), *Pavo cristatus* (Indian Peafowl), *Pernis ptilorhynchus* (Oriental Honey-buzzard), *Elanus caeruleus* (Black-winged Kite), *Haliastur Indus* (Brahminy Kite), *Haliaeetus leucogaster* (White-bellied Sea-eagle), *Accipiter badius* (Shikra), *Spizaetus cirrhatus* (Changeable Hawk-eagle), *Vanellus indicus* (Red-wattled Lapwing), *Columba livia* (Rock Pigeon), *Stigmatopelia chinensis* (Spotted Dove), *Chalcophaps indica* (Emerald Dove), *Treron bicinctus* (Orange-breasted Green-pigeon), *Treron pompadora* (Pompadour Green-pigeon), *Ducula aenea* (Green Imperial-pigeon), *Psittacula eupatria* (Alexandrine Parakeet), *Psittacula krameri* (Rose-ringed Parakeet), *Eudynamis scolopaceus* (Asian Koel), *Phaenicophaeus viridirostris* (Blue-faced Malkoha), *Centropus sinensis* (Greater Coucal), *Cypsiurus balasensis* (Asian Palm-swift), *Coracias benghalensis* (Indian Roller), *Merops orientalis* (Little Green Bee-eater), *Ocyrceros gingalensis* (Sri Lanka Grey Hornbill), *Anthraceroceros coronatus* (Malabar Pied Hornbill), *Megalaima zeylanica* (Brown-headed Barbet), *Megalaima rubricapillus* (Crimson-fronted Barbet), *Megalaima haemacephala* (Coppersmith Barbet), *Dinopium benghalense* (Black-rumped Flameback), *Artamus fuscus* (Ashy Woodswallow), *Aegithina tiphia* (Common Iora), *Tephrodornis pondicerianus* (Common Woodshrike), *Coracina macei* (Large Cuckooshrike), *Pericrocotus cinnamomeus* (Small Minivet), *Oriolus xanthornus* (Black-hooded Oriole), *Dicrurus macrocercus* (Black Drongo), *Dicrurus paradiseus* (Greater Racket-tailed Drongo), *Rhipidura aureola* (White-browed Fantail), *Terpsiphone paradise* (Asian Paradise-flycatcher), *Corvus splendens* (House Crow), *Corvus leuallantii* (Jungle Crow), *Mirafra affinis*



(Jerdon's Bushlark), *Eremopterix griseus* (Ashy-crowned Sparrow-lark), *Cisticola juncidis* (Zitting Cisticola), *Prinia hodgsonii* (Grey-breasted Prinia), *Prinia sylvatica* (Jungle Prinia), *Prinia socialis* (Ashy Prinia), *Prinia inornata* (Plain Prinia), *Pycnonotus cafer* (Red-vented Bulbul), *Pycnonotus luteolus* (White-browed Bulbul), *Orthotomus sutorius* (Common Tailorbird), *Dumetia hyperythra* (Tawny-bellied Babbler), *Chrysomma sinense* (Yellow-eyed Babbler), *Turdoides affinis* (Yellow-billed Babbler), *Acridotheres tristis* (Common Myna), *Copsychus saularis* (Oriental Magpie-robin), *Copsychus malabaricus* (White-rumped Shama), *Saxicoloides fulicatus* (Indian Robin), *Chloropsis jerdoni* (Jerdon's Leafbird), *Nectarinia asiatica* (Purple Sunbird), *Passer domesticus* (House Sparrow), *Ploceus philippinus* (Baya Weaver), *Lonchura striata* (White-rumped Munia), *Lonchura punctulata* (Scaly-breasted Munia), *Anthus rufulus* (Paddyfield Pipit).

#### Madhu Road Sanctuary

61. The Madhu roadSanctuary (N 8°55' and E 80° 15') is one of the largest sanctuaries in Mannar district. The Madhu road Sanctuary was declared as sanctuary on 1968/06/28 and it spreads over 26677 hectares. This sanctuary comes under dry and arid lowland floristic zone and arid zone bioregion. Currently the Department of Wildlife Conservation is planning to declare this sanctuary as a national park.

62. Birds species recorded in Madhu sanctuary are *Gallus lafayetii* (Sri Lanka Junglefowl), *Pavo cristatus* (Indian Peafowl), *Pernis ptilorhynchus* (Oriental Honey-buzzard), *Elanus caeruleus* (Black-winged Kite), *Haliastur Indus* (Brahminy Kite), *Haliaeetus leucogaster* (White-bellied Sea-eagle), *Accipiter badius* (Shikra), *Spizaetus cirrhatu*s (Changeable Hawk-eagle), *Vanellus indicus* (Red-wattled Lapwing), *Columba livia* (Rock Pigeon), *Stigmatopelia chinensis* (Spotted Dove), *Chalcophaps indica* (Emerald Dove), *Treron bicinctus* (Orange-breasted Green-pigeon), *Treron pompadora* (Pompadour Green-pigeon), *Ducula aenea* (Green Imperial-pigeon), *Psittacula eupatria* (Alexandrine Parakeet), *Psittacula krameri* (Rose-ringed Parakeet), *Eudynamis scolopaceus* (Asian Koel), *Phaenicophaeus viridirostris* (Blue-faced Malkoha), *Centropus sinensis* (Greater Coucal), *Cypsiurus balasiensis* (Asian Palm-swift), *Coracias benghalensis* (Indian Roller), *Merops orientalis* (Little Green Bee-eater), *Ocyrceros gingalensis* (Sri Lanka Grey Hornbill), *Anthraceroceros coronatus* (Malabar Pied Hornbill), *Megalaima zeylanica* (Brown-headed Barbet), *Megalaima rubricapillus* (Crimson-fronted Barbet), *Megalaima haemacephala* (Coppersmith Barbet), *Dinopium benghalense* (Black-rumped Flameback), *Artamus fuscus* (Ashy Woodswallow), *Aegithina tiphia* (Common Iora), *Tephrodornis pondicerianus* (Common Woodshrike), *Coracina macei* (Large Cuckooshrike), *Pericrocotus cinnamomeus* (Small Minivet), *Oriolus xanthornus* (Black-hooded Oriole), *Dicrurus macrocercus* (Black Drongo), *Dicrurus paradiseus* (Greater Racket-tailed Drongo), *Rhipidura aureola* (White-browed Fantail), *Terpsiphone paradise* (Asian Paradise-flycatcher), *Corvus splendens* (House Crow), *Corvus leuallantii* (Jungle Crow), *Hirundo daurica* (Red-rumped Swallow), *Mirafra affinis* (Jerdon's Bushlark), *Eremopterix griseus* (Ashy-crowned Sparrow-lark), *Cisticola juncidis* (Zitting Cisticola), *Prinia hodgsonii* (Grey-breasted Prinia), *Prinia sylvatica* (Jungle Prinia), *Prinia socialis* (Ashy Prinia), *Prinia inornata* (Plain Prinia), *Pycnonotus cafer* (Red-vented Bulbul), *Pycnonotus luteolus* (White-browed Bulbul), *Orthotomus sutorius* (Common Tailorbird), *Dumetia hyperythra* (Tawny-bellied Babbler), *Chrysomma sinense* (Yellow-eyed Babbler), *Turdoides affinis* (Yellow-billed Babbler), *Acridotheres tristis* (Common Myna), *Copsychus saularis* (Oriental Magpie-robin), *Copsychus malabaricus* (White-rumped Shama), *Saxicoloides fulicatus* (Indian Robin), *Chloropsis jerdoni* (Jerdon's Leafbird), *Nectarinia asiatica* (Purple Sunbird), *Passer domesticus* (House Sparrow), *Ploceus philippinus* (Baya Weaver), *Lonchura striata* (White-rumped Munia), *Lonchura punctulata* (Scaly-breasted Munia), *Anthus rufulus* (Paddyfield Pipit).

63. Mammals species recorded in Madhu sanctuary are *Macaca sinica* (Sri Lanka Toque Monkey), *Semnopithecus priam* (Grey Langur), *Trachypithecus vetulus* (Sri Lanka Purple-faced Leaf Monkey), *Canis aureus* (Jackal), *Herpestes edwardsii* (Grey Mongoose), *Herpestes smithii* (Ruddy Mongoose), *Elephas maximus* (Asian Elephant), *Bubalus bubalis* (Water Buffalo/ Domestic Water Buffalo), *Sus scrofa* (Wild Boar), *Axis axis* (Spotted Deer), *Muntiacus muntjak* (Barking Deer), *Moschiola meminna* (Mouse Deer), *Tatera indica* (Gerbil/ Antelope Rat), *Rattus rattus* (Common House Rat), *Funambulus palmarum* (Palm Squirrel), *Ratufa macroura* (Giant Squirrel), *Lepus nigricollis* (Black-naped Hare)

#### Vankalai Sanctuary

64. Vankalai Sanctuary (8°56'N 079°55'E) is located north-west of Sri Lanka in the district of Mannar. It was declared as a sanctuary on 21<sup>st</sup> August 2008 and as a RAMSAR site on 12<sup>th</sup> July 2010. This site covers an area of 4,839 ha and consists of several ecosystems, which range from arid-zone thorn scrubland, arid-zone pastures and maritime grasslands, sand dunes, mangroves, salt marshes, lagoons, tidal flats, sea-grass beds,



and shallow marine areas. Due to the integrated nature of shallow wetland and terrestrial coastal habitats, this sanctuary is highly productive, supporting high ecosystem and species diversity.

65. Vankalai with its numerous bird species has been declared a sanctuary by the Department of Wild Life Conservation (DWLC), a first in the area since the armed conflict erupted in the north several decades ago. Vankalai is primarily a fishing and farming village situated in Mannar district of the Northern Province of Sri Lanka. It lies along the Naanaattan Road with the sea on its west connecting to Indian Ocean. Its northern boundary is the historic Hindu shrine of Thiru Ketheeswaram. This sanctuary, partly a Wetland, comprises Puliyantivu Island, Thiru Ketheeswaram, Pallimunai, Vankalai and the strips of land on either side of the causeway connecting the island of Mannar to the mainland. Covering about 4,800 hectares, it consists of arid-zone thorn scrubland and pastures, waterholes and tanks, sand dunes, mangroves, salt marshes, lagoons and sea-grass beds and maritime grasslands. Many birds including the very rare migrants *Sarkidiornis melanotos* (Comb Duck), *Anas strepera* (Gadwall) and *Anas poecilorhyncha* (Spot-billed Duck); *Charadrius hiaticula* (Common Ringed Plover), *Calidris temminckii* (Temminck's Stint) and *Calidris subminuta* (Long-toed Stint) have been spotted at Vankalai.

66. The other common bird species recorded at this site are *Mycteria leucocephala* (Painted Stork), *Anastomus oscitans* (Asian Openbill), *Bubulcus ibis* (Cattle Egret), *Ardea cinerea* (Grey Heron), *Casmerodius albus* (Great Egret), *Egretta garzetta* (Little Egret), *Haliastur Indus* (Brahminy Kite), *Himantopus himantopus* (Black-winged Stilt), *Pluvialis squatarola* (Grey Plover), *Charadrius dubius* (Little Ringed Plover), *Charadrius mongolus* (Lesser Sand Plover), *Charadrius leschenaultia* (Greater Sand Plover), *Limosa limosa* (Black-tailed Godwit), *Tringa tetanus* (Common Redshank), *Tringa stagnatilis* (Marsh Sandpiper), *Tringa nebularia* (Common Greenshank), *Tringa ochropus* (Green Sandpiper), *Actitis hypoleucos* (Common Sandpiper), *Calidris minuta* (Little Stint), *Limicola falcinellus* (Broad-billed Sandpiper), *Sterna nilotica* (Gull-billed Tern), *Sterna caspia* (Caspian Tern), *Sterna bengalensis* (Lesser Crested Tern), *Merops orientalis* (Little Green Bee-eater) and *Dicrurus macrocercus* (Black Drongo).

## Social and Cultural Development

### Population and Community

67. The population of Mannar district was 103,688 in 2007, comprising mostly of Sri Lankan Tamils. According to the census of 1981, there are 106,900 people, which is about 0.7% of the Population of Sri Lanka. Estimated present population is 111,700. It is a predominantly Catholic Christian area, with an equal proportion of Muslim population and a few Sinhalese before 1990. Mannar is part of the "Catholic Belt" extending from Negombo to Jaffna.

68. The ancient "Madu Church" is one of the ancient churches in Asia and located near Murunkan in the district. An ancient Kali Temple was demolished by Portuguese to construct the Catholic Church on the same location. Mannar district is unique in its vegetation and wildlife, contrasting with rest of Sri Lanka. The district is notably one of the few places in Sri Lanka where Boabab trees (*Adansonia digitata*) thrive. The Boabab tree, native to Africa, was bought by Arab sailors to feed camels.

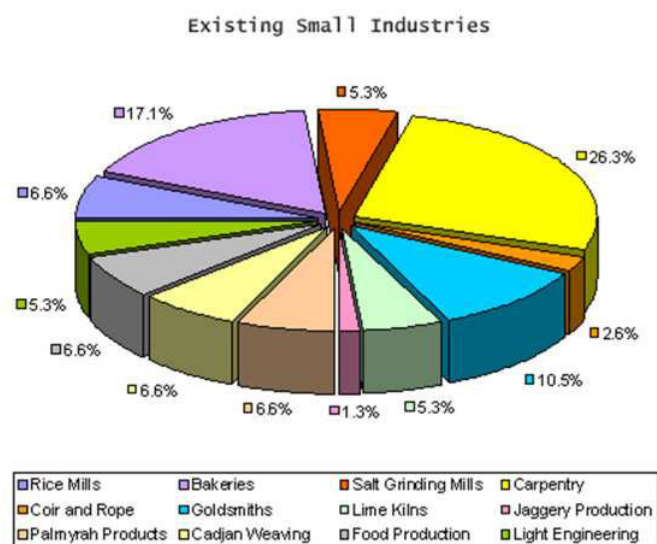
### Population

#### Employment

69. Main production activities are crop agriculture (mainly paddy), fisheries and livestock farming. There are 11 major and medium irrigation schemes servicing 36,613 acres. Labour Force in 1997 was 67.6 thousand of which about 12.4% were unemployed.

#### Industries

70. The local industries include a fish-canning factory, a Pesalai (now closed), slaterns, rice milling besides some small and cottage industries for drying of fish, pottery, carpentry, handicraft, and jewellery manufacturing. Figure 7 gives the details.

**Figure 7**

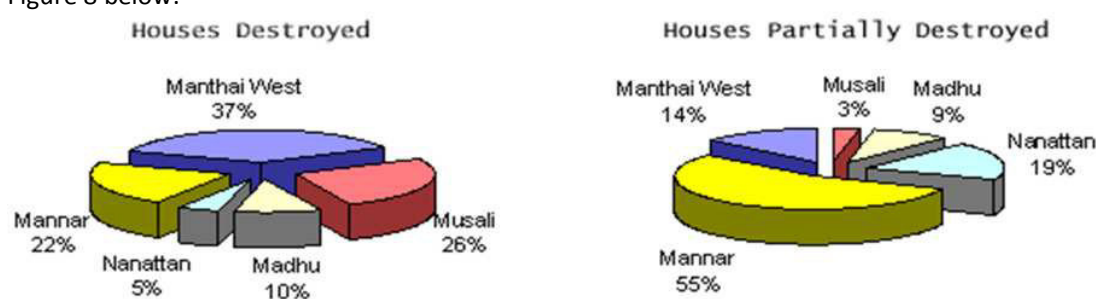
Source: Statistical Handbook 2002 – Mannar district. (Adapted from Resettlement Programme Mannar district)

### Trade and Finance

71. There are seven multi-purpose co-operative societies and 130 specialized co-operative societies and two state trading enterprises that have outlets in the district. Two state banks, the NSB and one private Commercial Bank operate branch offices.

### Housing

72. Prior to displacement from Mannar there were roughly 23,700 houses. A large number were damaged or destroyed during the conflict. Over 50% are completely destroyed, 66% of which belong to displaced persons (DPs). Over 20% were partially damaged. Currently nearly 900 houses owned by DPs are occupied by others, who for a variety of reasons are prevented from living in their own homes. Details in Figure 8 below:

**Figure 8**

Source: Field Survey 2003. (Adopted from Resettlement Programme Mannar district)

### Water and Sanitation

73. Mannar is located in the driest region of the country. For a variety of reasons, many areas in the district suffer shortages of potable water. Along Mannar's coasts, well water often is saline. Deep and expensive tube wells are necessary to reach fresh aquifers. Areas where displacement occurred suffer from disused wells. Throughout the district, 44% of individual wells and 57% of common wells need repair or reconstruction.

### Education

74. The education sector has been badly affected by the conflict. Though 90 of 111 schools are functioning, many of the original structures are damaged or destroyed. The SLA also has occupied a number of schools preventing their use.

75. The total number of school-going children in Mannar is 25,783. The entire district is divided into

two educational zones, Mannar and Madhu. In the Mannar Educational Zone, out of 70 schools 54 are functioning. In the Madhu Educational Zone, where displacement was most severe, out of 41 schools 30 are functioning in their original places while six schools have been displaced by the occupying security forces. The remaining five that are non-functional are Muslim schools initially damaged during the war. Due to 12 years of displacement, these schools have further deteriorated.

76. The total number of teaching positions for both zones is 1,303. However, currently there are only 799 positions filled, leaving 38% of teaching appointments vacant. The lack of teachers stems not from a dearth of qualified personnel but from insufficient funds for salaries and housing.

#### **Irrigation**

77. Agriculture is the mainstay of the population of the north and east. Ease of irrigation of paddy land plays a crucial role in its cultivation. Tank-irrigated agriculture declined sharply due to security problems, displacement, loss of agricultural equipment and machinery, and poor maintenance of tanks and water distribution systems.

78. Sri Lanka's tanks system includes major, medium and minor tanks. Major tanks are those that feed 400 or more ha. Medium tanks feed less than 400 ha but more than 80 ha. Minor tanks are those that feed 80 ha or less. The "Giants Tank," which actually is in three AGA/DS divisions is administered by the Central Irrigation Department, feeds 162 minor tanks, 61 of which are in Manthai West. The tank irrigates over 11,000 ha of paddy land. At the end of the monsoon season, excess water can be stored in a tank upstream (Tekkam Anicut) and irrigate an additional 2,500 ha. Giant Tank's directly benefits 2,560 farm families.

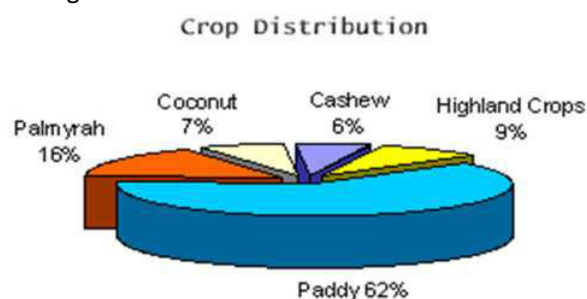
79. Akathimuripu is a major tank on the left bank of Aruvi Aru with a cultivated area of roughly 2,800 ha and an additional 225 ha irrigated by drainage water. Because local farmers were displaced completely in 1990, the tank and its structures have been abandoned. 1,840 farm families were dependent on this tank.

80. Viduyakulam is another major tank. It is located on the right bank of Motharagama Aru and provides irrigation to 560 ha through six minor tanks, plus another 91 ha. by drainage water each Yala and Maha. There are seven medium tanks in the district. Five are in Manthai West and two are in Madhu. They irrigate 4,347 ha. There are 347 minor tanks in the district providing irrigation to 6,053 ha.

#### **Economic Development**

##### **Agriculture:**

81. Agriculture is one of the key economic sectors in the district providing livelihoods for over 15,000 families, approximately 67% of the population. Out of a land area of 200,206 ha, the total cultivable land is 37,160 ha (19%). Over 65% is under forest cover. The pattern of agriculture practiced is dependent on climate and tradition. The average rainfall in the district is 960 mm per year, the majority of which occurs during the northeast monsoon from October to March. Crop distribution is given in Figure 9.



**Figure 9**

Source: Department of Agriculture – Administrative Report 2001 (Adopted from Resettlement Programme Mannar district)

##### **Soil**

82. Major soil types found in Mannar district are given in Table 4:

**Table 4: Soil Types**

Type	Nature of soil
------	----------------

<b>Reddish brown earth</b>	Good for other field crops, vegetables, horticulture and forestry.
<b>Grumusol (clay soil)</b>	High potential for paddy cultivation averaging 4.7 – 5.4 Mt per ha.
<b>Regosol</b>	Mainly found in Mannar Island – good for vegetables, Palmyrah and coconut.
<b>Yellow red latosol</b>	Found distinctively in coastal regions – good for vegetables, horticulture and other field crops.

Source: Statistical Handbook 2002 – Mannar district. (Adopted from Resettlement Programme Mannar district)

#### **Fisheries:**

83. Fishing is a major contributor to the local economy of Mannar district. It provides the principal source of livelihood for a large portion of the population, particularly in Mannar and Musali Divisions, where over 50% and nearly 40% of families respectively rely heavily on fishing activities. Over 8,700 families in 52 villages are involved in fishing.

84. The district has a marine coastline of 163 km, fresh water area of 4,867 ha and a brackish water area of 3,828 ha. The marine fishing area in the district stretches from Thavenpidy to the north to Mullikulam in the east and Talaimannar to the south. In addition, although the majority of anchorage facilities are damaged or destroyed, there are 29 separate, small fishing harbours spread around the coastline.

#### **Income Generation Activities**

85. Though the mainstays of the economy are agriculture and fishing, prior to the conflict the industrial sector was steadily expanding. One of the major industries in Mannar is salt production. Until 1989, the Mannar salterns produced between 3,500 and 4,000 Mt of salt per year. Since then, however, its capacity has reduced dramatically to 1,251 Mt per year. Currently, it supplies salt to fishing communities for dry fish production, to the ice factory at Pesalai, and to the Multi-Purpose Cooperative Societies (MPCSs) and private sector for consumption.

86. In the past, the state-run Paddy Marketing Board (PMB) maintained a rice mill at Nanattan available to all the rice farmers in Mannar. However, since the PMB ceased operations, the purchasing, storage and milling of paddy is controlled by millers in Vavuniya district.

87. Before the destruction of the railway network, clay (from Murunkan) was transported south to Kankasanthurai Cement Factory. Clay is readily available in the district. Although Mannar district has a large fishing population, currently there is no local boat manufacturing unit. Currently there is an ice plant operating in Pesalai that, although functioning, produces below capacity due to age, damage and neglect.

### **3.3 Vavuniya District**

#### **Physical Resources**

##### **Topography, Geology and Soil**

88. Vavuniya district is located in the southern part of the Northern Province of Sri Lanka covering a land area of 1,966 sq. km. The district is bordered by the Mullaitivu district to the north, north west and north east, Mannar district to the west and Anuradhapura district to the south west, south, south east and east. Mullaitivu district was carved out of the northern part of Vavuniya district in September 1978.

89. The district is divided into four DS divisions namely, Nedunkerni (formerly Vavuniya North), Vavuniya South (Tamil), Vavuniya South (Sinhala) and Cheddikulam, and further sub-divided into 102 GN Divisions. Vavuniya district has five local authorities, out of which one is an Urban Council and the remaining 4 are Pradeshya Sabhas. The main township in the district is Vavuniya while Cheddikulam, Puliyanakulam, Kanakarayanakulam, Omanthai and Nedunkerni are the medium scale townships.

90. Physiographically, the area covered by Vavuniya district belongs to lowest peneplain of Sri Lanka. The relief of the district varies from 100 – 200m average mean sea level. Generally, the area comprises of flat terrain with small-scattered hillocks. The topography becomes more pronounced in southeastern sector while a flat terrain is identified in rest of the areas within the district. Madukanda, Thammannakanda and Velikanda are the prominent strike ridge structures identified within the south eastern sector, representing higher elevations in the district.

## Climate

91. The district falls within the dry zone of Sri Lanka. The temperature is generally suitable for cultivation. The average temperature is 28.7°C and it is low during the period of October to January. The average rainfall of the district is 1310mm. From early October to late January is the Maha rainy season and from late April to late May is the Yala rainy season. The soil of the district is highly fertile due to reddish brown earth, low humid clays and alluvial soil. There are concave valleys and bottomlands. Red-yellow latro soils are found in the northern part of the district, and that area is more fertile and has better ground water potential. In the other part of the district, there are hard crystalline rocks with limited ground water potential that determine the substrata.

## Population

92. The district had a population of 95,425 as per 1981 census of population. No census was taken during 1991 due to unsettled condition. In 2001, census district had a population of 143,940 but this census was not held in the Vavuniya North D.S. Division and part of Vavuniya DS division. Whole district had an estimated population of 144,220 as at 31.12.2002. Density of the population including displaced population is 73 people per sq.km. high density population is 163 people per Sq.km in Vavuniya.

## Economic Development

93. Agriculture is the main livelihood of the majority of the people. Paddy is the major food crop cultivated in the district, which accounts for a total of 21,010 ha. Livestock farming (rearing cattle, cow, poultry, duck, pig, goat, and sheep) is also another income generating activity in this district. Approximately 15000 households in Vavuniya depend on dairy farming as a source of secondary income. The people in Vavuniya district have been engaged in inland fisheries for a long period based on major and medium tanks in the district. There are about 500 active fishermen in 15 villages in the district. The annual fish production is 160 MT. Although, this is not a large sector, it provides a source of income generation and employment for the people in the district. The economy of the district is largely centered on small and medium scale industrial units. There is a state run industrial estate at Poonthoddam which was established by the Industrial Development Board (IDB) in Sri Lanka. This industrial estate consists of 25 small scale and medium scale factories such as food processing, light metalwork, which provide employment to a considerable number of people in the district. One of the major projects under the Uthuru Vasanthaya rehabilitation and development program of the North is “Mankulam development project”. This project aims to develop the Mankulam town as the provincial administrative centre, since it is considered as a principal town of the North and could be easily accessed by all five districts in the North.

## Ecological resources

94. Out of the total land area of the district, more than 45% is covered with forest, which is 889 sq.km. The dense forest occupies an area of 83,390 ha whereas open forest occupies an area of 5640 ha. The major forest type found within the district is dry monsoon forest and the vegetation is semi deciduous. At present, large portions of the forest cover in the northern part of the district have been severely affected by the civil war. The forestry activities of the district are managed by the Department of Forest, which is the national authority responsible for the forestry operation, with the help of Divisional Forest Officer (DFO) in Vavuniya. The aquatic biology in the district is mainly concentrated to the minor, medium and major tanks such as Pavatkulam and Vavunikulam found within the district. The Vavunikulam Sanctuary is the important protected area located in the district.

## Social and Cultural Development

### Water Resources

95. There are 23 major irrigation schemes and 698 minor schemes. The water resources mainly depend on rainfall, as there are no perennial rivers. Major river systems are absent within the Vavuniya district. However, numbers of small to medium scale streams are drained through the district and all of them are seasonal streams, which are active only during NE monsoonal rainy periods. Kanakarayan Aru, Chamali Aru, Kiul Aru, Chamalankulam Aru, Per Aru, Kal Aru and parts of Malwathu Oya are the main river systems draining within the district. These river systems show a remarkable variability in discharge during dry and wet seasons.

96. Out of the 698 minor irrigation schemes, 52 are abandoned. Under the World Bank funded project (NEIAP), it is proposed to improve 100 minor schemes and 28 were completed up to the end of year 2002. there are 23 major irrigation schemes and 698 minor schemes.



### Land Use patterns of Vavuniya District

97. Recent surveys indicated that 40% of the total land is engaged in Agriculture and 45% of the land is forest cover. About 21,000 Ha land is used in paddy cultivation of which 10,900 ha is irrigated by minor irrigation schemes. In addition to this there are about 10,000 Ha under perennial and other crops. In addition, cultivation of other field crops livestock farming, forestry and inland fisheries are the main components. 26,274 Farm families are engaged in agricultural related activities. An Aquaculture Extension Centre was established in 1998 in the Kachcheri Premises by the Ministry of Fisheries and Aquatic Resources Development.

### Health and Educational Facilities

98. There are about 21 western medicinal hospitals and 20 ayurvedic medicinal hospitals available in the district. Out of the western hospitals, one government hospital (GH), five central dispensaries and maternity homes (CD& MH), one district hospital (DH) and one peripheral unit (PU) is located in the district. Apart from that, there is one chest and Sexually Transmitted Disease (STD) /AIDS clinic. The General Hospital in Vavuniya district acts as an important place for providing secondary health care services to people in many districts of Vanni region. Ground water is the most common source of drinking water in Vavuniya district despite the fact that the water available is hard water. In Vavuniya MOH area, in the PHI areas of Nelukulam, Nochchimoddai and Omanthai, safe water was available in less than 10% of households. Since 1981, there was much improvement in the availability of latrines throughout the Vavuniya district. Except for few PHI areas, generally in Vavuniya and Vavuniya South MOH areas more than 80% of the households have safe latrines. The PHI areas which have less than 80% households with safe latrines were: Sithamparapuram and Poovrasankulam in Vavuniya MOH area, Madukanthai in Vavuniya South MOH area and both PHI areas in Cheddikulam.

99. There are two education zones in the district, namely Vavuniya North and Vavuniya South with a total of 193 schools. According to the 2005 statistical data a total of 187 functioning schools with 17 Sinhala medium, 168 Tamil and 2 Tamil and English medium schools were identified in the district. There were about 42697 pupils and 1877 teachers in the district. However, at present, only 143 schools are functioning in their original places, leaving 43 schools displaced and 7 schools closed. There are about 900 teachers in the district. Apart from the schools, several higher educational institutes such as Vavuniya Campus of the University of Jaffna, Vavuniya National College of Education and Vavuniya Technical College in the district.

### Archaeological, Cultural and Historical significant sites:

100. There are several historically important sites in Vavuniya district which belong to the Pre Christian era up to the 7<sup>th</sup> Century AD. Vavuniya Madukanda temple and Samanalankulam Pillaiyar temple are the major historically important places in the district. Madukanda village itself has a historic significance because this is one of the places where Hemamali and Dantakumaru stayed with the 'Tooth Relic' which was brought from India.

## 3.4 Anuradhapura District

### Physical Resources

#### Topography, Geology and Soil

101. Anuradhapura is one of the ancient capitals of Sri Lanka, famous for its well-preserved ruins of ancient Sri Lankan civilization. The city, now a UNESCO World Heritage Site, lies 205 km north of the current capital Colombo in Sri Lanka's North Central Province, on the banks of the historic Malvathu Oya. It is one of the oldest continuously inhabited cities in the world and one of the eight World Heritage Sites of Sri Lanka. From the 4th century BC, it was the capital of Sri Lanka until the beginning of the 11th century AD. During this period, it remained one of the most stable and durable centres of political power and urban life in South Asia. The ancient city, considered sacred to the Buddhist world, is today surrounded by monasteries covering an area of over 40 km<sup>2</sup>.

#### Water Resources

102. The total area of the district is 7,179 km<sup>2</sup>. Of these 6,664 km<sup>2</sup> comprises of terrestrial lands and rest 515 km<sup>2</sup> is covered by inland waters. This 515 km<sup>2</sup> extend of inland waters consists of 2600 small, intermediate and large-scale tanks. Major water resource of district are Kala Oya, Mee Oya, Yan Oya and Malwathu oya. In addition to Oyas, 14 large-scale tanks, 79 medium scale tanks and 2510 small tanks are located in the district. The soil of the district is highly fertile due to reddish brown earth, low humid clays, and alluvial soil.

### Climate

103. The west part of the district, receives very less precipitation (1000 mm-1500 mm) than east part of district (1500-2000 mm). Highest precipitation is received in inter monsoon period from October to December. Throughout the year district has high temperature (29 °C - 30 °C). But, from December to January, temperature goes down to 26 °C.

### Social and Cultural Development

104. Anuradhapura district is the capital of north western province which consists of 22 DS Division, 18 local government authority and 694 Gramaniladari Divisions.

### Population

105. The population of the Anuradhapura district by 2008 amounted to 886,945. The population density of Anuradhapura district is 100/km<sup>2</sup>. The male population representing 49.04% amounts to 434,936 persons. The female population accounts for 452,009. On a community basis, Sinhalese accounts for 808,859 persons. This is 91.20% of the total population of the district. Muslims accounts for 72,289 persons and Tamils accounts for 4,502 persons. A minority of 1,295 persons belong to other religions. In categorizing the population on the basis of religions, 803,459 persons are Buddhists, 72,328 belong to Islam and Hindus and Christians account for 3844 and 7128 respectively.

### Employment

106. 24,592 of the population are employed in various industries. 7,632 persons are employed in 3,453 small-scale industries, while 9,710 persons are employed in 53 large-scale industries.

### Economic Development

107. For the economic development of the district, there are 55 State financial institutions and 110 private institutions. In the year 2008, 812,554 hectares were cultivated in the Anuradhapura district and the paddy harvest accrued amounted to 12,357 metric tons. 31,092 main irrigation schemes helped in this regard. In addition to paddy cultivation, a land area of 6324 hectares was cultivated with vegetable, additional crops, and pulses. The harvest reaped from these cultivations amounted to 3,513,000 Kgs. As per the land utilization in the district in the year 2008, 128,719.79 hectares were used for paddy cultivation and 59,084.05 hectares was used for Chena cultivation.

### Health and Educational Facilities

108. During the last four years, the health sector received unprecedented boost in the Anuradhapura district. Accordingly one surgery hospital, 3 base hospitals, 4 district hospitals, 7 central hospitals, 24 rural hospitals, 20 clinics, were established in the district. The total number of schools in the district amount to 544, with 9,228 teachers serving in these schools. The student population amounts to 174,359 students.

### Sites of Cultural, Archaeological and Historical Significance

109. Sri Maha Bodhi Tree is the oldest historically authenticated tree in the world (2,250 years). The great ancient Sinhalese Buddhist monuments of Anuradhapura are clustered around this Peepal tree (*Ficus religiosa*) called Sri Maha Bodhi, a sampling of the Peepal Tree at Buddha Gaya, Northern India in whose shelter Gautama Buddha attained supreme enlightenment. The sapling was brought to Sri Lanka by Buddhist nun Sanghamitta, the daughter of King Asoka of India in the 3rd Century B.C. To the north of the well protected and well adorned tree are three great monasteries: the Mahavihara, the Abhayagiri and the Jetavana.

110. Aukana Buddha, the 13 meter high statue carved out of solid granite, goes back to the 5th century, to the reign of King Dathusena. (about 50 km south of Anuradhapura). Guard stone at Thuparama Temple is considered to be the oldest dagoba in Sri Lanka and is believed to enshrine the collar bone relic of Lord Buddha. The guard stones like these are generally found in pairs at the entrance to temples, palaces and other revered sites. Isurumuniya Lovers Isurumuniya temple built in the 3rd century B.C. is noted for its rock carvings.

111. Ruwanveli Seya, the most popular stupas at Anuradhapura, Ruwanveli Seya, raised in the 2nd century B.C. this dagoba is supposed to have the perfect water bubble shape. Abhayagiri is the largest monastery complex in the Anuradhapura kingdom. Founded in the second century BC by king Valagamba (also known as Vattagamini Abhaya) was an international institution by the first century AD. Covering an area of 200 ha., the monastery includes full components of a Buddhist temple as well as other buildings. The stupa at Abhayagiri is 108m tall and one of the tallest brick buildings of the ancient world.

112. The finest Buddha sculpture in Sri Lanka, the Samadhi Statue (3- century AD) is among its many fine

stone carvings. Ritigala, a beautifully paved footpath, several elevated platforms, ruins of an old hospital and remains of a terraced pond are what is unearthed at this 180 BC Buddhist monastery at the foothill of 600m high Ritigala Rock. Dating back to around 350 B.C, it is one of the oldest historical places mentioned in the ancient chronicles situated about 50 km south east of Anuradhapura.

#### **Anuradhapura preservation area**

113. In the late 1990's it was felt that the issues related to urban development exerted undue pressure on Anuradhapura. The lack of development of other urban centres of the region meant that employment opportunities were available mostly in Anuradhapura only. The sacred area also offered much in the way of employment in the UNESCO-sponsored Cultural Triangle projects and other informal employment in the sacred area. Accordingly the Greater Anuradhapura Development Scheme that was prepared at the turn of this century took into consideration a large area covering almost 5% of the area of Sri Lanka. Intensive concentration on urban development was ironically considered as a strategy to save Anuradhapura and Mihintale from cracking down under pressure. The planning concept applied was in fact an extension of that used centuries ago. A third ring was added to the two concentric rings of ancient Anuradhapura. Whereas the first ring surrounding the ancient city was the monastic ring, and the second ring the forest monastic ring the third ring of the modern times was an agro-based industrial ring.

114. Mihintale is one of the key religious' sites and is regarded as the birthplace of Buddhism in Sri Lanka. It is located about 10 miles east of Anuradhapura along Anuradhapura – Trincomalee major road and it is also at the junction of Kandy – Jaffna road. Mihintale was originally known as Missaka Pakbata and Sila Kuta (peak). In the northern peak of this mountain the Tera Mahinda after arrival to the island of Sri Lanka and below Sila Kuta is the vast table land Ambathala and the whole of this area is included in the cultural triangle.

115. In 247 B.C. Buddhism was first introduced to Sri Lanka on the mountain of Mihintale. Since then, various kings of Sri Lanka have blessed this rock with magnificent masterpieces of architecture. These include a hospital, a monastic complex, stupas and dagobas. While some of these structures are in an almost perfect state of preservation, others are in complete ruin. The most spectacular of these is the Kantaka Chaitiya, which displays some of the finest architecture of the early Anuradhapura era.

### **3.5 Kegalle District**

#### **Physical Resources**

##### **Topography, Geology and Soil**

116. Kegalle district, situated between the central highlands and western southern planes. The altitude of the western region is less than 175 m from the sea level while eastern region exceeds 300 m. The extent of the district is 1,692.8 km<sup>2</sup>. Kegalle is the capital city of the district which is one of the two districts belonging to Sabaragamuwa province the other being Ratnapura district. The boundaries of the Kegalle district are; Kurunegala district by North, Kandy and Nuwara Eliya districts by East, Ratnapura district by South, and Colombo and Gampaha districts by West.

##### **Land Use and the Agriculture**

117. According to the land used pattern in district – 2010, home gardens (5,9271 ha) is the major land use pattern in Kegalle district. As commercial crops, rubber (51,976.0 ha), tea (11551.0 ha) and Coconut plantation (12,507.0 ha) can be seen. In addition to rubber, tea and coconut, cinnamon is cultivated as plantation scale (61.0 ha). Out of total area of district (2952.0 ha) 2.0% and (6188.0) 4.0% are categorized as irrigated paddy land and paddy land by using rainwater respectively. The available forests in Kegalle were classified in to three groups namely dense forests (4226.0 ha), open forests (3432.0 ha) and planted forests (3201.0 ha). Other major land use patterns of district are grass lands/chena (4814.0 ha), marshes and mangroves (5.0 ha), reservoirs (1017.0 ha), sand and mountain (1369.0 ha), abandoned land (1280.0 ha) and sacred places, roads, cemetery etc. (3486.0 ha). (Source - District Land use Planning Office 2011)

#### **Social and Cultural Development**

##### **Population and Community**

118. There are 11 DS divisions, 1677 villagers and 12 police stations located within the Kegalle district of the Sabaragamuwa province. A total population of 818000 is distributed within the 11 DS divisions of the district representing all ethnic and religious groups in the country. Warakapola DS recorded maximum



population (110422) and lowest population can be seen in Bulathkohupitiya DS. Considering the population density, Mawnalle DS had the highest value than other 10 DS in Kegalle district. 18,372 peoples live in urban area while 741,310 and 53,318 peoples live in rural and estates respectively (Source -Department of Census and Statistics 2010). 75,356 families are receiving Samurdhi Assistance given by district authorities in 2010. 9,364 families in the Warakapola DS is the highest number who received Samurdhi Assistance in 2010.

119. Altogether 1690 manufacturing industries are located in Kegalle district. Textile, weavings, apparel and leather (428), wood, wood production and furniture (352), food, beverages and tobacco (270) and mining and quarrying (154) are the major manufacturing industries. In addition to these four, Basic metal industries, metal products, machinery and equipment, chemicals, petroleum rubber and plastic and paper products and printing industries contribute to the national production process (Source - Local Government Institutes 2010). 11,188 commercial places can be seen in the district. Among them retail shops, restaurant and canteen, meat, fish and vegetable shops are the major commercial places.

#### **Health and Educational Facilities**

120. To uplift the education level of people in Kegalle district, 522 schools are established in three educational zones namely Kegalle, Dehiovita and Mawanella. According to the 2010 statistics, 159317 students are attending to school in those three educational zones. Within 2010 period, 24367 students had studied at ordinary level classes (Grade 11). Altogether 18,705 advance level students followed sciences, commerce and art subjects. According to statistics of the Provincial Deputy Director's Office of Health Service, A total of 20 hospitals are distributed in DS of the Kegalle district. These include a single provincial general hospital at Kegalle, three base hospital types at Mawenalle, Karawenalla and Warakapola. There are 4 district hospitals, 8 rural hospitals and 3 rural estate hospitals are also located within the district to facilitate the 122,926 outdoor patients and 113,705 indoor patients.

#### **Sites of Cultural, Archaeological and Historical Significance**

121. The Suthigara dagoba, a dome-shaped shrine that contains Buddhist relics gets its name from the word suthikagaraya meaning place of birth. The smaller dagoba found closer to the pesa walalu (concentric perimeter rings going around the dagoba) on the eastern side is 36 feet in diameter. Later it was discovered that both the larger outer dagoba and the smaller one housed inside had been built around the same time. The diameter of the bigger dagoba is 804 feet and it is 47 feet high. The top of the dagoba is purposefully flat and covers about 26,000 square feet. The museum which was started originally as a place to house artefacts from the Suthigara dagoba, later was expanded to become a museum displaying art effects and information about heritage and other historical sites of the entire Kegalle district.

122. Maahmpitiya Raja Maha Viharaya is a cave temple with a stone inscription measuring 12 by 14 feet. Other temple is Devanagala Raja Maha Viharaya on the Devanagala rock. Just a little below this can be seen the shape of a white dagoba situated on top of a bald round rock. This is the Devanagala Viharaya and the climb to it from the very bottom takes about 45 minutes. The ruins and 360 degree view are spectacular and it gives you an idea of the impregnability of this highland kingdom.

123. The Pinnewela Elephant Orphanage is situated northwest of the town of Kegalle, halfway between the present capital Colombo and the ancient royal residence Kandy in the hills of central Sri Lanka. It was established in 1975 by the Sri Lanka Wildlife Department in a 25-acre coconut property near the Maha Oya River. The orphanage was originally founded in order to afford care and protection to the many orphaned elephants found in the jungle. As of 2008, there are about 84 elephants. Kitulgala is a small town in the west of Sri Lanka. It is in the wet zone rainforest, which gets two monsoons each year, and is one of the wettest places in the country. Nevertheless, it comes alive in the first three months of the year, especially in February, the driest month.

### **3.6 Colombo District**

#### **Physical Resources**

##### **Topography, Geology and Soil**

124. Colombo is the most highly populated district in Sri Lanka. According to the census reports in 2001 the population was 2,251,274. Colombo district is divided into 13 Divisional Secretariat Divisions and their activities are coordinated and supervised by the Colombo District Secretariat. Colombo district is a combined mixture of mountains, plains and marsh lands. north and east parts of the district are

mountainous whereas east and south-east parts are surrounded by marsh lands. city of Colombo is connected by a network of canals and at the heart of the city is the Beira Lake. The boundaries of the Colombo district are North-Kelani River (Gampaha district), South-Bolgoda River (Kalutara district), West-Coast line, and East-Sabaragamuwa Province.

### **Geography and climate**

125. Colombo's geography is a mix of land and water. The city has many canals and, in the heart of the city, there is a 65-hectare Beira Lake. The northern and north-eastern border of the city of Colombo is formed by the Kelani River, which meets the sea in a part of the city known as the Modera (mōdara in Sinhala) which means river delta. Colombo's climate is fairly temperate all throughout the year. From March to April the temperature averages around 31<sup>0</sup> Celsius. The only major change in the Colombo weather occurs during the monsoon seasons from May to August and October to January. Colombo sees little relative diurnal range of temperature, although this is more marked in the drier winter months, where minimum temperatures average 22<sup>0</sup> Celsius. Rainfall in the city averages around 2,400 mm a year.

### **Population**

126. The ethnic composition is 76.6% Sinhalese, 12.2% Tamil, 9% Muslim and 3% others. The literacy rate of the population aged 10 years and over is 93.6% (male 94%, female 93.1%). The labour force participation rate, expressed as the percentage of employed aged 10 years and over, is 47.5%. Employment rate is 93.6% and unemployment rate is 6.4%. The people tend to be engaged in craft and craft related work, manufacturing and wholesale and retail trade. The total number of households in the district is 507,678, 86.8% are permanent houses, 11.2% are semi-permanent houses, 0.3% are improvised houses and 1.8% are not classified. Out of the occupied housing units, 71.6% are single houses, 9.2 % are flats, 6.4% are row houses/line rooms, and 1.5% are huts.

### **Socio Economic Profile**

127. The Colombo Metropolitan Region, defined by the districts of Colombo, Gampaha and Kalutara, has an estimated population of 5,648,000, and covers an area of 3,694.20 km<sup>2</sup>. As per the Provincial Gross Domestic Product-2010, the Western Province, which includes the cities of Colombo, Gampaha and Kalutara recorded GDP per capita of USD 3,808, the highest recorded GDP per capita for any region in South Asia. Colombo has the highest degree of infrastructure - electricity, water and transport etc. The majority of the major shopping malls in Sri Lanka are located in the city apart from that, many luxurious hotels, clubs and restaurants are situated in the city. In recent times, there's been an outpour of high rise condominiums in the city, mainly due to very high land prices.

### **Economy**

128. The majority of Sri Lankan corporations have their head offices in Colombo. Some of the industries include chemicals, textiles, glass, cement, leather goods, furniture, and jewellery. In the city centre is located South Asia's second tallest building – The World Trade Centre. The 40 story Twin Tower complex is the centre of important commercial establishments, situated in the Fort district, the city's nerve centre. Right outside the Fort area is Pettah which is derived from the Sinhalese word pita, which means out or outside as it is outside the Fort.

129. Pettah is more crowded than the fort area. Pettah's roads are always packed and pavements are full of small stalls selling products ranging from delicious sherbat to shirts. Main Street consists mostly of clothes shops and the cross roads, which are literally known as Cross Streets where each of the five streets specializes in a specific business - First Cross Street is mostly for electronic goods shops; the Second cross street is mostly for cellular phones and fancy goods. At the end of the main street further away from Fort is the Sea Street, Sri Lanka's gold market. This mile-long street is full of jewellery shops. The Colombo Metropolitan Region (CMR) encompasses the country's administrative capital Kotte and Colombo. Found within the borders of the CMR is 80% of the country's industries and over 60% of all vehicles plying Sri Lankan roads.

130. Colombo district has relatively high proportion of modern facilities such as teaching, provincial, and base hospitals while in Gampaha and Kalutara Districts these facilities are very limited. For example, there are 610 hospital beds per every 100,000 population in Colombo district, compared with 260 beds in Gampaha and 210 in Kalutara. In terms of doctors per 100,000 populations, Colombo district average is 68 while the average for Gampaha and Kalutara are 17 and 22 respectively.

## 4 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

### 4.1 CEB'S Approach for Route Selection

131. At the planning stage itself, one of the factors that govern the establishment of the transmission line is the infringement of populated/forest/cultivated area and scarce land. Wherever such infringements are substantial, different alternative options are to be considered. During route alignment, all possible efforts are made to avoid the populated/forest/cultivated area infringement completely or to keep it to the barest minimum. Whenever it becomes unavoidable due to the geographical locations/terrain, mitigation costs involved towards avoidance needs to be worked out. While identifying the transmission system for a generation project or as a part of distribution grid, preliminary route selection is done by CEB based on the interpretation and walk over surveys according to the 1:50,000 maps/topographical maps of the area.

132. For selection of optimum route, the following points are taken into consideration:

- (i) The route of the proposed transmission lines does not involve any human habitation
- (ii) Any monument of cultural or historical importance is not affected by the route of the transmission line
- (iii) The proposed route of transmission line does not create any threat to the survival of any community with special reference to Tribal Community
- (iv) The proposed route of transmission line does not affect any public utility services like playgrounds, schools, other establishments etc.
- (v) The line route does not pass through any sanctuaries, protected park etc.
- (vi) The line route does not infringe with area of natural resources.

### 4.2 Alternatives for Transmission Line Alignment

133. In order to achieve this, CEB has undertaken route selection for transmission line in close consultation with representatives from Divisional Secretaries, Ministry of Land, Agrarian Service Department, Department of Survey, Forest Department, and the local community. Although under National law, CEB has the right of way, yet it considers alternative alignments during site selection, with minor alterations often added to avoid environmentally sensitive areas and settlements at the implementation stage.

- As a principle, alignments are generally cited atleast 500m away from major towns, whenever possible, to account for future urban expansion and atleast 50m away from any houses or structures.
- Similarly, plantations/forests are avoided to the maximum extent possible. When it is not possible, a route is selected in consultation with the Divisional Secretaries that causes minimum damage to existing plantation/forest resources.
- Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.
- In addition, care is also taken to avoid/minimise protected parks/forests, bird sanctuaries and any other forest area rich in wild life.

134. Keeping above in mind, various alignments of line were considered. All such different alternatives were studied by the CEB officials before being proposed to ADB for funding to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental and social impacts for their proper management. Annexure 2 given the alternative analysis for the GSSs and the Annexure 3 gives an illustrative evaluation analysis of the alternative alignments for the proposed subproject. Annexure 4 gives the inventorisation along the proposed transmission lines. Table 5 gives the summary of the final evaluation of the site selection.

**Table 5: Summary of final alternative taken for Project Consideration**

S No	Project Component	Alternative Chosen	Reason
<b>A.I</b>	<b>Transmission System Strengthening in Mannar region</b>		
A.I.2	132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line	B. Alternative that passes outside the the boundary of the Mihintale Preservation area.	Avoids houses and home gardens in the RoW; and avoids the archeologically significant area in Mihintale sacred city.
A. I.4	132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.	B. Alternative that passes parallel to the railway and road which passes	Giant Tank Sanctuary avoided.

S No	Project Component	Alternative Chosen	Reason
		through a minimum sanctuary area.	
A.I.5	132 kV/ 33 kV Mannar GSS (1 x 31.5 MVA).	B. Government Land in the paddy fields.	Land belongs to Irrigation Department.
<b>A-II.</b>	<b>New Polpitiya 220/ 132 kV GSS and associated transmission line.</b>		
A.II.1	220/132 kV New Polpitiya GSS	A. Rubber tree estate in Gonagamuwa village.	No forest reserve areas and no houses in alignment.
A.II.2	132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.	A. Traverses the rubber lands, home gardens, secondary forests.	No forest reserve areas and no houses in RoW.
A.II.4	220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the exiting Pannipitiya GSS.	A. Traverses through urban areas near Pannipitiya, rubber lands, paddy fields, home gardens and some marshy area.	No forest reserve areas. Interference with the houses/buildings is a very low quantum.
<b>A-III.</b>	<b>Padukka 220/132/33 kV GSS and associated transmission line</b>		
A.III.1	220/132/33 kV Padukka GSS	A. Land under the alignment of the 220 kV line.	The land private and government. It has rubber plantation.
A.III.2	132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.	A. Passes through paddy fields, home gardens and housing scheme.	Least number of trees to be cut.
A.III.3	132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.	A. Old RoW for 132 kV line.	Existing RoW
<b>A-IV.</b>	<b>Construction of 132/33 kV GSS at Kegalle.</b>		
A.IV.1	132/33 kV GSS at Kegalle	A. Paddy Field location.	Land has no forests or any sensitive area.
A.IV.2	132 kV 22.5 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.	A. Alternative through rubber plantation and paddy areas.	Uses more paddy fields and plantation areas.

### Reasons for the final selection

135. Considering the various reasons based on information in the Annexures 2, 3, and 4 the alternative selected were found to be most suitable as they involved lesser populated area, plantation/forest areas, and minimum RoW problems. Also, a minimum disturbance to the reserve forests and the adjoining sanctuary and national parks as the route utilised by the proposed lines will have more degraded forests.

### 4.3 Environment Impacts and Mitigation Measures

#### Environment problems due to project location and design

136. Potential adverse environment impacts associated with transmission lines has been avoided or minimised through careful route selection. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however route alignment passes through scrub lands, cultivated and abandoned paddy fields, rubber plantations, tea cultivations etc. Alignment in this project has avoided wetlands and geologically unstable areas, which can also pose foundation related problems. No land acquisition is required for placing transmission towers on private land. However, any damage to the crops during the construction phase of the project will be duly compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will be lost permanently at the base of the transmission tower. After construction, agricultural land within the transmission corridors can be used again for farming purpose.

#### Environmental Impacts Associated with Pre-Construction Stage

##### Acquisition of Paddy Fields and Other Lands

137. There may be loss of agricultural productivity due to obstruction and reduce the land of paddy

fields. Thus following measures will have to be taken prior to the project activities:

- Avoid farming season wherever possible in the planning of project activities,
- Ensure existing irrigation facilities are maintained in working condition,
- Protect /preserve topsoil and reinstate after construction is completed,
- Repair /reinstate damaged bunds etc. after construction is completed, and
- Compensation for temporary loss in agricultural production.

#### **Impacts on Temporary Use of Land**

138. The mobilisation of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labour camps for human resource to avoid environmental impact and public inconvenience. These locations must comply with the local laws and regulations and need approval from authorities to utilise these facilities (access roads, telecommunication, and pipe borne water supply). It is important that selection of temporary lands is done at least 500 m away from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. Removal of trees and green cover vegetation should be minimised during preparation of access road and other facilities.

#### **Environmental Problems Associated with Construction and Operation Stage**

139. The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to transmission line and line stringing. For substation, it will involve excavation for building and equipment foundations, civil works and erection of equipment. During the operation phase, most of the construction phase impacts will get stabilised and the impacts will be restricted only to the operation and maintenance of the project.

140. The impacts on the environment from various activities of the project can be categorised as follows:

- Impact on Physical Resources
  - Impact on Topography
  - Impact on Climate
- Impact on Environmental Resources
  - Impact on Air Quality
  - Impact on Noise Levels
  - Impact on Surface Water Quality
  - Impact on Ground Water Quality
  - Impact on Soils and Geology
- Impact on Ecological Resources
  - Terrestrial Ecology
  - Wild Life
  - Aquatic Ecology
- Impact on Human Environment
  - Health and Safety
  - Agriculture
  - Socio-economics
  - Resettlement and Rehabilitation
  - Cultural sites
  - Traffic and Transport
  - Interference with other utilises and traffic
- Waste Disposal
  - Solid waste disposal
  - Liquid waste disposal.

141. The impacts of the project activities on various environmental attributes are discussed in subsequent sections.

## Impact on Physical Resources

### Impact on Topography

142. During the construction of the transmission line and substation, the topography will change due to excavation and erection of tower, fill and cut for levelling the tower erection place. The most prominent impact on the surface topography will be due to the removing of the trees at the tower erection site and all along the Right of Way (35 m, RoW for both 132 kV and 220 kV lines as prescribed by CEB) for construction facilitation. This will lead to change in the surface features only. The impact will be irreversible as the present features along the 35 m RoW will be changed due to presence of the transmission line.

143. No topographical changes are envisaged during the operation phase of the transmission line and the substation. The existing access routes will be utilised during the operation and maintenance of the transmission lines.

### Impact on Climate

144. The study area along the RoW is predominantly tea/coconut/rubber plantation/paddy plantation and home gardens in the project area. However, impact on the climate conditions from the proposed projects both during the construction and operation phases will not be significant.

## Impact on Environmental Resources

### Impact on Air Quality

145. During the construction phase, the activity would involve excavation for the tower erection, movement of transporting vehicles carrying the construction materials etc. along the haul road (through un-built roads, but are not maintained). At majority of locations, movement of heavy vehicles may not be possible; from approach road to construction site material will be head loaded. All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site which although will be transitory in nature. Sprinkling of water during excavation will reduce the dust emission to a great extent.

146. The construction of transmission line and the substation will not have any negative impact on the air quality of the region during the operation phase.

### Impact on Noise Levels

147. During the construction phase, the major sources of noise pollution are movement of vehicles transporting the construction material and equipment to the site. Most of the access roads along the alignment are motorable. The major work of the construction is expected to be carried out during the day time. The noise produced during the construction will have negligible impact on the residents as the predominant land use along most part of the alignment are paddy fields/ coconut trees, tea and rubber plantations area. There will be very limited presence of population being exposed to noise generated during the construction phase.

148. Following measures will help to keep noise and vibration in acceptable level during construction phase:

- Contractor shall equip their heavy construction equipment and plants with exhaust silencers to limit the engine noise so as not to exceed 75 db (compacters, loaders, vibrators and cranes) and regularly maintain all construction vehicles and machinery that should meet the National Emission Standards.
- Contractor shall limit working time for activities that create noise only from 6.00 am to 6.00 pm except for construction site near public sensitive receptors. Construction related activities closer to sensitive receptors have to be scheduled in coordination with the relevant authorities.
- Contractor and its suppliers of construction materials should strictly implement noise control regulations stipulated by the CEA in 1996 (Gazette Extra Ordinance, No 924/12) for all construction vehicles and equipment.

149. During the operation phase of the project, there will be corona noise from the conductors which will be felt only up to 15 to 30 m area, hence the ambient noise level meets the CPCB standard for residential areas (55 dB(A) during daytime and 45 dB(A) during night time ).

### Impact on Surface Water Quality

150. The construction and operation of the transmission lines will not have any major impact on the surface and ground water quality in the area. Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site joining the water body. There may be increase in the turbidity levels temporarily where the proposed alignment is crossing and if the surface



runoff during construction meets the river. This can be avoided by careful selection of the tower site and the access roads so that the surface runoff does not meet the river.

151. Proposed activities will create temporary impacts to the existing drainage system in the area including irrigation canals, natural flow paths, and also earth and line drains. Stagnation of water will also create temporary breeding sites to mosquitoes, which will have direct impact on public health. Thus incorporation of following measures will minimise anticipated impact due to obstruction of natural flow paths and existing drainage:

- Provisions of temporary drainage facilities to the particular locations if existing drains are obstructed due to construction activities.
- Maintenance of all drainage paths by avoiding blockages at all times
- Contractor should minimise excavation of beds of any streams, irrigation systems, and other water resources available in the project affected area.

152. Care shall be taken to locate the temporary construction worker sheds away from the water bodies. Adequate drinking water facilities, sanitary facilities, and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

#### **Impact on Ground Water Quality**

153. Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. For transmission line construction activity, no chemical substance or oil is used hence there is no impact on ground water quality. The silt discharge from the earthwork around water bodies, oil, grease and fuel release from the construction vehicles/equipment and spoil from construction and other construction related activities such as raw sewerage from worker accommodation sites will mix with runoff water. This situation will increase during the rainy season and have a critical impact on surface and ground water. Thus following measures will be required in order to prevent deterioration of water from the construction and construction related activities:

- All construction vehicles and equipment should be maintained in proper conditions without any leakage,
- Contractors shall use silt traps and erosion control measures where the construction is carried out in close proximity to the water bodies to avoid entering of cement particles, rock, rubbles and waste water to the surrounding water bodies,
- Construction activities should be restricted to dry season,
- Waste oil should be collected properly and disposed to the approved location by Local Authorities (LA) / CEA.

#### **Impact on Soil and Geology**

154. Project activities including excavation, cut and fill operations, removal of trees and green cover vegetation etc., will enhance the soil erosion during the rainy season. Removal of trees and green cover vegetation will reduce infiltration rate of rainwater. The impact on soils will be due to the soil erosion at the tower construction site and along the access routes. Excavation activity and land clearance in the erosion prone areas have to be minimised while conducting site selection for towers. Levelling and stabilisation of tower construction sites will be done after completion of construction activity which will avoid increased acceleration of surface runoff and damage to the topsoil. The impact associated with landslides due to excessive erosion and other civil works can be avoided or minimised by following mitigation measures:

- Maximum effort should be taken to minimise removal of trees and green cover vegetation.
- Minimise obstruction or destruction to natural drainage pattern of the surrounding area.
- Proper treatment of clearing and filling areas against flow acceleration.
- Turfing work should be taken prior to rainy season around the substation.
- Contractors shall restrict cut and fill operation around sharp/deep slope areas.
- Piling activities will be restricted to non-rainy season, unless piled materials will spread all over the area and contaminate close by water bodies.
- Top soil (2-3 cm from the top of the soil), which is removed during construction from the cultivated lands must be stored separately for future utilisation of cultivated lands near tower leg locations.

### Impact on Ecological Resources

155. There is no national wildlife park, bird sanctuary, wetland in the route alignment of the proposed transmission line. The study area for route alignment has sparse forest and plantations area. The ecological impacts are briefly described in the following sections.

#### Effect on Flora and Fauna

156. Considerable amount of trees will be removed from the project area for RoW (total 35m for both 132 kV and 220 kV (as per CEB norms) for the transmission line. None of the declared environmentally sensitive areas is located within the project-affected area. It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. However, noise, vibration and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner. The impacts related to above activities are temporary and can be mitigated through following measures:

- Strict attention on worker force regarding disturbance to surrounding habitats, flora and fauna including hunting of animals and fishing in water bodies.
- Selection of approved locations for material storage yards and labour camps away from the environmental sensitive areas.
- Avoid entering of construction waste (cement particles, rock, rubbles and waste water) and sanitary waste to the surrounding water bodies.

#### Impact on Terrestrial Ecology

157. There is no sensitive ecological area / protected forest area such as national wildlife park, or bird sanctuary crossing the proposed route alignment. The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimised through adoption of mitigation measures like paving and surface treatment and water sprinkling.

#### Removal of Trees

158. Approximately 2,800 forest trees and 26,000 fruit/nonfruit/plantation trees will be removed from the RoW of the transmission line. These would include shading timber, plantation species as well as edible fruit species. The initial construction works along the alignment involving land clearance, cutting, filling, and levelling may cause loss of vegetation. This will be irreversible impact. Care has been taken to avoid the thick plantations/vegetation as far as possible and tower locations are selected at plain paddy fields where the vegetation is thin. This will minimise the tree loss. Compensation is being paid to the tree owners in the private areas as per GoSL norms. Clearing of home gardens, plantations and forest area is involved along the route alignment, hence the compensatory afforestation is required for which clearance will be obtained from the appropriate authority of the forest department and amount for compensation for home garden and plantations will be paid direct to the farmers. Also needed is a replanting programme with the help of project affected community where two trees will be planted when a single tree is cut.

#### Effect on Local Road Network

159. Transformers, tower material, substation equipment, iron bars, concrete materials, equipment etc. will be transported through the provincial and local road network to the project site. Transporting of large quantities of materials using heavy vehicles could exceed the carrying capacity of the road. This would lead to physical damages to local road network. Thus, it will be necessary to obtain consent from Road Development Authority (RDA) or Provincial Road Development Authority (PRDA) to use local roads prior to transportation. In addition, contractor should properly maintain all road sections, which will be utilised for the construction related activities.

#### Disposal of Debris

160. Because of construction related activities, spoil and debris will generate during the construction stage. Improper disposal of the debris will have an impact on the surrounding ecology, public health, and scenic beauty. Following measures will minimise the impacts associated with disposal of debris:

- Spoil materials (soil, sand, rock etc.,) generated from construction activities shall be used wherever possible for site levelling, back - filling etc. Dismantled and demolished structural materials should not be dumped at agricultural lands.
- Dumped materials could interfere with the drainage pattern of the area, any water bodies, agricultural



lands, marshlands and down slope or any environmental sensitive area and therefore must be handled properly.

161. During operation phase, corridor along the alignment will be chopped of vegetation and lopping of trees will be done for maintenance purpose. This will also reduce the chances of fires due to electric sparks.

#### **Wild Life**

162. For selecting the route alignment, any wild life travel routes have been avoided; although the elephant corridors do exist in the proposed extension area of the Madhu Road Sanctuary which is used for the Mannar-Vavuniya 132 kV transmission line.

#### **Impact on Aquatic Ecology**

163. No significant impacts on aquatic ecology of the river are envisaged, as there will be careful selection of the tower sites near the river, to avoid river pollution and disturbance to the aquatic fauna of the area.

#### **Impact on Human Environment**

##### **Health and Safety**

164. Health and safety impacts will be in terms of risk of accidents and exposure to electromagnetic fields along the alignment. The accidents may be caused due to electrocution, lightening, fires and explosions. To avoid this, the houses will be allowed within the RoW of the project, only if the stipulated safety clearance is met with. Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor. Personal protective equipment like safety gloves, helmet, mufflers etc will be provided during construction period and during the maintenance work. First aid facilities will be made available with the labour gangs and doctors called in from nearby towns when necessary. Workers are also covered by the statutory workmen compensation as per GoSL laws by the contractor.

165. Project activities may create accidental damage to public and the construction workers. Therefore, contractors should take necessary action to enhance personal safety during the construction through following measures:

- Organise awareness programmes relevant to personal safety of the workers and public in the area.
- Installation of warning signs to particular locations such as transverse points of local road network by transmission lines.
- Provide protective safety belts, footwear, helmets, goggles, eye-shields, and clothes to workers depending on their duty.
- Arrangement of proper first aid unit and transport facilities to take injured people to the hospitals.

##### **Agriculture**

166. Permanent and temporary loss of agricultural land occurs due to tower location in the agricultural field and loss of crop for access route etc. There will not be any land acquisition for the tower erection. As far as possible, any prime agricultural land will be avoided and the construction will be done after crop harvesting.

##### **Socio-Economics**

167. Construction of transmission line will generate local employment, as number of unskilled labours (men/women) will be required at the time of construction activities. Local employment during this period will increase the income and socio-economic standards of the residents of the project area.

##### **Temporary Outage of the Electricity**

168. Temporary disconnection of power supply will occur during the construction activities. Thus public and the industrial places, which are located in project-affected area, will face inconvenience for short periods. The following measures will have to be taken:

- Advance notice to the public about the time and the duration of the utility disruption, and
- Restore the utilities immediately to overcome public inconvenience.

##### **Resettlement and Rehabilitation**

169. For the construction of GSS at Padukka, New Polipitiya, and Kegalle, private lands are being proposed, which will be purchased at market rates, and acquisition of land will not be required from the surrounding communities. For Mannar GSS, it is a government land and hence no land acquisition is required. There lands are vacant and besides the purchase value of land being paid to affected persons, there is no physical resettlement and rehabilitation involved in the project.

### **Cultural Sites**

170. There are no archaeological, historical, or cultural important sites along the route alignment; and hence, the impacts on these sites are not envisaged. Mihintale preservation area in Anuradhapura has been avoided along the 132 kV (on 220 kV towers) Anuradhapura-Vavunia transmission line.

### **Traffic and Transport**

171. During the construction phase, traffic disturbance needs to be minimised by avoiding high-density areas, using proper traffic signs, ensuring proper access roads and avoiding road blockage.

### **Interference with Other Utilities and Traffic**

172. As per regulations enacted by GoSL, it is mandatory for CEB to seek clearance prior to construction from railways, telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of transmission lines. The transmission lines affect nearby telecommunication circuits by causing electrical interference and induced voltage which may occur to nearby telecom circuit and suggested necessary protection measures will need to be adopted. This may require measures like rerouting of the telecom circuits, conversion of overhead telecom circuits into cables etc. to minimise the interference. The exact cost to mitigate the impacts of induction in neighbouring telecom circuits would vary from case to case. Wherever transmission line crosses the railways, clearance is taken from that department. In general, the system is planned and executed in such a way that adequate clearance is maintained between transmission lines on the one hand, and railways, civil aviation and defence installations on the other. Wherever the transmission lines passes near the airport, the towers beyond specified height are painted in alternate orange and white stripes for easy visibility and warning lights are placed on the top of these towers.

### **Waste Disposal**

#### **Solid Waste Disposal**

173. The solid waste generation will be at the location of the tower erection site which will include metal scraps, wooden packing material etc. Wooden waste and metal scrap will be collected and disposed of in compliance with applicable regulations and rules.

#### **Sanitary Waste Disposal at Construction Sites and Labour Camps**

174. The labour camps at the site of tower erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labour will be staying will be near hamlets, which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities, and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

175. There should be proper solid waste disposal procedure to enhance sanitation of workers who stay in camps. Thus, possibilities of infecting water borne diseases or vector borne diseases (Parasitic infections) will be eliminated by adopting proper solid waste disposal procedure. Unacceptable solid waste disposal practices such as open dumping of solid waste and poor sanitation facilities will lead to pollution of surrounding environment, contamination of water bodies and increase adverse impact to the aquatic; terrestrial lives and general public inhabited in the area. Surrounding of labour camps, garbage disposal sites and material storage yards provide favourable habitats for vectors of diseases such as mosquitoes, rats and flies.

176. Thus following measures are needed to protect and enhance the quality of environment during the construction stage:

- A better way to overcome garbage disposal as mentioned above is by reducing or avoiding the construction of labour camps, thus the selection of majority of skilled and unskilled workers from the project influence area will be a proper measure in this regard.
- Contractor should provide adequate facilities to manage its wastes in accordance with the guidance given by the CEA.
- Provision of the solid waste disposal, sanitation, and sewage facilities at all sites of the construction/labour camps to avoid or minimise health hazards and environmental pollution.
- Contractor should handle and manage waste generated from the construction/labour camps without contamination to natural environment and it will reduce risk to public who stay close to sites. In addition, contractor should be responsible to enhance the quality of environment.

- Adequate supply of water should be provided to the urinals, toilets, and washrooms of the workers' accommodation.
- Contractor should provide garbage bins to all workers' accommodation and construction sites, for dumping wastes regularly in a hygienic manner with the help of Public Health Inspector (PHI) in the area.

**Liquid Waste Disposal**

177. There will be no oil or chemical waste generated during the construction of transmission line, hence no mitigation is required.

**Environmental impacts associated with operational stage****Electric shock**

178. This may lead to death or injury to the workers and public in the area. This can be minimised or avoided by:

- Security fences around substation.
- Establishment of warning signs.
- Careful design using appropriate technologies to minimise hazards.

**Noise Generation**

179. Nuisance to the community around the site can occur during the project implementation stage. Provision of appropriate noise barriers will be essential in this regard.

**Maintenance of Transmission Line and Substation**

180. Possible exposure to electromagnetic interference could occur during these activities. Design of transmission line should comply with the limits of electromagnetic interference from overhead power lines.

**Oil Spillage**

181. Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident. Substation transformers are normally located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities will be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season.

**4.4 Environmental Management Plan**

182. The Environmental Management Plan (EMP) has been prepared for the sub-project that discusses the anticipated impacts, monitoring requirements, and development of mitigation measures with respect to the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans were developed and will be implemented during the project implementation phase.

183. The EMP for the project is attached as Annexure 5, which identifies feasible and cost - effective measures to be taken to reduce potential significant, adverse, impacts to acceptable levels. Here, proper mitigation measures are proposed for each potential impact, including details on responsible parties for implementation of mitigation measures and supervision. A summary environmental impact matrix and the mitigation measures are given in Table 6 below.

**Table - 6: Environmental Impact Matrix**

Sl. N <sup>o</sup>	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation & Monitoring
				Low	Medium	High		
A. Physical Resources								
1.	Topography	Change in the surface features and present aesthetics due to the construction of the project.	Direct/Local/irreversible		X		The compensatory afforestation of equivalent area of forest land in RoW will be undertaken by the Forest Department to compensate for the loss on CEB expenses to minimise the impact of loss of vegetation as per existing norms under the Forest (Conservation) Act 2002.	Before construction phase
2.	Climate	No impacts on the climatic conditions	Direct/Local/irreversible	X			No measure impact on the climatic conditions, hence no mitigation is required	
B. Environmental Resources								
1.	Air Quality	Project will have marginal impact on air quality during the construction period due to increase in the dust emission.	Direct/Local/reversible	X			Watering at construction site, limited bare soils, proper maintenance of vehicles etc.	During construction activity
2.	Noise	Noise due to general construction activities.	Direct/Local/reversible	X			Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers etc.	During construction activity
		Noise arising from corona noise from conductors	Direct/Local/reversible	X			Monitoring of possible corona noise to identify and correct problems.	During operational phase
3.	Surface and Ground Water quality	Runoff from the construction site	Direct/Local/reversible	X			Careful siting of towers and access roads.	Before and during construction activity
		Domestic wastewater from construction sites	Direct/Local/reversible	X			Domestic waste treatment by providing septic tank/soak pits.	During construction and operation
4.	Soils and Geology	Soil erosion due to tower erecting and clearing of vegetation in the RoW and access roads.	Direct/Local/reversible		X		Avoiding sites, which are prone to the soil erosion. Levelling of tower construction sites. Adoption of proper slope protection measures. Use of few access roads.  Rehabilitation and stabilisation of disturbed land.	During and after the construction activity
		Damage due to seismic activity	Direct/regional	X			Site selection and proper tower foundation	Before the construction

Sl. N°	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation & Monitoring
				Low	Medium	High		
			/ reversible				design considering the geological conditions and seismicity of the area.	activity.
<b>C. Ecological Resources</b>								
1.	Terrestrial Ecology	Loss of vegetation	Direct/Local/irreversible		X		Location of towers at the forest and plantation area. Selection of few access roads. Compensation to the tree owners. The tree planting will be done by the forest department for which CEB will pay the estimated cost to them.	Before the construction phase
2.	Terrestrial Fauna	Disturbance to the local fauna during construction	Direct/Local/reversible	X			Wildlife routes and their habitats has been avoided as far as possible during the route selection.	Before and during construction phase
		Disturbance to the local fauna during operation	Direct/Local/reversible	X			Monitoring of line especially for bird strikes during the operation and use of deflectors if required.	During operation phase
3.	Aquatic Ecology	No significant impacts envisaged	Direct/Local/reversible	X			No mitigation required.	Before and during construction phase
<b>D. Human Environment</b>								
1		Fires, explosion and other accidents at the route alignment of transmission line.	Direct/Local	X			Use of personal protective equipment during construction. By lopping and chopping of trees fire hazards will be avoided during maintenance period. Regular inspection of lines for faults prone to accidents.	During construction and operation phase
2.	Health and Safety	Exposure to electromagnetic fields	Direct/Local/continuous	X			Alignment route away from the settlement. Houses will be allowed in the RoW of the alignment only if the relevant safety clearance is met with. No mitigation required.	Before and after the construction phase.
3.	Agriculture	Permanent and temporary loss of agriculture land due to tower erection and due to access routes.	Direct/Local/reversible	X			Avoid prime agriculture land. Assessment of land required and compensation. Construction activity after crop harvesting and selection of few access routes.	Before and during construction phase.

Sl. N°	Environmental attribute	Potential impacts	Nature of impact	Magnitude of impacts			Mitigation measures	Implementation & Monitoring
				Low	Medium	High		
4.	Socio-economics	Beneficial impacts from rural and urban electrification. Job opportunities during construction phase	Direct/regional		X		Unskilled labor and indirect benefits. Overall economic growth of the region.	During operational phase
5.	Resettlement	Resettlement of the house falling along the RoW.	Direct/Local/reversible	X			Route alignment is selected in such a way that there is no resettlement issue.	Before the construction phase.
6.	Cultural sites	No archaeological, historical or cultural important sites are affected by the construction of the lines.	Direct/Local/reversible	X			Archaeological, historical or cultural important sites avoided, hence no mitigation required	--
7.	Traffic and Transportation	Traffic congestion due to movement of construction vehicles	Direct/Local/reversible	X			Avoid high density traffic areas, proper traffic signs at the construction site, ensuring proper access roads	During construction phase
8.	Solid Waste Generation	Probability of surface and ground water pollution	indirect/Local/reversible	X			Separated wooden and scrap will be collected and disposed of in compliance with applicable regulations and rules.	During operation phase

## 5 INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PROGRAMME

### 5.1 Institutional arrangements

184. According to the National Environmental Act (NEA), there exists a mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for any kind of power plants of prescribed capacity and transmission lines over 50 kV in capacity, and above 10 km in length. In most cases, Central Environmental Authority (CEA) designates the Ministry of Power and Energy as the PAA for the environmental approval process for transmission line. Therefore, the Ministry of Power and Energy has established an environment cell in the Planning Division to implement the requirements of NEA. CEB has set up a Design & Environment Division (D&ED) for dealing with environmental issues at the corporate level to monitor and implement environmental good practices.

185. The Design and Environment Division is headed by Dy. General Manager who is qualified and also well aware of the project activities and its impacts on the environment. A Chief Engineer has been deputed to as the Head of the Environment Unit to give guidance to the project staff and contractors to adopt the environmental good practice while implementing the project. There is a need to strengthen the Division by hiring middle level executives who would be engaged in the field to work under the Chief Engineer to report project implementation.

186. The duties of the Environment Division at the corporate level:

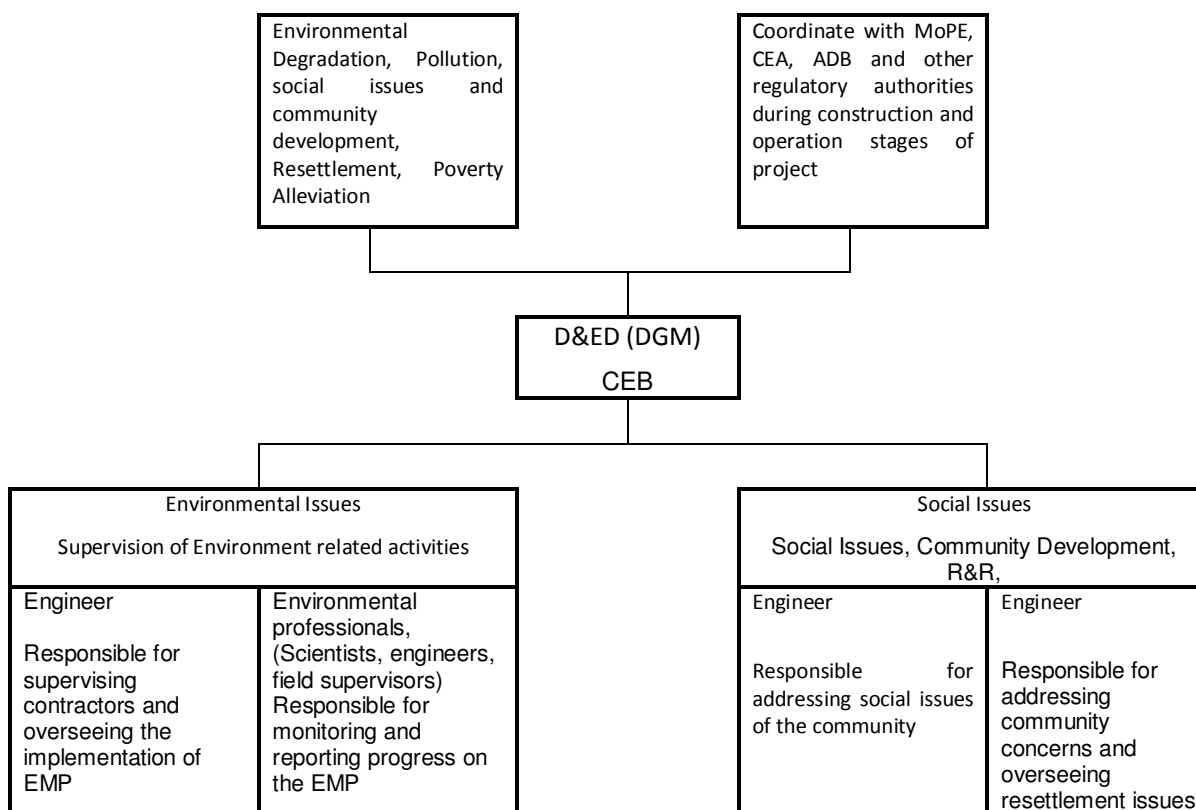
- Monitoring and implementation of mitigation measures during construction and operation phases of the project.
- Coordinate the preparation of suitable environmental management reports at various project sites.
- Advising and coordinating field environmental management cells activity towards effective environment management.
- Liaise with the Ministry of Power and Energy (MoPE) and Central Environmental Authority (CEA), and other relevant agencies and seek their help to solve the environment related issues of the project implementation.
- Advice project planning cell on environmental and social issues to avoid negative environmental impacts.
- Provide training and awareness on environmental and social issues related to power transmission projects to the project staff.

187. The duties of the Environment Division at the Field level:

- Implement the environment policy guidelines and environmental good practices at the sites.
- Advising and coordinating the field offices activity towards effective environment management.
- Liaise with the forest department and seek help of forest officers in resolving environment monitoring related issues.
- Carry out environmental and social survey in conjunction with project planning cell to avoid negative environmental impact.
- Make the contractor staff aware on environmental and social issues related to power transmission projects so that EMP could be managed effectively.

188. The mitigation measures suggested requires monitoring of environmental attributes both during construction and operational phase of the project. The Figure 10 below depicts the institutional organisation structure showing the various entities within CEB and their role vis-à-vis- other government agencies.

**Figure 10 Institutional Structures and Responsibility for Environmental Management Plan at Ceylon Electricity Board (CEB)**



*D&ED = Design & Environment Division, EMP = environmental management plan, MoPE = Ministry of Power and Energy, PIU = Project Implementation Unit*

## 5.2 Environmental Monitoring Plan (EMoP)

189. During the construction and operation phase of this project, the monitoring of the environmental aspects shall be done at the transmission line by a competent officer of the ED. During the construction phase, the contractor should ensure that activities like handling of earth works clearing work, access road construction, putting traffic signals is done properly to have minimum impact. This in turn should be monitored by the Engineer-in-Charge of the individual transmission line/substation project.

190. Monitoring of sanitary waste treatment should be done periodically to avoid water pollution. Other environmental good practices include noise abatement, maintaining hygienic conditions, maintenance of fire and safety equipment etc. Monitoring report should be prepared once in six months with the corrective action plan for the problem areas. Overall, the environmental good practices should be followed as per environmental policy guidelines.

191. In addition to the EMP, to ensure that project would not be generating a negative impact to the overall environment quality, an EMoP will be prepared. The monitoring activities of the project include site supervision, verification of permits, monitoring of water quality, soil, noise and air. Monitoring of the quality of water, soil, air, and noise during the construction stage is a responsibility of the contractor by the approved government agency. PIU and Environmental and Social Assistants will supervise the contractor. The environmental monitoring report will be submitted by the PIU to the PMU, which will include the result of environmental monitoring into its environmental report. The environmental monitoring activities along with their periodicity for developing the EMoP for the Project is summarised in Annexure 6.

192. As per ADB's Safeguards Policy 2009, ADB requires the borrower to retain external qualified experts or qualified NGOs to verify monitoring reports with significant impacts and risks. This external monitoring report will be on a semi-annual basis directly to ADB to verify whether sound environmental management



practices are applied, and the set environment targets are achieved. In case the implementation of EMP measures is not satisfactory, this external monitoring experts/NGO will recommend actions to enhance environmental compliance.

### 5.3 Critical Environmental Review Criteria

#### (i) Loss of irreplaceable resources

193. The rural electrification projects do not involve any large-scale excavation and land lost is insignificant. The EMP includes compensation for the loss by minimising the impact of loss of vegetation as per existing norms under the Forest (Conservation) Act, 2002. There will be no net biodiversity loss in this project due to the afforestation being done by Department of Forests and the rule of planting two trees for cutting one tree.

#### (ii) Accelerated use of resources for short-term gains

194. The project will not use any natural resources occurring in the area during construction as well as its operation cum maintenance phases. The construction material such as tower material, cement etc. shall come from factories mostly from abroad, while the excavated soil shall be used for backfilling and revetment to restore the surface. Thus, the project shall not cause any accelerated use of resources for short-term gains.

#### (iii) Endangering of species

195. Endemic species of flora and fauna exist in the project area and adjoining forest areas, but the project activities will not threaten or cause their extinction.

#### (iv) Promoting undesirable rural-to urban migration

196. The project will not cause any submergence or loss of land holdings that normally trigger migration. It also does not involve acquisition of any private land holdings. Hence, there is no possibility of any migration.

#### (v) Increase in affluent/poor income gap

197. The project will increase availability and reliability of power. Power is a key input to the economic development of any area. Experience indicates that economic development leads to generation of more jobs, which in turn should raise the living standards of poor. Thus, the project will contribute to reduction of affluent/poor income gap by providing opportunities for employment and rural based economic activities.

### 5.4 Environmental Management Plan Budget Costs

198. The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the project; (ii) providing offsets to negate project impacts especially ecological impacts. Without such expenditures, the project might generate large environmental impacts, causing the biophysical environment in the area to deteriorate and indirectly depressing the economies of local communities.

199. An indicative budget in the range of USD 4 to 6 million is proposed for EMP implementation costs (using the 2-4% spread on project base costs of USD 148 Million) based on CEB's experience in recently completed or on-going projects that are being implemented in similar regions. This cost range will vary from region to region as this includes variable cost items such as tree compensation, cost crop compensation, compensation for plantations, cost towards implementation of EMP (contractor's scope), EMP implementation and monitoring in entire route of transmission lines and independent audit. The compliance costs for minimisation of mitigation measures for the EMP has been arrived based on optimum and "least-cost" basis.

### 5.5 Associated Facilities

200. The transmission lines evacuate power from the Laxapana and Mahaweli Hydro electric power (HEP) complexes which have been the main backbone for electric power generation in Sri Lanka since the early 1960's and late 1980's consecutively.

201. The Laxapana HEP complex consists of following power plants - Canyon (2 x 30 MW), Wimalasurendra PS (2 x 25 MW), Old Laxapana (3 X 8.33 MW+ 2 x 12.5 MW), New Laxapana (2 x 50 MW), and Polpitiya (2 x 37.5 MW). From Laxapana HEP complex, following main existing transmission lines evacuate power – i). Polpitiya–Kollonnawa 132 kV Line 1 and 2, 3, and 4, ii). Laxapana–Balangoda–Galle line 132 kV line 1 and 2, Balangoda–Embilipitiya–Hambantota 132 kV line 1 and 2, and Laxapana–Badulla 132 kV

line 1 and 2 and Badulla Ampara 132 kV line 1.

202. The Mahawali HEP complex consists of following power plants, Victoria PS (3 x 70 MW), Kotmale PS (3 x 67 MW), Randeinigala (2 x 61 MW), Rantambe (2 x 24.5 MW), Ukuwela (2 x 19 MW) and Bowathanna (1 x 40 MW). From Mahawali HEP complex following main existing transmission lines evacuates the power- i). Kotmale–Anuradhapura 220 kV line, ii). Kotmale–Biyagama 220 kV line, iii). Randenigala Badulla 132 kV line, whereas Randenigala–Mahiyangana 132 kV line, and Mahiyangana–Vaunativu–Ampara 132k V line are committed projects.

## 6 GRIEVANCE REDRESS MECHANISM

### 6.1 Awareness of Stakeholders

203. During Public consultation sessions of the IEE study, the discussions with groups and individuals were conducted to make them aware of the proposed project. Thus, the project-affected community residing beside the proposed transmission line has gained a reasonable knowledge about the potential grievances, which will arise in the future.

204. A community awareness programme must be conducted one month prior to construction by the Project Implementation Unit (PIU) of CEB regarding the scope of the project, procedure of construction activities, utility of resources, identified impacts and mitigation measures. These awareness programmes will help the community to resolve problems, and clarify their distrusts related to the proposed project at initial stage.

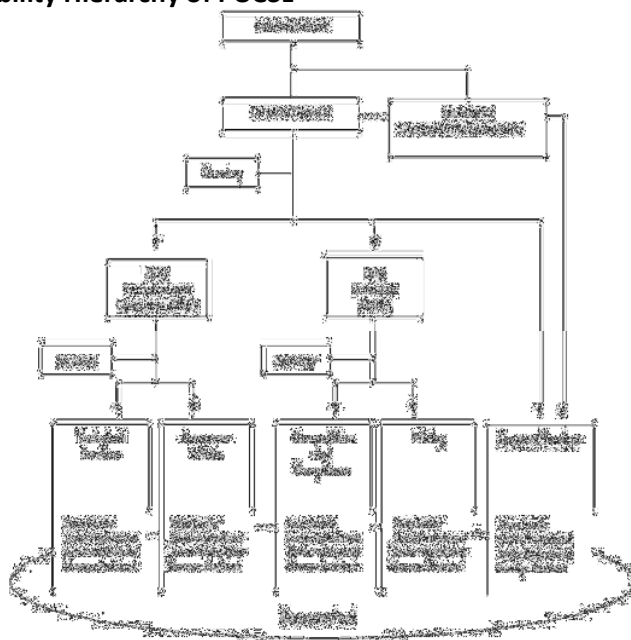
205. The Community should be informed about the Grievance Redress Mechanism (GRM), which is already established by the Public Utilities Commission of Sri Lanka (PUCSL), procedure for making complaints, including the place and the responsible person to contact in practical way in this regard. Almost all the stakeholders related to the GRM will also be aware of the established grievance process, the requirement of grievance mechanism, goals, benefits, relevant laws regulations etc. PUCSL Act lays down procedures for Grievance Redressal for transmission lines as attached in Annexure 7.

### 6.2 The Grievance Redress Mechanism and PUCSL

206. The Grievance Redress Mechanism (GRM) for the infrastructure development project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism will remain active throughout the life cycle of the project. The Public Utilities Commission of Sri Lanka (PUCSL) Act creates an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda of the country. PUCSL's mission is to regulate all the utilities within the its purview to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner. Figure 11 depicts the PUCSL hierarchy.

207. All the members in PUCSL need to be informed by the PIU regarding procedures of GRM. The information should include procedures of taking/ recording complaints, handling of on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders etc. PUCSL has a standard mechanism of (i) informing the affected people GRM and its functions, (ii) how peoples representatives in the GRC will be selected, (iii) procedure and the mechanisms adopted for making the complaints, (iv) supporting the complainants in communicating their grievance and attending the GRM meetings and (v) implementing compliance to a GRMs' decision, its monitoring and communication to the people. Periodic meetings of PUCSL are to be conducted by the PIU so that all the members of the PUCSL are familiar with the problems and responses received by individuals in the PUCSL.

**Figure 11: Responsibility Hierarchy of PUCSL**



## 7 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

208. In line with National Environmental Act (2002) in Sri Lanka, public consultation and information disclosure will be undertaken through public notice prior to the approval by CEA for the particular project. According to ADB SPS 2009, public consultation and information disclosure is to be made during the initial stages by the client itself. This activity supports the view to understand the public's perception of the project and respond to their concerns and suggestions during the early stages of the project design. Incorporation on the environmental concerns to the decision making process through the public consultation will avoid or minimise conflict situation during the implementation process.

209. Public consultations were conducted in project-affected area between 15 March to 10 May 2012. The community aired their opinions freely on the project, its impact, and suggestions for mitigating adverse impacts. People participated in voluntary public consultation sessions to express their views about the proposed project. Table 7 indicates a summary of public consultations conducted during the field survey.

### Table 7: Public Consultation

S.N O	Name of the Component /Site	Name of the Village, Gramasevaka Division, District, Province	Distance from Project Location	Names of the Participants
1	New Anuradhapura- Vauvnia	Ukkulankulama, Ukkulankulama – 588, Anuradhapura, North Central	0.2 km	S. Chamila Harshani, K. Kusumalatha, S. Rupasinghe, D. Karunaratne, M.S. Devika Sandamali, K.A. Swarna Jayasinghe , P.B. Somawathi, Pakkiyam
2	New Anuradhapura- Vauvnia	Ukkulankulama, Ukkulankulama – 588, Anuradhapura, North Central	0.1 km	K.H. Padmaseeli, J.A. Harishchandra, W.K. Gnnawathi, Samandika Jayawardena, Padmini Thilakaradne, K.B. Jayawathi, M. Gnanawathi, S.G. Sriyani, K. Ramani Jayanthi, Ashoka Nimali, Jayani Nisansala
3	New Anuradhapura- Vauvnia	Kovilpuddukkulam, Kovilkulam 244 C, Vauvnia, Northern	0.1 km	Priyangani Seneviratne, K. Rengar, K. Somachandran
4	New Anuradhapura- Vauvnia	Kuda Halmillewa, Kumbugollawa , Anuradhapura, North Central	0.5 km	Samantha Kumari, G. Seetha, S. Saman Kumara
5	Vauvnia - Mannar	Kattaladama, Madhu -128, Mannar, Northern	0.5km	Sebastiyamma, A. Jude Punitharaja, P. Tharseelamma, P. Sinnathurai, S. Robinson, T. Selvam
6	Vauvnia-Mannar	Poomalandan Madhu Road, MN 130 Poomalandan, Mannar, Northern	0.5km	R. M. Sriyani, K.P. Prabath Anuradha, K.H. Priyanthi

7	Vauvnia-Mannar	Kannatikanesapuram, Periyakattu, Vauvnia, Northern	0.4km	V.Jesudas, J.Rajeswary, K. Sellamma, G. Mangayarkarasi, S. Saraswathi, S. Sivapakyam, S. Letchchami, M. Rajkumar, K. Chandra, Velu Sivakimar, T.Pushparani, P.Subakaran, S. Udaya Chandran, K. Elangeswari
8	Athurugiriya-Kolonnawa	Godallawatte Para, Malambe, Colombo, Western	0.1 km	Sunil Premawardhana, K. Pathmasiri
9	Athurugiriya-Kolonnawa	Polkanathawatte, Kadjugahawatte, Colombo, Western	0.1km	K.L.G. Premachandra, G. Manoj, A.K. Padmawathi
10	Padukka-Athurugiriya	Pathumpura, Homagama, Ambilladeniya, Colombo, Western	0.3km	Karunasekera, Sriyalatha, Wijesinghe, G.K.C.T. Alwis, P. Nishani
11	Pannipitiya-Polpitiya	Thunnana, Thunnana – 444 B, Colombo, Western	0.75km	E.P. Sumanasinghe, Nalini Heenatigala, R.P. Dayaseeli, Sriyani Ediriweera, Sachini Ayesha, Padmini Weerasinghe, M.Chandarwathi, R.P. Anura, K.A. Chameer Kasun, H.A. Chandra, Sriyani Ediriweera, P.S. Warnakulasooriya, M.A.J. Udayakumara, M.A.J. Udayakumara, H.M.J. Niroshan
12	Pannipitiya Polpitiya	Gonagamuwa, Gonagamuwa, Kegalle, Sabaragamuwa	0.5km	K.L. Somaweera, D.S.N. Lankathilake, K.L.Sirisena
13	Polpitiya – New Polpitiya	Batakiththa, Kalukohutenne, Kegalle, Sabaragamuwa	0.5km	M.L. Ruwan Chaminda, U.B. Sriyani Chandralatha, I. Nilmini, K.A.D. Anne Mangalika, K.L. Susila, Indrani Biyagama, M.K. Gunapla, Y.D. Chaminda, G.R. Ranatunga, K. Soroja Kumar, S. Somaratne
14	Pannipitiya-Polpitiya	Kamburapola, Kamburapola, Kegalle, Sabaragamuwa	0.5km	M.A. Indrani, Seetha Ranjani, w. Hemalatha, Amanjali, M.A.J. Udekumara, M.A.A. Somali, K.G. Aberathne, K.G.G. Karunaratne, Ratnaweera Silva, Jayalatha Menike, R.S. Wickremasinghe, Kamal Kumara
15	Pannipitiya-Polpitiya	Kundaluwila, Kundaluwila, Colombo, Western	0.5km	T.I.R. Pradeep, M.H. Weerawardena, H. Premasiri Silva, M.A. Dirukshi, M.W. Gamini, W.N. Asilin Nona
16	Polpitiya_New Polpitiya site	Klaugohutenna, Yatiyantota, Kegalla, Sabaragamuwa	0.5km	E.S. Ediriweera, K.L. Sirisena, M.G. Sumanawathi, G.R.Karunaratne, U.V. Kusumawathi, G.R.S.Chandima, G.R. Wilbat, D.T.Damayanthi
17	Thulhiriya-Kegalla	Thulhiriya, Thulhiriya-82A, Kegalle, Sabaragamuwa	0.1km	L.P. Yasohamy, M.A. Sriyani

## 7.1 Consultation Findings

### Transmission System Strengthening in Mannar region

210. Though the population in this area is very scarce, the villagers feel that if a parallel line to the existing line is put up, more land will be required. They expressed that if the existing line can be updated, it will minimize damages to people, cultivations, and vegetation, residential and commercial structures. They expressed that since people who live in the area have lost everything in the war and therefore, project should not further affect the livelihoods, cultivations, and houses of people. They require CEB to give adequate compensation taking into account the long-term losses to people. When transmission lines were installed recently, compensation was paid for valuable trees that were cut down. Each tree was paid LKR 7000-8000. Compensation was not paid for land. They would prefer an alternate land close to the town rather than cash compensation. If a tower is installed on a land, they expect to be paid at least LKR 200,000 as compensation. If any trees are removed, they need to be paid market value. These lands do not have any legal titles, so if the land is acquired, they will not get any compensation or alternate land. If lines run over land, they will not be able to build houses, therefore the lines should be installed far away from houses and preferably over paddy fields and forests. If towers are installed in the middle of settlements they should be fenced particularly for the safety of children. They will not be able to grow big trees under the lines - now green gram, cowpea, sesame and kurakkan can only grow. Madhu forest reserve surrounds the villages and the Madhu shrine is only a few kilometres away. If forests are cleared, it will affect the rainfall pattern. If jak and coconut trees are cut down, they may not be able to replace them and can affect the family incomes. However, there are several un-electrified households who spend about LKR 1,000 for kerosene oil. If they get electricity, their costs of living would reduce.

**New Polpitiya 220/ 132 kV grid substation (GSS) and associated transmission line.**

211. The people did not want any displacement from their agricultural lands and common/community centres, houses and other property. They get water from the river during dry season and they feel that if more trees are cut down, streams will run out of water. The people requested adequate compensation if the project causes losses to their property and assets. If lines are installed at a height and not affect the cultivations, they do not expect compensation. People in this area get incomes from fruit trees such as durian. If such trees were cut down, they would lose their incomes. A majority of people living in the area are rubber tappers or casual labourers and they would prefer to get additional employment or income from the project.

212. Because of a previous electricity project that ran close to Kelani River, they lost their lands for which they have not been paid any compensation. They want cash compensation according to the nature and degree of loss at the time of land acquisition. The farmers expressed that they will not be able to cultivate around towers and would reduce the extent of cultivable land, and affect the water streams.

**Construction of 132/33 kV GSS at Kegalle.**

213. The people did not like this project, as this will cause loss of their meagre land holdings. This is because, the tower installations will make them lose their lands and restrict their cultivations under the electricity lines. If the electricity lines cross over their gardens, it will require cutting of coconut, jak and durian cultivations. They wanted CEB to minimise damages to property and cultivations and compensate properly before the project is initiated. If land is acquired, they expect a very high compensation, as there are several families who sell durian. If such durian trees are cut down, it affects their incomes. However, people may not get much compensation for land because they do not have legal titles to the land.

214. In a previous project, Divisional Secretary threatened to take them to court if they did not allow CEB to cut the trees. First, the project was planning to take the lines over the Mahawatte temple, and then finally after villagers protest, the line was taken over the rubber land belonging to the temple. A large number of rubber trees were cut down and incomes were reduced. Earlier, they were paid LKR 3,000/- per coconut tree that was cut down, but no compensation was paid for land. Now they cannot even grow banana trees on that land. CEB usually cut those trees that are bearing fruits. Since the lines are running close to homes or above homes, many trees will have to be cut down. If the land is acquired, they should be given similar land from this area itself and not in remote areas. They do not expect only cash compensation, but need more than that for the losses. If rubber tree has to be cut down for the project, it will affect their future incomes.

**8 FINDINGS AND RECOMMENDATIONS**

215. Impacts are manageable and can be managed cost effectively - Environmental impacts are likely to result from the proposed transmission system development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage, are now taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

216. The selected land for Mannar substation is located within the Irrigation Department land that needs to be transferred to CEB, New Polpitiya, Padukka, and Kegalle GSS land's will need to be purchased from private persons at prices based on market rates. The acquisition of land will be required from the surrounding communities in Kegalle, Padukka, New Polipitiya GSS only if the negotiations do not succeed. Since proposed land for Kegalle has paddy cultivation, there will be no need to removal of trees for the construction of new substation but for Padukka, and New Polipitiya sites, rubber plantation will have to be removed for the construction of the GSS. Larger extent of proposed transmission line from Mannar to Vavuniya and Vavuniya to Anuradhapura runs through paddy fields, cultivated lands, uncultivated lands and lesser extent runs through human settlements. It passes close to the Giant Tank sanctuary but passes through the outskirts of the Madhu Road sanctuary and parallel to the existing rail and road network.

217. The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- Significant improvement of the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact.
- Removal of trees for the transmission line corridor is the main negative impact to the proposed project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.

218. No reliable baseline information of water air and noise /vibration in these areas with respect to transmission line and substation is available. Therefore, collection of baseline parameters of water, air, soil, and noise / vibration is being recommended to conduct sampling at locations as mentioned in EMoP. Establishment of baseline parameters is essential to monitor changes of the quality of water, air, soil and noise during the construction and operation periods.

219. Proper GRM will have to be implemented through PUCSL to overcome public inconvenience during the proposed project activities. It is highly recommended to establish a tree replanting programme with the help of project affected community where at least two trees are planted as replacement for cutting of a tree.

220. Benefits far outweigh negative impacts - The proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to the region will boost economic development of the area by strengthening the power transmission infrastructure. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. The impact matrix depicts that the project will not have significant negative environmental impacts and the project would help in improving the socio-economic conditions of this developing state. As the project falls in category B as per the ADB's SPS 2009 guidelines, no detailed EIA study is required.

## 9 CONCLUSIONS

221. Based on the NEA, the proposed project will be categorised as “prescribed” and accordingly, approval and the environmental clearance for the project will be required by CEA. In accordance with the ADB's SPS 2009, the proposed new substations of Mannar, Padukka, New Polipitiya and Kegalle and the associated construction of transmission lines fall under “Category B”. Thus, an IEE report has been prepared for the project for meeting ADB's SPS 2009 guidelines. The environmental approval process under the NEA is also under progress.

222. The IEE performed is adequate for purposes of project implementation. Based on the environmental assessment and surveys conducted for the project, the potential adverse environmental impacts can be mitigated to an acceptable level by adequate implementation of the mitigation measures identified in the EMP. Adequate provisions are being made in the project to cover the environmental mitigation and monitoring requirements, and their associated costs.

223. The proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to the region will boost economic development of the area by strengthening the power transmission infrastructure. The impact matrix depicts that the project will not have significant negative environmental impacts and the project would help in improving the socio-economic conditions of this developing state. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. As the project falls in “Category B” as per the ADB's guidelines, no detailed EIA study is required.



## Annexure 1 Applicable Environmental Policy and Procedures

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
Agrarian Services Act (Nº 58 of 1979) Agrarian Development Act Nº 46 of 2000	To provide secure background to farmers and their agricultural premises	Regulates the acquisition of land that belongs to paddy and other activities, which are related to agricultural areas.	The Ministry of Agriculture Development and Agrarian Services
Ceylon Electricity Board Act , 1969	To provide for the establishment of an electricity board for the development and co - ordination of generation	Enters with joint schemes by such board with any government department or approved body for the generation of electrical energy, the irrigation lands, control of floods or other like objects, and to make provision for all matters connected there with or incidental thereto.	Ceylon Electricity Board
Electricity Act 2009	To provide reliable and cheap electrical energy	Regulates the generation, transmission, transformation, distribution, supply and use of electrical energy	Ceylon Electricity Board
Fauna and Flora Protection (Amendment) Act 1993 (Nº 49 of 1993).	To provide greatest protection to fauna and flora	Makes provision for the establishment of protected areas, regulates human involvements to such areas and their fauna and flora.	Department of Wild Life and Department of Forest
Felling of Trees (Amendment Act Nº 01 of 2000 and Act to Amend felling of trees control)	The control removal of trees.	Regulates the removal of trees relevant to type and the compensation	Department of Forest
Fisheries and Aquatic Resources Act 1996	To provide for the management, regulation , conservation and development of fisheries and aquatic resources	Restricts detrimental or risk activities for aquatic fauna and flora	National Aquatic Resources Research & Development Agency (NARA) and CEA
Flood Act Nº 22 of 1955	Protection of areas subject to flood	Flood prevention	Department of Irrigation
Forest Ordinance Act Nº 13 of 1966 Forest (Amendment) Act Nº 65 of 2009	Conservation, protection and management of forest and forest resources for control of felling and transport of timber	Definition of Conservation Forest, Reserve Forest, Village forests	Forest Department
Irrigation Clauses Act 1973	To provide regulations for the construction of structures across the irrigation canals and water resources.	Regulates the construction of structures across the irrigation canals and water resources.	Department of Irrigation
Land Acquisition (Amendment) Act, Nº 13 of 1986	Establishes the procedure to be followed by the competent authorities for the acquisition of land for public purpose.	It includes, among other matters: investigations for selecting land to be carried out by a district officer appointed by the Minister; issue of notice of intended acquisition indicating the compensation to be paid for any damage caused during investigations; issue of notice of acquisition of land or servitude for a public purpose.	Department of Valuation
Monuments and Archaeological Sites and	An Act to provide for the preservation of ancient and	For the regulation of archaeological excavations and for	Department of Archaeology

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
remains Act, 1958. Act №24 of 1958	historical monuments and archaeological sites and remains of national importance	the protection of sculptures, carvings and other like objects etc.	
Antiques Ordinance, 1960			
Motor Traffic Act № 60 of 1979	To provide sustainable approach for vehicle traffic	Regulates vehicle traffic during transportation of construction materials and the construction activities	
National Environmental Act № 47 of 1980, amendment № 56 of 1988, and other amendments	Provide protection, management, enhancement of the environment with prevention and control of pollution	Regulates sustainable utilisation of almost all natural resources such as water, soil and air	Central Environmental Authority (CEA)
National Environmental (Protection & Quality) Regulations, No 01 1990.	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and effluents into inland surface water	CEA
National Environmental (Ambient Air Quality) Regulations, 1994.	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	CEA
National Environmental (Noise Control) Regulations №1 1996	To provide maximum allowable noise levels	Regulates noise pollution	CEA
National Involuntary Resettlement Policy	Land Acquisition Act does not deal with the broader social and economic impacts of the project. Thus, this policy was established to overcome these impacts.	To monitor land replacement, income restoration, relocation assistance and allowances, consultation and grievance redress, assistance to vulnerable groups and provision of resettlement sites and services.	Government of Sri Lanka / Land Acquisition and Resettlement Committee (LARC)
Public Utilities Commission of Sri Lanka Act , № 35 of 2002	Create an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda	Regulate all the utilities within the purview of the Public Utilities Commission of Sri Lanka, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner.	The Public Utilities Commission of Sri Lanka
Soil Conservation (Amendment) Act № 24 of 1996	Act for conservation of soil resources and productive capacity of land	Degraded Land, prevent damage against salinity, water logging, drought, floods	Soil Conservation Board
Sri Lanka sustainable energy Authority Act, № 35 of 2007	To develop renewable energy resources; to declare energy development areas; to implement energy efficiency measures and conservation programmes; to promote energy security	Reliability and cost effectiveness in energy delivery and information management, function as a National Technical Service Agency of Clean Development Mechanism (CDM) in Sri Lanka that provides technical assistance to the Designated National Agency for Clean Development Mechanism and project developers, on energy sector clean development project activities	Sri Lanka Sustainable Energy Authority



## ASSESSMENT OF LEGAL FRAMEWORK AND INSTITUTIONAL CAPACITY

### Environmental Legislation

The requirement for Environmental Assessment in Sri Lanka is established by the National Environment Act No. 47 (1980), and the amendment to the act 1988, Act No. 56 Section 23A, for EPL procedure and the EIA regulation under Part 4C, under the provision of section 23Z. The procedures are defined in the environmental impact assessment (EIA) Regulations Gazette No. 772/22 (1993). The Prescribed Projects set out in the Gazette Extra Ordinary No. 772/22 of 24th June 1993, No: 1104/22 dated 6th November 1999, and No: 1108/1 dated 29th November 1999 for which environmental assessment is mandatory, and described as below:

#### **Part I: Projects and undertakings if located wholly or partly outside the coastal zone as defined by Coast Conservation Act No. 57 of 1981.**

- Reclamation of Land, wetland area exceeding 4 hectares.
- Extraction of timber covering land area exceeding 5 hectares
- Conversion of forests covering an area exceeding 1 hectare into non-forest uses.
- Clearing of land areas exceeding 50 hectares.
- Installation of overhead transmission lines of length exceeding 10 kilometers and voltage above 50 Kilovolts
- All renewable energy based electricity generating stations exceeding 50 Megawatts
- Involuntary resettlement exceeding 100 families other than resettlement effected under emergency situations.
- Development of all Industrial Estates and Parks exceeding an area of 10 hectares

**PART III:** All projects and undertaking listed in Part I above irrespective of their magnitudes and irrespective of whether they are located in the coastal zone or not, if located wholly or partly within the areas specified in part III of the Schedule.

1. Within 100 m from the boundaries of or within any area declared under
  - i. the National Heritage Wilderness Act No. 3 of 1988;
  - ii. the Forest Ordinance (Chapter 451);
 whether or not such areas are wholly or partly within the Coastal Zone as defined in the Coast Conservation Act, No. 57 of 1981
2. Within the following areas whether or not the areas are wholly or partly within the Coastal zone:
  - iii. any erodible area declared under the Soil Conservation Act (Chapter 450)
  - iv. any flood area declared under the Flood Protection Ordinance (Chapter 449) and any flood protection area declared under the Sri Lanka Land Reclamation and Development Corporation Act, 15 of 1968 as amended by Act, No. 52 of 1982.
  - v. 60 meters from the bank of a public stream as defined in the Crown Lands Ordinance (Chapter 454) and having a width of more than 25 meters at any point of its course.
  - vi. any reservation beyond the full supply level of a reservoir.
  - vii. any archaeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (Chapter 188).
  - viii. any area declared under the Botanic Gardens Ordinance (Chapter 446).
  - ix. within 100 meters from the boundaries of, or within, any area declared as a Sanctuary under the Fauna and Flora Protection Ordinance (Chapter 469).
  - x. within 100 meters from the high flood level contour of, or within, a public lake as defined in the Crown Lands Ordinance (Chapter 454) including those declared under section 71 of the said Ordinance.
  - xi. Areas declared under the Urban Development Authority Act No 41 of 1978 and Act No. 4 of 1982 section 29 (this indicates in its definition that laws are valid to the areas of the Local authorities).

The requirement for EIA and the level of study required are determined by the Central Environment Authority (CEA) after submission by the proponent of a Project Information Document (PID), plus supporting information, if relevant. There are two possible outcomes:

**Categorical Exclusion:** The activity is not on the list of prescribed projects in the EIA regulations, is not in or

near a sensitive area, has not been the subject of public protest, and it is clear from the PID and supporting information that the project will have no significant environmental impacts. Environmental clearance is granted (with or without conditions) and the project may proceed.

**Environmental Assessment:** All other projects require Environmental Assessment and the CEA establishes a Scoping Committee to decide on the level of study (IEE or EIA) and prepare Terms of Reference (ToR). Alternatively, if the project lies wholly within the jurisdiction of a single government agency, only if it is a gazetted PAA agency. CEA may refer the project to this authority (as the Project Approving Agency) to administer the EIA process. A Technical Review Committee (TRC) reviews the completed IEE or EIA report and recommends whether environmental approval shall be granted; the final decision is made by CEA.

There are further compliance requirements prescribed by other certain legislation, in particular the Coast Conservation Act, which requires clearance by the Coast Conservation Department (CCD) for any development activity or structure in the coastal zone<sup>31</sup>. An Environmental Protection License (EPL) from CEA, is required for the operation of the completed facilities (A list has been published by CEA).

No development or encroachment of any kind is permitted in archaeological reserves declared under the Antiquities Ordinance No. 9 of 1940 as amended (Section 34). The Director General of Archaeology is empowered to conduct an Archaeological Impact Assessment of areas that may be affected by development or other projects proposed by the government or any person.

No construction activities are permitted in national reserves (under the jurisdiction of the Department of Wildlife Conservation - the Fauna and Flora Protection Ordinance No. 2 of 1937, as amended) and forest reserves (under the jurisdiction of the Forest Department - see the Forest Ordinance of 1907 as amended). Sanctuaries, also declared under the Fauna and Flora Protection Ordinance, may include privately-held land. Clearance from the Department of Wildlife Conservation is required if construction is proposed in sanctuaries. Construction within 1 mile (1.6 km) radius of a national reserve, sanctuary or buffer zone needs permission from the Department of Wildlife Conservation (see the Fauna and Flora Protection Ordinance No. 2 of 1937, as amended). Any development activity within a fishery reserve<sup>32</sup> requires the permission and approval of the Director of Fisheries and Aquatic Resources (see the Fisheries and Aquatic Resources Act No. 2 of 1996). Any construction taking place in close proximity to a forest reserve must be approved and cleared by the Forest Department.

Using paddy land for a purpose other than agricultural cultivation without the written permission of the Commissioner General is a punishable offence under the Agrarian Development Act No. 46 of 2000 (Section 32). In addition to environmental clearance, approval from the local authorities and CEA for site clearance; and consent from all relevant *Pradeshiya Sabhas*, Provincial Councils, and Divisional Secretaries shall be obtained before construction begins.

Clearance shall be obtained for the proposed development activities, if the area is declared under the UDA Act or Sri Lanka Land Reclamation and Development Corporation (SLLR and DC) Act.

A summary of Government environmental compliance requirements applicable to the project is presented in **Table 1**.

**Table 1: Summary of Environmental Compliance Requirements of the Project Components for EARF Consideration**

	Subproject	Subcomponent	Applicable Legislation	Statutory Requirement	Authorizing Body
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<sup>31</sup>The coastal zone is defined in the Coast Conservation Act No. 57 of 1981 “as the area lying within a limit of 300 meters landward from mean high water line (MHWL). In the case of rivers, streams, lagoons or any other body of water connected to the sea, either permanently or periodically, the landward boundary extends to a limit of 2 km measured perpendicular to the straight base line drawn between the natural entrance points thereof and includes waters of such rivers, streams and lagoons or any other body of water so connected to the sea.”

<sup>32</sup>Certain areas adjoining earmarked reservoirs and water bodies can be declared as a fishery reserve with the concurrence of the Ministry of Wildlife and Natural Resources.

	Subproject	Subcomponent	Applicable Legislation	Statutory Requirement	Authorizing Body
1.	New Transmission lines, Distribution lines, substations	All subcomponents in sensitive areas	National Environment Act (NEA)	Environmental Clearance (EC)	Central Environment Authority (CEA)
		All subcomponents falling within the coastal zone	Coast Conservation Act	Clearance	Coastal Conservation Department (CCD)
		All subcomponents that require site clearance	Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the <i>Pradeshiya Sabha</i> Act No. 15 of 1987 as amended	Clearance	Municipal Councils, Urban Councils and <i>Pradeshiya Sabhas</i>
		All subcomponents that require cutting of trees	Felling of Trees (Control) Act No 9 of 1951	Tree-cutting Permit	Forest Department
		All subcomponents within a 1 mile (1.6 km) radius of a national reserve, sanctuary, or buffer zone	Fauna and Flora Protection Ordinance No. 2 of 1937 as amended	Clearance	Department of Wildlife Conservation
		All subcomponents in close proximity of a reserve forest	Forests Ordinance No. 16 of 1907 as amended	Clearance	Forest Department
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology
		All subcomponent in and around irrigation development	Irrigation Development Act	Clearance	Director, Irrigation Department
		All subcomponent in and around archaeological reserves around UDA declared areas	UDA Act No. 41 1978 and No. 4 of 1982	Clearance	Regional Director UDA
2	Solar Park, Wind Farm	All subcomponents in sensitive areas	NEA	EC	CEA
		All subcomponents falling within the coastal zone	Coast Conservation Act	Clearance	CCD
		All subcomponents that require site clearance	Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the <i>Pradeshiya Sabha</i> Act No. 15 of 1987 as amended	Clearance	Municipal Councils, Urban Councils and <i>Pradeshiya Sabhas</i>
		All subcomponents that require cutting of trees	Felling of Trees (Control) Act No. 9 of 1951	Tree-cutting Permit	Forest Department
		All subcomponents within a 1 mile (1.6 km) radius of a national reserve, sanctuary, or buffer zone	Fauna and Flora Protection Ordinance No. 2 of 1937 as amended	Clearance	Department of Wildlife Conservation
		All subcomponents in close proximity of a reserve forest	Forests Ordinance No. 16 of 1907 as amended	Clearance	Forest Department
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology

CCD= Coastal Conservation Department, CEA = Central Environment Authority, EC = Environmental Clearance, NEA = National Environment Act, UDA = Urban Development Authority.

**Table 2** summarizes the application procedures for the main environmental permits.

**Table 2: Summary of Procedure for Obtaining Environmental Permits Required by the Government of Sri**

## Lanka

Legislation	Regulatory, Agency	Summary of Procedure	Time scale
1. Central Environmental Authority - Environment Impact Assessment/Initial Environmental Examination (IEE/EIA) Clearance			
National Environmental Act No. 47 of 1980 and amended Act No. 56 of 1988; Government Gazette No. 772/22 of 24th June 1993 and No. 859/14 of 23rd February 1995	Central Environmental Authority (CEA)	1. Proponent to submit Project Information Document to CEA	During Feasibility Stage
		2. CEA to designate Project Approving Authority (PAA)	36 days
		3. PAA to appoint scoping committee; Issue of Terms of Reference (ToR) for the EIA/IEE	
		4. Proponent to conduct the environmental assessment and submit report to PAA	One and half years
		5. PAA to check adequacy	14 days
		6. For EIA, report will be open for public comments	30 days
		7. Technical Review Committee (TRC) to review report and forwarding comments	36 days
		8. PAA to recommend to CEA issuance of Clearance	
2. Coast Conservation Department Permit			
Under Section 5, 14, 15 and 16 of Coast Conservation Act No. 57 of 1981	Coast Conservation Department (CCD)	1. Proponent to submit application to CCD	During Feasibility Stage
		2. CCD to issue ToR for EIA/IEE	About 14 days
		3. Proponent to conduct the environmental assessment and submit report to CCD	One and half years
		4. For EIA, CCD will (i) invite Coast Conservation Advisory Council for comments; and (ii) open report for public comments	120 days (maximum)
		5. CCD to review comments	
		6. CCD to issue permit	
3. Environmental Protection License (EPL)			
National Environmental Act No. 47 of 1980 amended by Acts No. 56 of 1988 and No. 53 of 2000; Gazette Notification No. 1533/16 dated 25.01.2008	CEA	1. Proponent to submit application to CEA	Minimum of 30 days prior to the commencement of operation
		2. CEA to conduct field inspection and verification from relevant authorities	14 days
		CEA to prepare Inspection Report with Recommendations	14 days
		TRC to review report	
		Proponent to pay license fee	
		CEA to issue EPL	
4. Archaeological Impact Assessment Survey			
Under Section 47 read with Section 43(b) of Antiquities (Amendment) Act No. 24 of 1998; Gazette Notification No. 1152/14 dated 04.10.2000	Department of Archaeology	Proponent to submit application to Department of Archaeology.	During Feasibility Stage
		DA Regional Office to conduct Preliminary Observation and submit report to Department of Archaeology.	About 30 days
		(i) If there are no antiquities according to the recommendation and observation report, land will be released for the project.	
		(ii) If the preliminary observation report has proposed to carry out an archaeological impact assessment survey, steps will be taken to conduct the survey including scoping with other agencies.	30 days
		Department of Archaeology to call for quotations and award contract for Archaeological Impact Assessment (AIA) survey	
		Selected agency to conduct AIA survey and submit report to Department of Archaeology	42 days

Legislation	Regulatory, Agency	Summary of Procedure	Time scale
		Department off Archaeology to submit AIA report to Minister in charge of approval	About 30 days
		Department of Archaeology to issue approval	
5. Clearance from Department of Forest Conservation			
Under the ordinance enacted in 1907 No. 16, and subsequent amendment No. 23, 1995 and No. 65 of 2009.	Department of Forest Conservation (DFC)	Proponent to submit application to DFC	During Feasibility Stage
		District Forest Office along with the DFC officials to conduct preliminary observation and submit report to Conservator General of DFC for approval	About 60 days
		(i) If the project is located within the core protected area, the application will be rejected;	60 days
		If the project will utilize resources from the forest (timber or related) the application will be rejected (even if it is located outside the boundary and the buffer);	
		If the project is outside the boundaries and buffers of any Forest Reserves (FRs), DFC’s consent will be released.	
		DFC will refer to CEA if the proposed activities will cause negative impacts on forest conservation areas and there will be extraction of resources involved.	30 days
		- Under NEA, EIA will be conducted - DFC will become the project approving agency	116 days
		DFC will release the approval with the concurrence of the CEA.	

Notes: CEA = Central Environmental Authority, PAA = Project Approving Agency, CCD = Coast Conservation Department, ToR = Terms of Reference, EPL = Environment Protection License, EIA = Environmental Impact Assessment, IEE = Initial Environmental Examination, DA = Department of Archaeology, AIA = Archaeological Impact Assessment, UDA = Urban Development Authority, SLLR&DC = Sri Lanka Land Reclamation and Development Corporation, DFC = Department of Forest Conservation.

### Applicable International Environmental Agreements

In addition to national rules and regulations, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species of Wild Animals (CMS) and Ramsar Convention on Wetlands of International Importance are applicable for selection and screening of subprojects under restricted/sensitive areas. Sri Lanka is a party to these conventions.

**A. International Union for Conservation of Nature and Natural Resources (IUCN).** The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1963, is a comprehensive inventory of the global conservation status of plant and animal species. The IUCN is an authority on the conservation status of species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit. The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.

**B. Convention on Migratory Species of Wild Animals (CMS).** CMS was adopted in 1979 and entered into force on 1 November 1983. CMS, also known as the Bonn Convention, recognizes that local authorities must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine, and avian migratory species throughout their ranges. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international cooperation are listed in Appendix II of the Convention, and CMS encourages the range states to conclude global or regional agreements.

**C. Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).** It is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants

does not threaten their survival. CITES was first formed, in the 1960s. Annually, international wildlife trade is estimated to be worth billions of dollars and includes millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products, exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future. Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation.

**D. Ramsar Convention on Wetlands of International Importance 1971.** The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem. According to the Ramsar list of Wetlands of International Importance, there are five designated wetlands in Sri Lanka need to be protected. Activities undertaken in the proximity of Ramsar wetlands shall follow the guidelines of the convention. Sri Lanka presently has 5 sites designated as Wetlands of International Importance, with a surface area of 32,372 hectares.

**E. United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Convention.** The most significant feature of the 1972 World Heritage Convention is that it links together in a single document the concepts of nature conservation and the preservation of cultural properties. The Convention recognizes the way in which people interact with nature, and the fundamental need to preserve the balance between the two. The convention defines the kind of natural or cultural sites, which can be considered for inscription on the World Heritage List. The convention sets out the duties of states parties in identifying potential sites and their role in protecting and preserving them. By signing the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The states parties are encouraged to integrate the protection of the cultural and natural heritage into regional planning programs, set up staff and services at their sites, undertake scientific and technical conservation research, and adopt measures, which give this heritage a function in the day-to-day life of the community. It also encourages states parties to strengthen the appreciation of the public for World Heritage properties and to enhance their protection through educational and information programs.

**Table 4: Environmental Criteria for Subproject Selection**

	Components	Environmental Selection Guidelines	Remarks
1.	Overall Selection Guideline (applicable to all components)	Comply with all requirements of relevant national, state, and local laws, rules, and guidelines.	
		Site selection process will avoid where possible land acquisition and involuntary resettlement where possible including impacts on vulnerable persons and indigenous peoples.	
		Site selection will avoid where possible locations in protected areas, including notified reserved forests or biodiversity conservation hotspots (sanctuary/national park, etc.).	Approval from concerned authority if unavoidable
		Subproject location shall not result in destruction/disturbance to historical and cultural places/values.	
		The subproject will avoid where possible, and minimize to an extent feasible facilities in locations with social conflicts.	
		The subproject will avoid where possible tree cutting and if any trees have to be removed, will plant two new trees for every one that is lost.	Approval from Forest Department
		Retain mature roadside trees, which are important/ valuable or historically significant and if any trees have to be removed, plant two new trees for every one that is lost.	
		The subproject will reflect inputs from public consultation and disclosure for site selection.	
2.	Transmission Lines,	Comply with all requirements of relevant national law.	

	Distribution Lines, Substations	Provincial and Local Authority regulations	
		Locate all new facilities at least 100 m from houses, shops or any other premises used by people, thus establishing a buffer zone to reduce the effects of noise, dust and the visual appearance of the site.	Distance restriction may be reviewed depending on site availability and buffer zone planning as well as by-laws of respective local authorities
		Locate Substations at sites where there is no risk of flooding or other hazards that might impair functioning or present a risk of damage to its environs.	Flood statistics data of the project area needs to be reviewed.
		Consult the relevant national and/or local archaeological agencies regarding the archaeological potential of proposed sites and power lines to ensure that these are located in areas where there is a low risk of chance finds.	
		Locate towers/poles within the Right of Way (RoW) of other linear structures (roads, irrigation canals) as far as possible, to reduce the acquisition of new land.	
		Ensure that transmission routes do not require the acquisition of land from individual farmers in amounts that are a significant proportion of their total land holding (>10%).	
		Subproject will be implemented only with consent of CEA	
		Retain mature roadside trees, and if any trees have to be removed, plant two new trees for every one that is lost.	
3.	Solar and Wind parks, augmentation of substations	Only projects proposed or requested by the relevant agencies shall be considered for implementation.	
		Subprojects shall involve improvements within the boundary of existing facilities only.	
		Ensure that any facilities involving hazardous or polluting materials (e.g. waste oil disposal, SF6) are designed to national and international standards, to protect human health, both within and outside the facility.	
		Where new facilities are required, these shall be sited on vacant government land and ROWs where feasible.	
		Ensure that waste disposal in constructed facilities are designed to national and international standards.	



## Annexure 2 Alternative Site Analysis for Grid Substations

### A.I Transmission System Strengthening in Mannar region

#### I.5 Construction of 132 kV/ 33 kV Mannar GSS (1 x 31.5 MVA).

S No	Description	Site - A	Site – B	Site - C
1.	Land Details			
1.a	Area of land	1.25 Ha	1.6 Ha	1.6 Ha
1.b	Slope/Plain land	Flat terrain	Flat terrain	Flat terrain
1.c	Approximate amount of land cutting required	None	None	None
2.	Ownership of land (Private / Forest/ Other Govt. Department/ Other)	Private	Government - Irrigation dept. behind Vannamodai GTM school	Private
3.	Private land (in ha.)			
	(i) Agriculture - Irrigated - Non – irrigated	1.25 Ha Irrigated	1.6 Ha Irrigated	NIL
	(ii) Non - Agriculture/ Private Waste land.	NIL	NIL	1.6 Ha. non irrigated
	(iii) House or Building - Residential - Non – Residential	Non– Residential	Non – Residential	Non– Residential
4.	Distance from nearest (With name )			
4.a	River (Name/Distance)	NA	NA	NA
4.b	Highway	A14	A14	A14
4.c	Forest Area	Scrub area	Scrub area	Scrub area - 250 m to Vankalai Sanctuary
4.d	Village / town	Muttakutti	Vannamoddai	Kallikaddaikadu
4.e	Market/Area of Economic Activity	Paddy cultivation	Paddy cultivation	None
5.	Road accessibility	A14	A14	A14
6.	EHV Line Passing Nearby (Distance)	No	No	No
7.	HT line Passing Nearby	Yes	Yes	yes
8.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	None	None	None
9.	No. of private trees			
	Fruit Trees: - Trees to be felled - Trees to be lopped	None	None	None
	Non - Fruit Trees: - Trees to be felled - Trees to be lopped	None	None	
10.	Distance from mountaineous/coastal area	4.8 km	5.2 km	3.8 km
11.	Distance from cultivated area	50 m	0.5 km	1 km
12.	Altitude of GSS site	8 m	7 m	5 m



13.	Distance from nearest airport	295 km	293 km	296 km
14.	Distance from nearest religious or archaeological sites	6.5 km from Thiru Keethiswaram	8 km from Thiru Keethiswaram	2 km from Thiru Keethiswaram
	Alternative Selected		Selected	

## A-II. New Polpitiya 220/ 132 kV GSS and associated transmission line.

### II.1 Construction of 220/132 kV New Polpitiya GSS

S No	Description	Site – A	Site – B	Site - C
1	Land Details			
1.a	Area of land	1.6 Ha		
1.b	Slope/Plain Land	Slope towards west		
1.c	Approximate amount of land cutting required	1.6 Ha		
2.	Ownership of land (private / forest/ Governemnt department/other)	Private		
3.	Private land (in ha.)			
	(i) Agriculture - Irrigated - Non – irrigated	Rubber plantation		
	(ii) Non - Agriculture/ private waste land	Rubber plantation		
	(iii) House or Building: - Residential - Non – Residential	Non – Residential		
4.	Distance from nearest (With name )			
4.a	River (Name/Distance)	100 m from Bibili Oya		
4.b	Highway	0.60 km to (A7) road		
4.c	Forest Area	None		
4.d	Village / town	Gonagamuwa		
4.e	Market/Area of Economic Activity	Rubber		
5.	Road accessibility	Gonagamuwa road, near 36 km post at A7		
6.	EHV Line Passing Nearby (Distance)	Yes		
7.	HT line Passing Nearby	Yes		
8.	No. of Forest Trees - Trees to be felled - Trees to be lopped	None		
9.	No. of private trees	800 rubber trees		
	Fruit Trees: -Trees to be felled -Trees to be lopped	None		
	Non - Fruit Trees: -Trees to be felled	None		

S No	Description	Site – A	Site – B	Site - C
	-Trees to be lopped			
10.	Distance from mountainous/coastal area	2.50 km		
11.	Distance from in cultivated area	1.2 km		
12.	Altitude of GSS site	240 m		
13.	Distance from nearest airport	115 km		
14.	Distance from nearest religious or archaeological sites	1 km from Thaligama temple		
	Alternative Selected	Only Option A		

### A-III. Padukka 220/132/33 kV GSS and associated transmission line.

#### III.1 Construction of 220/132/33 kV Padukka Grid Substation.

S No	Description	Site – A	Site – B	Site - C
1	Land Details			
1.a	Area of land	1.6 Ha		
1.b	Slope/Plain land	Flat terrain		
1.c	Approximate amount of land cutting required	None		
2.	Ownership of land (private / forest/ Govt. department/ other)	Private		
3.	Private land (in ha.)			
	(i) Agriculture - Irrigated - Non – irrigated	Rubber plantation		
	(ii) Non - Agriculture/ Private Waste land	Rubber plantation		
	(iii) House or Building: -Residential -Non – Residential	Non – Residential		
4.	Distance from nearest (With name )			
4.a	River (Name/Distance)	3.5 km from Kelani		
4.b	Highway	3.00 km from High level (A4) road		
4.c	Forest Area	None		
4.d	Village / town	Batawala		
4.e	Market/Area of Economic Activity	Rubber		
5.	Road accessibility	A4, B354		
6.	EHV Line Passing Nearby (Distance)	Yes		
7.	HT line Passing Nearby	Yes		
8.	No. of Forest Trees :- -Trees to be felled -Trees to be lopped	None		
9.	No. of private trees			
	Fruit Trees:	720 rubber trees		

S No	Description	Site – A	Site – B	Site - C
	-Trees to be felled -Trees to be lopped			
	Non - Fruit Trees: -Trees to be felled -Trees to be lopped	None		
10.	Distance from coastal/ mountainous area	None		
11.	Distance from in cultivated area	0.5 km (Paddy)		
12.	Altitude of GSS site	26 m		
13.	Distance from nearest airport	60 km		
14.	Distance from nearest religious or archaeological sites	1 km, Manungala Temple		
	Alternative	Only Option A		

**A-IV. Construction of 132/33 kV GSS at Kegalle.****IV.1 Construction of 132/33 kV grid substation at Kegalle.**

S No	Description	Site – A	Site – B	Site - C
1.	Land Details			
1.a	Area of land	1.6 ha	2 ha (5 acres)	
1.b	Slope/plain land	Flat terrain	30 <sup>0</sup>	
1.c	Approximate amount of land cutting required	None	Cutting and filling required	
2.	Ownership of land (private / forest/ govt. department/ Other)	Private	Private	
3.	Private land (in ha.)			
	(i) Agriculture :- - Irrigated - Non – irrigated	Abandoned paddy field	Rubber plantation	
	(ii) Non - Agriculture/ private waste land.			
	(iii) House or Building: - Residential - Non – Residential	Non – Residential	Non – Residential	
4.	Distance from nearest (With name )			
4.a	River (Name/Distance)			
4.b	Highway	0.80 km from Kandy (A1) road	1.30 km from Kandy (A1) road	
4.c	Forest Area	None	None	
4.d	Village / town	Kumbaldiwele/ Kegalle	Kawdaulla village/ Kegalle	
4.e	Market/Area of Economic Activity	Kegalle town	Kegalle town	
5.	Road accessibility	0.80 km along Kumbaldiwele road from Kandy (A1) road	1.3 km along Annasigala road from Kandy (A1) road	
6.	EHV Line Passing Nearby (Distance)	Yes	Yes	
7.	HT line Passing Nearby	Yes	No	
8.	No. of Forest Trees : - Trees to be felled - Trees to be lopped	None	None	
9.	No. of private trees	None, only Paddy.	None	
	Fruit Trees: - Trees to be felled - Trees to be lopped			
	Non - Fruit Trees: - Trees to be felled - Trees to be lopped	None	900 Rubber trees	

S No	Description	Site – A	Site – B	Site - C
10.	Distance from mountainous/coastal area	Not Applicable	Not Applicable	
11.	Distance from the cultivated area			
12.	Altitude of GSS	109 m	137 m	
13.	Distance from nearest airport	81 km	84 km	
14.	Distance from nearest religious or archaeological sites	0.5 km (Temple)	1.0 km (Kumbalidiwela Galgane Rajamaha Temple)	
	Alternative Selected	Selected		

### Annexure 3 Alternative Route Analysis for Transmission Lines

#### A.I Transmission System Strengthening in Mannar region

##### I.2 Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line.

Sr. No	Description	Route – A Passing thr Mihintale	Route – B Avoiding Preserv. scheme	Route – C Existing 132 kV Route
1.	Length of line	54.85 ha	57.85 km	Same as A
2.	Canal / River crossings	Yes	Canal 16, stream /Oya-03	
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	Secondary forest (9.60 ha) & Scrubland (34.95 ha)	Scrublands (79.62 ha), Teak plantation (5.6 ha), None, 0.10km to Mihintale Sanctuary	
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None		
5.	Land Strata	Home gardens, Agricultural lands, Secondary forest, Scrublands & Chena cultivation	Home gardens, scrublands, secondary forest, paddy fields, Agricultural lands & Chena	
6.	Road accessibility	A9, A12, A13, A14 A20 & A29	A13, A, A9, A29 & B282	
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential	Irrigated (43.20 ha) Non-irrigated (17.55 ha)  Home garden (51.60 ha)	Irrigated (paddy)(77.00 ha) Teak Plantation (5.6 ha) Non-irrigated (Chena) (27.82 ha)  Residential (18.55 ha)	
8.	EHV Line Crossing		Yes	
9.	HT line crossings	Yes	Yes	
10.	No. of Forest Trees :- a) Trees to be felled b) Trees to be lopped	1235	1696	
11.	No. of private trees (i) Fruit Trees: a) Trees to be felled b) Trees to be lopped (ii) Non-Fruit Trees: a) Trees to be felled b) Trees to be lopped	785	174	
12.	Length of line in mountainous area	Not applicable		
13.	Length of line in coastal area	Not applicable		
14.	Length of line in cultivated area	37.45 km	35.10 km	
15.	Length of line in un-cultivated area	14.85 km	22.75 km	
16.	Highest altitude en-route the line			
17.	Distance from nearest airport		175 km to Anuradhapura 223 km to Vavuniya	
18.	Distance from nearest religious or archaeological sites		2.00 km to Mihintale temple, 0.10 km to Anuradhapura Preservation Scheme	
19.	Name of villages involved/Name of District	Anuradhapura & Vavuniya	Villages- Nedunkulam, Velikkulam, Samalankulam, Alagalla Kanadara Diwulwewa Mihintale Kawarakkulama Anuradhapura/ Vavuniya	

Sr. No	Description	Route – A Passing thr Mihintale	Route – B Avoiding Preserv. scheme	Route – C Existing 132 kV Route
			Districts	
20.	Land to be permanently acquired: - Area (in ha) - Cost.			
	Alternative chosen		Selected.	

#### I.4 Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.

Sr. No	Description	Route –A, passing through Giant Tank	Route – B Outside Giant tank	Route – C passing through MRS
1.	Length of line	67.60km	67.70	
2.	Canal / River crossings	Yes	Yes	0
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	Secondary forest (16.35 ha) Scrub land (57.45 ha) Passing through Giant Tank and Madhu Road Sanctuary	Secondary forest (24.60 ha), scrubland (41.40 ha), Outside Giant's tank sanctuary (0.75 km), Madhu Road Sanctuary (0.1 km),	Forest Area and through the middle of Madhu Road sanctuary
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None	None	None
5.	Land Strata	Home gardens, Agricultural lands, Secondary forest, Scrublands, Plantation, abandoned clay fields & Chena cultivation	Home gardens, Agricultural lands, Secondary forest, Scrublands, Plantation, abandoned lands & Chena cultivation	Home gardens, Agricultural lands, Primary and Secondary forest, Scrublands, Plantation, abandoned
6.	Road accessibility	A9, A14 & A30	A9, A14, A30	A14, A9, A32
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential	Irrigated (78.60 ha) Non-irrigated (9.60 ha) Home garden (25.30 ha) Abandoned lands (3.90ha) Plantation (1.20ha)	Irrigated (82.05 ha) Non-irrigated (13.35 ha) Home garden (25.65 ha) Abandoned lands (4.5ha) Plantation (1.20ha)	Irrigated (78.60 ha) Non-irrigated (9.60 ha) Home garden (25.30 ha) Abandoned lands (3.90ha) Plantation (1.20ha)
8.	EHV Line Crossing			
9.	HT line crossings	Yes	Yes	Yes
10.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	1100	1135	Over 5000
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	865	380	Forest Area , less than 200
12.	Length of line in mountainous area	None	None	None
13.	Length of line in coastal area	None	None	None
14.	Length of line in cultivated area	37.85 km (Home gardens, Agricultural & Chena)	40.75 km (Home gardens, Agricultural & Chena)	
15.	Length of line in un-cultivated area	29.75 km	26.95 km	
16.	Highest altitude en-route the line	400 m (Viharahalmillawa)	400 m (Viharahalmillawa)	
17.	Distance from nearest airport	250 km	223 km from Vavuniya	250 km

Sr. No	Description	Route –A, passing through Giant Tank	Route – B Outside Giant tank	Route – C passing through MRS
			280 km from Mannar	
18.	Distance from nearest religious or archaeological sites	None	None	None
19.	Name of villages involved/Name of District	Murukkam, Madhu Road, Poorarasankulam, Thandikulam, Vauniya & Mannar Districts	Murukkam, Madhu Road, Poorarasankulam, Thandikulam, Vauniya & Mannar Districts	Murukkam, Madhu Road, Poorarasankulam, Thandikulam, Vauniya & Mannar Districts
20.	Land to be permanently acquired: - Area (in ha) - Cost.	None	None	None
	Alternative chosen		Selected	

#### A-II. New Polpitiya 220/ 132 kV GSS and associated transmission line.

##### II.2 Construction of 132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.

Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
1.	Length of line	10 km		
2.	Canal / River crossings	Yes		
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	None		
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None		
5.	Land Strata	Home gardens, Plantations, agricultural lands, forests,.		
6.	Road accessibility	A4, A7, B188 & B408		
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential	Agricultural Lands (0.6 ha) Home gardens (9.3 ha) Rubber Plantation (14.1 ha)		
8.	EHV Line Crossing	Yes		
9.	HT line crossings	Yes		
10.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	None		
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	133 non fruit 3800 rubber trees 37 other		
12.	Length of line in mountainous area	Not applicable		
13.	Length of line in coastal area	Not applicable		
14.	Length of line in cultivated area	8 km		
15.	Length of line in un-cultivated area	2 km		
16.	Highest altitude en-route the line	220 m		
17.	Distance from nearest airport	115 km		
18.	Distance from nearest religious or archaeological sites	850 m, Thaligama Temple		
19.	Name of villages involved/Name of District	Gonagamura, Nuwara Eliya		
20.	Land to be permanently acquired:			

Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
	- Area (in ha) - Cost.			
	Alternative chosen	Only Option A		

All.4 Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the exiting Pannipitiya grid substation.

Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
1.	Length of line	56.50 KM		
2.	Canal / River crossings	Yes		
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	2.25 ha Passes through Kanampella Forest Reserve		
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None		
5.	Land Strata	Home gardens, Plantation, Agricultural, Forest, Marshland & Industrial zone.		
6.	Road accessibility	A4 & A7		
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential	Irrigated (Paddy) (40.80 ha) Home gardens (65.85 ha) Plantations (49.80 ha) Industrial zone (4.5 ha) Marshlands (1.5 ha)		
8.	EHV Line Crossing	Yes		
9.	HT line crossings	Yes		
10.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	385		
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	12948 fruit and non-fruit trees		
12.	Length of line in mountainous area	Small hillock – Pohorabawakanda 200 m		
13.	Length of line in coastal area	Not applicable		
14.	Length of line in cultivated area	51.75 km		
15.	Length of line in un-cultivated area	2.75 km		
16.	Highest altitude en-route the line	280 m (Gaabout napalla)		
17.	Distance from nearest airport	45 km from Pannipitiya GSS		
18.	Distance from nearest religious or archaeological sites	Seetawaka – 2 km		
19.	Name of villages involved/Name of District	Avissavella, Kitulgala, Hanwella, Kosagama, Colombo, & Kegalle		
20.	Land to be permanently acquired: - Area (in ha) - Cost.	None		
	Alternative chosen	Only Option A		

### A-III. Padukka 220/132/33 kV GSS and associated transmission line.

III.2 Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.



Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
1.	Length of line	10.5 km		
2.	Canal / River crossings	Yes		
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	None		
4.	Development of Tower site - Number of towers - Land to be acquired for tower base			
5.	Land Strata	Paddy fields, Home gardens, Rubber lands & housing Scheme		
6.	Road accessibility	Yes		
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential	Irrigated (25.80 ha)  Home gardens (2.55 ha) Housing scheme (1.80 ha)		
8.	EHV Line Crossing	Yes		
9.	HT line crossings	Yes		
10.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	None		
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	123		
12.	Length of line in mountainous area	Not applicable		
13.	Length of line in coastal area	Not applicable		
14.	Length of line in cultivated area	9.45 km		
15.	Length of line in un-cultivated area	0.60 km		
16.	Highest altitude en-route the line	37 m		
17.	Distance from nearest airport	60 km		
18.	Distance from nearest religious or archaeological sites	--		
19.	Name of villages involved/Name of District	Batawala, Koratota, Oruwala, Colombo		
20.	Land to be permanently acquired: - Area (in ha) - Cost.			
	Alternative chosen	Only Option A		

### III.3 Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.

Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
1.	Length of line	15 km		
2.	Canal / River crossings	Yes		
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	None		
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None		
5.	Land Strata	Paddy fields, Home gardens, Rubber lands, housing Scheme		

Sr. No	Description	Route – A	Route – B (if Any)	Route – C (if Any)
6.	Road accessibility	Yes		
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential - Non-Residential			
8.	EHV Line Crossing	Yes		
9.	HT line crossings	Yes		
10.	No. of Forest Trees :- - Trees to be felled - Trees to be lopped	None		
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	None Lopping of some trees		
12.	Length of line in mountaineous area	Not applicable		
13.	Length of line in coastal area	Not applicable		
14.	Length of line in cultivated area	13 km		
15.	Length of line in un-cultivated area	2 km		
16.	Highest altitude en-route the line	37 m		
17.	Distance from nearest airport	60 km		
18.	Distance from nearest religious or archaeological sites	--		
19.	Name of villages involved/Name of District	Kolonnawa, Athurugiriya, Colombo		
20.	Land to be permanently acquired: - Area (in ha) - Cost.			
	Alternative chosen	Only Option A		

**A-IV. Construction of 132/33 kV GSS at Kegalle.****IV.3 Construction of 132 kV 14 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.**

Sr. No	Description	Route – A (South)	Route – B (North)	Route – C (Small deviation)
1.	Length of line	22.5 km	21.75 km	21.5 km
2.	Canal / River crossings	Yes – 10	Yes - 7	Yes -6
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	3.5 km to Kurulu Kele Sanctuary, 5.1 km to Elephant orphanage, Pinnawala	6.5 km to Kurulu Kele Sanctuary, 3.6 km to Elephant orphanage, Pinnawala	4.0 km to Kele Sanctuary and 3 km from elephant orphanage
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	None	None	None
5.	Land Strata	Plantation, Home gardens, Agriculture, Paddy	Plantation, Home gardens, Agriculture, Paddy	Plantation, Home gardens, Agriculture, Paddy
6.	Road accessibility	A6, A1,A19 and B199	A6, A1,A19 and B199	A6, A1,A19 and B199
7.	Private land (in ha.) (i) Agriculture:- - Irrigated - Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: - Residential	Agriculture (36.00 ha)   Residential (14.85 ha)	Agriculture (33.3 ha)   Residential (18.45ha)	Agriculture (38 ha)   Residential (17ha)

Sr. No	Description	Route – A (South)	Route – B (North)	Route – C (Small deviation)
	- Non-Residential			
8.	EHV Line Crossing	Yes	yes	Yes
9.	HT line crossings	Yes	Yes	Yes
10	No. of Forest Trees :- - Trees to be felled - Trees to be lopped			
11.	No. of private trees Fruit Trees: - Trees to be felled - Trees to be lopped Non-Fruit Trees: - Trees to be felled - Trees to be lopped	6937 trees to be felled Fruit Trees and Non fruit trees	6050 trees to be felled	5500 trees to be felled
12	Length of line in mountainous area	Not applicable	Not applicable	
13.	Length of line in coastal area	Not applicable	Not applicable	
14.	Length of line in cultivated area	12.60 km through paddy fields, 9.9 km through home gardens and plantations	10.75 km through paddy fields, 11.00 km through home gardens and plantations	12.25 km through paddy fields, 0.9 km from Home gardens
15.	Length of line in un-cultivated area	-	-	
16.	Highest altitude en-route the line	283 m	278 m	278 m
17.	Distance from nearest airport	110 km	110 km	110 km
18.	Distance from nearest religious or archaeological sites	5.1 km Pinnewala elephant orphanage.	3.6 km Pinnewala elephant orphanage.	3 km Pinnewala elephant orphanage.
19.	Name of villages involved/Name of District	Weragoda, Dewalegama, Puwakdemiya, Kegalle	Weragoda, Dewalegama, Puwakdemiya, Kegalle	Weragoda, Dewalegama, Puwakdemiya, Kegalle
20.	Land to be permanently acquired: - Area (in ha) - Cost.	None		
	Alternative chosen	Selected		

## Annexure 4 Inventorisation along the Transmission Lines

## A.I Transmission System Strengthening in Mannar region

## I.2 Construction of 132 kV double circuit 55 km New Anuradhapura - Vavuniya Transmission line.

No.	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
1	0.00	0.50	0.50	Anuradhapura	Keerikkulama	Private	Agricultural (0.25km) & Chena (0.25km)	Paddy	
								Maila	4
								Ketakela	1
								Welan	1
								Ahala	4
								Kohoba	3
								Siyambala	1
2	0.50	2.50	2.00	Anuradhapura	Nelunkulama	Private	Home gardens (0.50km) & Scrublands (1.50km)	Palu	5
								Coconuts	3
								Jackfruit	1
								Kohoba	4
								Kon	3
								Mango	6
								Palu	3
								Hik	2
								Weera	4
3	2.50	3.90	1.40	Anuradhapura	Nelunkanniya	Private	Home gardens (0.80km)& Agricultural (0.60km)	Kubuk	4
								Acacia	5
								Paddy	
								Coconuts	8
								Jackfruit	2
								Kohomba	5
								Mango	4
								Tal	4
								Palu	4
4	3.90	6.55	2.65	Anuradhapura	Tariyankulama	Private	Home gardens (0.50km)& Agricultural (0.50km)	Siyambala	1
								Paddy	
								Tal	3
								Mango	2
								Kohomba	2
								Kaju	2
								Kon	2
								Burutha	1
								Coconut	3
5	6.55	9.00	2.45	Anuradhapura	Illuppukaniya (South)	Private	Home gardens (0.50km), Agricultural (0.50km), Chena (1.40km) & Scrublands (0.20km)	Palu	4
								Damini	3
								Hik	1
								Coconut	4
								Ehala	5
								Wood Apple	2
								Jackfruit	1
								Paddy	
								Tal	2
6	9.00	12.35	3.35	Anuradhapura	Maradankulama	Private/ Government	Plantation (1.60km), Scrublands(1.00km) & Chena (0.75km)	Mango	2
								Kaju	2
								Kon	1
								Burutha	1
								Palu	1

No.	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
								Daminiya	2
								Hik	1
								Seru	2
7	12.35	13.55	1.20	Anuradhapura	Yaya 01, Left bank Mahakanadara wa	Private	Home gardens (0.40km)& Agricultural (0.80km)	Kohomba	1
								Kon	2
								Mango	4
								Palu	5
								Hik	2
								Coconut	3
								Paddy	
								Teak	3
8	13.55	23.65	10.10	Anuradhapura	Diviyandabendawewa	Private	Home gardens (0.90km), Agricultural (5.40km)& Chena (3.80km)	Paddy	
								Pihimbiya	1
								Kotta Pulun	3
								Kohomba	5
								Teak	5
								Mango	5
								Siyambala	2
								Coconut	4
								Beli	2
								Palu	8
								Weera	3
								Maila	4
9	23.75	31.25	7.50	Anuradhapura	Kanadara/ Diwulwewa	Private	Agricultural (5.40km), Chena (0.80km) & Scrublands (1.30km)	Ehala	5
								Paddy	
								Ficus	2
								Burutha	1
								Siyambala	4
								Palu	7
								Weera	2
								Maila	3
Acasia	3								
10	31.25	36.65	5.40	Anuradhapura	Mahadiwulwewa	Private	Agricultural (2.50km), Chena (0.30km) & Scrublands (2.60km)	Paddy	
								Palu	4
								Weera	3
								Godakaduru	6
								Acacia	5
								Kon	1
								Ehala	2
								Helamba	4
Kumbuk	4								
11	36.65	42.40	5.75	Anuradhapura	Ataweeragolla wa/ Paranaahalmilla wa	Private/ Government	Agricultural (1.50km)& Scrublands (4.25km)	Welan	2
								Paddy	
								Ficus	2
								Burutha	2
								Siyambala	3
								Palu	4
								Weera	5
								Godakaduru	2
Acacia	3								
12	42.40	52.65	10.25	Vavuniya	Kovilkulam	Private	Home gardens (1.05km), Agricultural	Kon	4
								Mango	5
								Palu	6

No.	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
							(2.60km), Scrublands (6.20km)& Tank (0.40km)	Hik	3
								Kon	5
								Paddy	
								Coconut	10
								Teak	4
								Tal	6
								Nelli	1
								Boradaminia	3
								Burutha	3
13	52.65	53.90	1.25	Vavuniya	Ambalangodalla	Private	Agricultural (0.65km)& Scrublands (0.60km)	Paddy	
								Palu	2
								Hik	3
								Kon	2
								Boradaminia	1
								Burutha	1
								Kubuk	3
								Ehala	1
14	53.90	54.70	0.85	Vavuniya	Pinuwakubugas Wewa	Private	Home gardens (0.20km), Agricultural (0.35km), Scrublands (0.30km)	Coconut	4
								Teak	3
								Tal	3
								Mango	1
								Kubuk	2
								Nabada	3
								Kon	2
								Godakaduru	1
								Palu	2
								Weera	2
15	54.70	57.85	3.15	Vavuniya	Vavuniya GSS/Kurundankulam	Private	Home gardens (0.35km), Agricultural (1.20km), Scrublands (1.60km)	Paddy	
								Helamba	3
								Maila	4
								Eraminiya	2
								Daminiya	5
								Coconut	8
								Jackfruit	1
								Siyambala	1
								Teak	3
								Weera	2
								Burutha	4

## I.4 Construction of 132 kV double circuit Zebra 70 km Vavuniya - Mannar Transmission line.

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
1	0.00	0.90	0.90	Vavuniya	Nedumkulam	Private	Home gardens (0.50km) & Chena (0.40km)	Coconut	11
								Tal	4
								Teak	8
								Jackfruit	2
								Mango	5
								Halmilla	4
								Andara	14

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming
	From	To							
								Palu	7
								Seru	5
								Ehela	6
2	0.90	2.60	1.70	Vavuniya	Poonthoddam road	Private	Agricultural (0.40km) & Chena (0.95km)	Paddy	
								Siyambala	4
								Halmilla	6
								Andara	9
								Palu	6
								Seru	5
								Ehela	7
								Kohomba	9
3	2.60	5.80	3.20	Vavuniya	Kokeliya (Thandikulam)	Private	Home gardens (0.30km) & Agricultural (2.70km)	Weera	4
								Coconut	6
								Tal	4
								Kohomba	6
								Paddy	
								Siyambala	3
								Gamsooriya	9
4	5.80	.10	0.30	Vavuniya	Thandikulam	Private & Government	Agricultural (0.10km) & Scrubland (0.20km)	Ehela	5
								Kohomba	8
								Tal	6
								Paddy	
								Welan	7
								Palu	6
								Mee	4
								Edi	5
5	6.10	8.00	1.90	Vavuniya	Ganeshapuram	Private	Agricultural (1.15km) & Home gardens (0.20km)	Kumbuk	7
								Tal	11
								Siyambala	5
								Cocunut	18
								Mango	9
								Kohomba	14
								Andara	15
								Palu	6
6	8.00	8.90	0.90	Vavuniya	Tampanaikkulam	Private	Home gardens (0.90km)	Seru	7
								Paddy	
								Kohomba	6
								Tal	9
								Siyambala	4
								Cocunut	12
								Mango	6
7	8.90	10.70	1.80	Vavuniya	Tampanaikkulam	Private & Government	Home gardens (0.60km), Scrubland (0.40km) & Agricultural (0.50km)	Coconut	12
								Tal	5
								Teak	12
								Jackfruit	3
								Mango	9
								Halmilla	5
8	10.70	11.40	0.70	Vavuniya	1st lane Katpakapuram	Private	Agricultural (0.70km)	Andara	10
								Palu	5
								Seru	5
								Ehela	6
								Kohomba	9
								Paddy	
9	11.40	12.40	1.00	Vavuniya	4th lane Katpakapuram	Private	Home gardens (1.00km)	Coconut	13
								Mango	6
								Kohomba	7
								Jackfruit	3
								Teak	7

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
								Burutha	7
								Lemon	6
								Wood Apple	5
10	12.40	14.20	1.80	Vavuniya	Katpapuram (at 9.2 km of Vavuniya road)	Private & Government	Home gardens (1.10km), Plantation (0.40km) & scrubland (0.30km)	Coconut	23
								Mango	12
								Kohomba	13
								Jackfruit	3
								Palu	5
								Weera	4
								Helamba	4
								Andara	9
								Acacia	5
11	14.20	15.35	1.15	Vavuniya	Near student hostel of Vavuniya campus	Private	Agricultural (0.10km) & Chena (1.05km)	Welan	3
								Paddy	
								Weera	4
								Helamba	7
								Andara	8
								Palu	9
								Seru	8
								Ehela	7
								Kohomba	9
12	15.35	16.60	1.25	Vavuniya	7 km post Sopalapuliankulam	Private & Government	Home gardens (0.75km), Agricultural (0.25km) & Scrublands (0.25km)	Welan	6
								Kumbuk	4
								Paddy	
								Coconut	11
								Jackfruit	2
								Halmilla	5
								Palu	6
								Tal	12
								Teak	4
13	16.60	17.50	0.90		Sopalapuliankulam	Private	Home gardens (0.45km) & Agricultural (0.25km)	Siyambala	3
								BoraDamin iya	4
								Weera	6
								Kumbuk	5
								Kaluwara	3
								Kone	5
								Kohomba	5
								Paddy	
								Coconut	5
14	17.50	17.90	0.40	Vavuniya	Pavaikulam	Government	Scrubland (0.35km)	Palu	3
								Murunga	4
								Jackfruit	1
								Halmilla	5
								Bannana	6
								Mango	3
								Tal	5
								Siyambala	1
								Teak	6
								Weera	5
								Burutha	4
								Godakaduru	4
								Dunumadala	4
								Helamba	3
								Palu	4
								Weera	5



SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
								Tal	3
								Siyambala	4
								Burutha	3
								Helamba	5
								Seru	2
								Lolu	1
								Nabada	3
15	17.90	21.00	3.10	Vavuniya	Poovvarasankulam	Private & Government	Home gardens (0.25km), Agricultural (0.80km) & Scrublands (1.85km)	Paddy	
								Palu	12
								Godakirilla	6
								Maila	14
								Milla	5
								Kohomba	16
								Ehela	13
								Wood	5
								Apple	
								Mee	4
								Tal	11
								Mango	6
								Siyambala	3
16	21.00	21.75	0.75	Vavuniya	Kanthankulam	Private	Agricultural (0.75km)	Paddy	
17	21.75	22.80	1.05	Vavuniya	Kundikulam	Private	Agricultural (0.30km) & Chena (0.75km)	Paddy	
								Siyambala	1
								Mango	6
								Kohomba	7
								Tal	5
								Palu	7
								Maila	9
								Seru	10
								Lolu	11
								Nabada	6
18	22.80	23.40	0.60	Vavuniya	Kurukkalpudukkulam	Private & Government	Home gardens (0.10km), Agricultural (0.25km) & Scrublands (0.25km)	Paddy	
								Siyambala	1
								Mango	2
								Kohomba	3
								Tal	2
								Palu	3
								Maila	4
								Seru	3
								Lolu	4
19	23.40	24.10	0.70	Vavuniya	Kurukkalpudukkulam	Private & Government	Home gardens (0.20km) & Chena (0.50km)	Mango	3
								Teak	2
								Coconut	3
								Tal	4
								Maila	2
								Helamba	3
								Kumbuk	5
								Siyambala	1
								Palu	7
								Welan	2
								Seru	3
								Lolu	4
								Nabada	3
20	24.10	27.10	3.00	Vavuniya	Pandisurichchan	Private & Government	Agricultural (1.20km), Scrublands (1.40km) &	Paddy	
								Weera	6
								Palu	7
								Tal	6

Sl Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) Chena (0.40km)	Name of crops	Number of trees under cutting/ trimming
	From	To							
								Kohomba	8
								Maila	5
								Ehela	6
								Andara	12
								Welan	10
								Daminiya	5
21	27.10	28.15	1.05	Vavuniya		Private	Agricultural (1.05km)	Paddy	
22	28.15	30.15	2.00	Vavuniya	Piramanalankulam	Private & Government	Scrublands (1.80km) & Agricultural (0.20km)	Paddy	
								Weera	5
								Siyambala	6
								Palu	7
								Helamba	8
								Tal	6
								Andara	5
								Welan	7
								Daminiya	5
Ehela	4								
23	30.15	32.15	2.00	Vavuniya	Pulukkulam	Government	Scrublands (2.00km)	Maila	12
								Tal	5
								Kohomba	13
								Weera	8
								Siyambala	3
								Palu	12
								Andara	16
								Welan	14
								Daminiya	8
								Ehela	5
Acacia	13								
24	32.15	34.45	2.30	Vavuniya	Marakaranpalaikulam	Private & Government	Secondary forest (0.75km) & Scrublands (1.30km)	Weera	10
								Tal	12
								Helamba	5
								Maila	8
								Kumbuk	6
								Kohomba	7
								Eraminiya	5
								Siyambala	4
								Palu	3
								Dunumadala	4
Lolu	5								
Burutha	3								
25	34.45	35.75	1.30	Vavuniya	Periyakaltu	Private & Government	Home gardens (0.40km) & Scrublands (0.75km)	Coconut	6
								Tal	6
								Murunga	5
								Maila	4
								Kumbuk	7
								Kohomba	6
								Jackfruit	1
Siyambala	1								
Palu	8								
26	35.75	37.85	2.10	Vavuniya	(500 m from railway track) Paraiyanalankulam	Private & Government	Agricultural (1.00km), Scrublands (0.35km) Abandoned	Paddy	
								Maila	3
								Kumbuk	3
								Kohomba	2
								Palu	5

Sl No	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) Tank (0.75km)	Name of crops	Number of trees under cutting/trimming
	From	To							
								Acacia	3
								Weera	2
	37.85	38.35	0.50	Vavuniya	Paraiyanalankulam	Government	Scrublands (0.50km)	Maila	3
								Kumbuk	4
								Kohomba	2
								Palu	3
								Acacia	2
								Weera	2
								Diwul	1
27	38.35	39.65	1.30	Vavuniya	850 m from Paraiyanalankulam	Private & Government	Scrubland (1.30km)	Palu	4
								BoraDamin iya	2
								Welan	2
								Acacia	1
								Weera	1
								Ficus	1
								Lolu	2
								Siyambala	1
								Kohoba	1
28	39.65	41.40	1.75	Vavuniya	Pumalaruttan	Private & Government	Agricultural (0.50km) & Secondary forest (1.25km)	Paddy	
								Tal	1
								Maila	2
								Helamba	3
								Kumbuk	2
								Kohomba	1
								Palu	3
								Acacia	2
								Weera	1
								Ficus	1
								Lolu	1
								Siyambala	1
								BoraDamin iya	2
29	41.40	44.15	2.75	Mannar	Madu road	Private & Government	Home gardens (0.75km) & Secondary forest(2.00km)	Mango	2
								Teak	3
								Coconut	4
								Tal	2
								Maila	2
								Helamba	2
								Kumbuk	3
								Kohomba	3
								Palu	4
								Acacia	5
								Weera	2
	44.15	52.00	7.85	Mannar	Near Army Camp/ Kovitkulam		Agricultural (2.50km), Secondary forest (3.50km), Chena (0.40km), Tank (0.25km) Scrubland (0.80km) &Home gardens (0.40km)	Kumbuk	3
								Andara	3
								Maila	2
								Helamba	4
								Ficus	1
								Lolu	1
								Siyambala	1
								BoraDamin iya	1
								Helamba	2
								Weera	5
								Kohomba	3
								Palu	4
								Acacia	1
	52.00	53.75	1.75		Isamalaithaiyu	Private &	Agricultural	Paddy	

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
							(0.75km), Tank (0.30km) & Secondary forest (0.70km)	Tal	3
								Maila	3
								Helamba	4
								Kumbuk	5
								Kohomba	2
								Palu	3
								Acacia	1
	53.75	56.50	2.75		Kattidantakulum	Private & Government	Agricultural (1.25km) & Abandoned land (1.50km)	paddy	
	56.50	58.20	1.70		Chundikkuli	Private	Agricultural (1.70km)	Paddy	
	58.20	59.70	1.50		Murunkankulam	Private	Agricultural (1.50km)	Paddy	
36	59.70	61.25	1.55	Mannar	Mahaviankerni	Private	Agricultural (1.00km) & Home gardens (0.10)	Paddy	
								Tal	4
								Mango	3
								Siyambala	2
								Kohomba	1
								Lemon	4
								Murunga	1
								Katupila	2
37	61.25	63.60	2.35	Mannar	Maliapity	Private	Agricultural (2.20km)& home gardens(0.15km)	Wood Apple	1
								Paddy	
								Siyambala	2
								Mango	4
								Kohomba	6
								Tal	4
								Lemon	3
								Burutha	2
38	63.60	65.90	2.30	Mannar	Illangamodai/ Uyirtharasankulam	Private	Agricultural (2.30km)	Bannana	6
								Paddy	
39	65.90	67.70	1.80	Mannar	Vannamodai	Private	Agricultural (1.80km)	Paddy	

## A-II. New Polpitiya 220/ 132 kV GSS and associated transmission line.

### II.2 Construction of 132 kV 10km double circuit (2xZebra) Polpitiya-New Polpitiya transmission line.

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/trimming
	From	To							
1	0.00	0.50	0.50	Nuwara Eliya	Polpitiya		Home gardens (0.50km)	Coconut	4
								Durian	2
								Rambutan	4
								Avocado	5
								Jackfruit	3
								Breadfruit	2
								Embaralla	1
2	0.50	1.75	1.25	Nuwara Eliya	Kalugala 43 km post (A7)		Home gardens (1.25km)	Areca nut	6
								Alstonia	4
								Rambutan	5
								Jackfruit	3

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under , cutting/trimming
	From	To							
3	1.75	2.10	0.35	Nuwera Eliya	Kalugala 42 km post (A7)		Home gardens (0.35km)	Coconut	4
								Kala del	2
								Breadfruit	3
								Embaralla	4
								Areca nut	9
								Avocado	6
								Kaju	3
								Na-imbul	1
								Jackfruit	2
								Coconut	3
4	2.10	4.80	2.70	Nuwera Eliya	Belilena road		Plantation (2.70km)	Rambutan	4
								Embaralla	1
								Areca nut	6
								Rubber	1800
								Mahogany	12
								Alstonia	6
5	4.80	5.80	1.00	Kegalle	Malwatte road/ Kithulgala		Home gardens (1.00km)	Weralu	2
								Mango	1
								Rathkaliya	4
								Alstonia	5
								Rambutan	5
								Jackfruit	1
								Coconut	13
								Karabu	5
								Mahogany	2
								Embaralla	1
								Areca nut	12
								Mango	5
								Alstonia	3
								Siyambala	1
6	5.80	8.00	2.20	Kegalle	Gonagamuwa, Bibili Oya		Agricultural (0.20km) & Plantation (2.00km)	Mangus	2
								Avocado	3
								Paddy	
								Rubber	2000

II.4 Construction of 220 kV 58.5km, double circuit (2xZebra) New Polpitiya-Pannipitiya transmission line through Padukka to the existing Pannipitiya grid substation.

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under , cutting/trimming
	From	To							
1	0.00	2.60	2.60	Kegalle	Ganepalle road, Teligama		Plantation (2.60km)	Rubber	2100
								Kala-del	4
								Astonia	6
								Rath keliya	8
2	2.60	4.55	1.95	Kegalle	Ganepalle Estate,		Home gardens (0.10km), Agricultural (0.150km) & Plantation (1.70km)	Paddy	
								Rubber	1800
								Kala-del	5
								Astonia	7
								Na ebul	3
3	4.55	7.40	2.85	Kegalle	Hakbellawaka		Home gardens	Mahogany	6
								Rubber	1850

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under, cutting/trimming
	From	To							
							(0.15km), & Plantation (2.70km)	Kala-del Astonia Coconut Kithu Karabu Mahogany Na-ebul Rambutan Astonia Mango Nangus Avocado	4 3 1 1 1 6 7 3 8 1 3 3
4	7.40	12.05	4.65	Kegalle	Kanangama		Home gardens (0.15km), & Plantation (4.50km)	Rubber Coconut Rambutan Mahogany Weralu Gaduguda Mangus Kala-del Lunumedella Sapu	2350 20 1 2 1 1 1 1 1
5	12.05	13.80	1.75	Kegalle	10 km post (A7)		Home gardens (1.75km),	Rubber Coconut Rambutan Mahogany Sapu Astonia Mango Kala-del	45 12 6 5 1 6 3 2
6	13.80	15.35	1.55	Kegalle	Moragahahe na		Home gardens (1.05km), & Plantation (0.50km)	Alstonia Hora Kala-del Coconuut Kithul Rubber Rath-keliya Sapu Rambutan Durian Avocado	12 2 4 13 3 350 3 4 6 1 2
7	15.35	17.15	1.80	Kegalle	Kamburapola road/ Ehala Thaldewa		Home gardens (1.30km), Agricultural (0.30km) & Plantation (0.20km)	Paddy Rambutan Gaduguda Breadfruit Jackfruit Coconut Emberella Mango Areca nut Rubber	 6 4 3 3 15 3 6 20 150
8	17.15	19.05	1.90	Kegalle	Ammithirigal a road/ Weralupitiya		Home gardens (0.30km), Agricultural (0.20km) & Plantation (1.40km)	Rubber Coconut Rambutan Mahogany Na-ebul Astonia Mango	1000 34 2 4 1 5 6

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under, cutting/trimming
	From	To							
								Kala-del	3
								Murutha	4
								Sapu	2
								Paddy	
								Rath-kaliya	3
								Areca nut	12
								Ruk	2
9	19.05	20.95	1.90	Kegalle	Kudagama road (Sithawaka BOI zone)		Home gardens (0.10km), Agricultural (0.30km) & Plantation (1.50km)	Paddy	
								Rubber	1200
								Coconut	45
								Rambutan	3
								Mahogany	4
								Na-ebul	1
								Astonia	12
10	20.95	24.55	3.60	Colombo	Eswatta		Home gardens (3.35km), & Agricultural (0.25km)	Mango	4
								Jackfruit	1
								Coconut	18
								Durian	4
								Rambutan	7
								Avocado	4
								Jackfruit	5
11	24.55	27.35	2.80	Colombo	Alubodala		Forest (0.30km), Home gardens (0.70km), Palntation (1.50km) & Agricultural)	Breadfruit	4
								Embaralla	4
								Areca nut	16
								Paddy	
								Rubber	150
								Mahogany	6
								Rathkaliya	4
12	27.35	29.95	2.60	Colombo	Kosgama		Home gardens (1.00km), & Agricultural (1.60km)	Walla	2
								Gaduba	6
								Hora	4
								Keballa	4
								Ruk	2
								Na-ebul	1
								Durian	1
13	29.95	33.15	3.20	Colombo	750m away from Kaluaggala		Home gardens (2.50km), & Agricultural	Rambutan	3
								Avocado	4
								Jackfruit	1
								Breadfruit	1
								Embaralla	3
								Gaduguda	2
								Alstoniya	5
								Mahogany	4
								Paddy	
								Mango	4
								Rambutan	3

SI Nº	Kilometre		Dist ance (km)	Nº Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) (0.70km)	Name of crops	Number of trees under , cutting/ trimming
	Fro m	To							
					Junction towards Awissawella			Coconut	19
								Dodam	2
								Jackfruits	5
								Weralu	2
								Durian	4
								Gaduguda	2
								Avocado	4
								Jackfruit	1
								Breadfruit	1
								Embaralla	4
								Alstoniya	6
								Mahogany	4
14	33.1 5	33.8 0	0.65	Colombo	500m away from Kaluaggala Junction towards Labugama		Home gardens (0.65km)	Coconut	6
								Durian	1
								Rambuttan	4
								Avocado	3
								Jackfruit	2
								Breadfruit	1
								Embaralla	1
								Gaduguda	1
								Alstoniya	2
								Mahogany	3
15	33.8 0	36.2 0	2.40	Colombo	Pahathgama		Marsh (0.20km), Home gardens (1.60km) & Agricultural (0.60km)	Coconut	19
								Durian	3
								Rambuttan	8
								Avocado	2
								Jackfruit	4
								Breadfruit	1
								Embaralla	3
								Areca nut	12
								Alstoniya	7
								Mahogany	6
								Kaduru	6
								WelAttha	14
								Para	16
16	36.2 0	40.9 5	4.75	Colombo	Batawala		Marsh (0.30km), Scrub lands (0.45km), Home gardens (3.15km) & Agricultural (0.85km)	Alstoniya	10
								Mahogany	8
								Kaduru	4
								WelAttha	19
								Para	18
								Gaduba	7
								Kaballe	6
								Rath-kaliya	5
								Avocado	4
								Jackfruit	3
								Breadfruit	2
								Embaralla	1
								Coconut	13
								Rambutan	4
17	40.9 5	43.2 5	2.30	Colombo	Jalthara road		Home gardens (0.70km), Agricultural (1.10km) & Industrial Estate (0.50km)	Mahogany	3
								Alstonia	4
								Mango	3
								Coconut	17
								Ahala	2
								Rabutan	5
18	43.2 5	45.4 5	2.20	Colombo	Habarakada		Home gardens (0.10km), Agricultural	Coconut	13
								Paddy	
								Siyabala	1



SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under, cutting/trimming
	From	To							
							(1.10km) & Industrial Estate (1.00km)	Mahogany	5
								Alstonia	3
								Gaduba	4
19	45.45	46.55	1.10	Colombo	Habarakada		Home gardens (1.10km)	Mango	3
								Rambutan	4
								Coconut	6
								Dodam	1
								Jackfruits	2
								Weralu	1
								Jambu	3
								Avocado	4
								Nangus	1
20	46.55	48.20	1.65	Colombo	Galawelawatta road/Homagama		Agricultural (1.10km)	Paddy	
21	48.20	49.20	1.00	Colombo			Home gardens (0.90km), Agricultural (0.10km)	Paddy	
								Mango	5
								Rambutan	3
								Coconut	6
								Dodam	4
								Jackfruits	4
								Mangus	1
22	49.20	50.55	1.35	Colombo	Malapalla		Home gardens (0.55km) & Agricultural (0.80km)	Paddy	
								Mango	4
								Rambutan	3
								Coconut	8
								Jambu	1
								Mahogani	3
23	50.55	51.90	1.35	Colombo	Rukmale road		Home gardens (0.35km) & Agricultural (1.00km)	Paddy	
								Mango	2
								Rambutan	1
								Coconut	4
								Dodam	1
								Jackfruits	1
24	51.90	55.25	3.35	Colombo	Pannipitiya Railway Station		Home gardens (0.45km) & Agricultural (2.90km)	Paddy	
								Coconut	5
								Mango	3
								Rambutan	2
								Jackfruits	2
								Breadfruits	1
25	55.25	56.50	1.25	Colombo	Pannipitiya GSS		Home gardens (0.45km) & Agricultural (0.80km)	Paddy	
								Coconut	10
								Mango	4
								Rambutan	5
								Jackfruits	3

**A-III. Padukka 220/132/33 kV GSS and associated transmission line.**

III.2 Construction of 132 kV 12.5 km, double circuit (2xZebra) Athurugiriya to Padukka, transmission line.

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under, cutting/trimming
	From	To							
1	0.00	1.1	1.10	Colombo	Walpita		Agricultural (1.10km)	Paddy	
2	1.10	2.35	1.25	Colombo	Pokunuhena		Agricultural	Paddy	

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) (0.80km) & Home garden (0.45km)	Name of crops	Number of trees under, cutting/trimming
	From	To							
								Mahogany	3
								Coconut	8
								Breadfruit	2
								Rubber	48
								Areca nut	10
								Mango	6
								Alstonia	8
3	2.35	3.50	1.15	Colombo	Near Manungala temple/Dadiga muwa		Agricultural (1.15km)	Paddy	
4	3.50	4.95	1.45	Colombo	Maha wela/Welikadaowita		Agricultural (1.45km)	Paddy	
5	4.95	6.40	1.45	Colombo	Oruwala		Agricultural (1.45km)	Paddy	
6	6.40	7.15	0.75	Colombo	Gamunu Mawattha.		Agricultural (0.75km)	Paddy	
7	7.15	7.65	0.50	Colombo	Galwarusawa/Oruwala		Home gardens (0.40km) & Agricultural (0.10)	Kale-Del	1
								Ruk	2
								Alsastonia	2
								Hal	1
								Nadun	1
								Lunuannkenda	2
8	7.65	9.25	1.60	Colombo	M.D.H. Jayawardane road		Agricultural (1.00km) & housing Scheme (0.60km)	Kenda	2
								Areca nut	3
								Coconut	2
								Mango	1
								Iriya	1
								Dawata	1
								Rathkaliya	2
								Malla	1
								Paddy	
								Mango	3
								Coconut	10
								Rambutan	3
9	9.25	10.05	0.80	Colombo	Athurugiriya GSS		Agricultural (0.80km)	Paddy	

### III.3 Construction of 132 kV 15 km, double circuit (2xZebra) Athurugiriya to Kolonnawa transmission line.

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under, cutting/trimming*
	From	To							
1	0.00	1.25	1.25	Colombo	Godallawatte para/Pothuwarawa	Private	Home gardens (0.35km) & Agricultural (0.90km)	Paddy	--
								Coconut	
								Mango	
								Rambutan	
								Weralu	
								Jackfruit	
2	1.25	1.75	0.50	Colombo	Malabe	Private	Home gardens (0.50km)	Pihibiya	
								Coconut	
								Mango	
								Rambutan	
								Pihimbiya	
								Anoda	
								Ambaralla	
3	1.75	4.20	2.45	Colombo	Talahena	Private	Home gardens (2.20km) &	Jackfruit	
								Kottamba	
								Paddy	
								Mango	

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under , cutting/ trimming*
	From	To							
							Agricultural (0.25km)	Rambutan	
								Weralu	
								Jackfruit	
								Pihibiya	
								Ambaralla	
								Avocado	
								Kathurmurina	
4	4.20	4.55	0.35	Colombo	Near School/ Talahena	Private	Home gardens (0.35km)	Coconut	
								Mango	
								Rambutan	
								Pihibiya	
								Amberalla	
5	4.55	5.15	0.60	Colombo	Dutugamunu Mawatta	Private	Home gardens (0.60km)	Coconut	
								Mango	
								Rambutan	
								Mahogany	
								Teak	
								Avocado	
6	5.15	6.85	1.70	Colombo	Walpola/ Angoda	Private	Home gardens (1.60km) & Agricultural (0.10km)	Coconut	
								Mango	
								Rambutan	
								Mahogany	
								Siyambala	
								Avocado	
								Araliya	
								Dodam	
								Kottamba	
7	6.85	8.05	1.20	Colombo	Walikada road, Thalagaha Junction	Private	Urban area / Home gardens (1.20km)	Coconut	
								Mango	
								Rambutan	
								Mahogany	
								Ehala	
								Avocado	
								Pera	
								Dodam	
								Kottamba	
8	8.05	9.50	1.45	Colombo	Gothatuwa/ Mulleriyawa New Town	Private	Home gardens (1.45km)	Coconut	
								Mango	
								Ambaralla	
								Jackfruit	
								Mangus	
								Rambutan	
								Araliya	
9	9.50	11.80	2.30	Colombo	Wellampitiya	Private	Marsh (0.05km), agricultural (0.50km) & Home gardens (1.75km)	Wel aththa	
								Para	
								Coconut	
								Mango	
								Ambaralla	
								Jackfruit	
								Mangus	
								Rambutan	
								Avocado	
								Delum	
10	11.80	12.40	0.60	Colombo	Vihara Mawatha/ Kolonnawa	Private	Urban area / Home gardens (0.60km)	Coconut	
								Mango	
								Jambu	

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	Number of trees under cutting/ trimming*
	From	To							
					GSS			Rambutan	
								Pihimbiya	
								Laulu	

\*- existing towers are used for reconductoring, cutting of trees not required

#### A-IV. Construction of 132/33 kV GSS at Kegalle.

##### IV.3 Construction of 132 kV 22.5 km, double circuit (Zebra) Thulhiriya to Kegalle transmission line.

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow)	Name of crops	No. of Trees under cutting/ trimming
	From	To							
1	0.00	0.25	0.25	Kegalle	Thulhiriya/ Rathnapala road	Private	Agricultural & residential	Paddy Coconut	25
2	0.25	1.00	0.75	Kegalle	Thulhiriya/ Pansal mawatha	Private	Agricultural (0.75km)	Paddy	
3	1.00	1.40	0.40	Kegalle	Hunuwala, Nangalla	Private	Agricultural (0.35km)	Paddy	
4	1.40	1.75	0.35	Kegalle	Hunuwala,	Private	Home gardens (0.35km) Agricultural (0.05km)	Mahogany	15
								Jackfruit	6
								Coconut	26
								Mango	5
								Goraka	1
								Halmilla	1
								Areca nut	4
								Kithul	1
5	1.75	2.75	1.00	Kegalle	Hunuwala kanda, Thalawattha Rubber Estate	Private	Agricultural (1.00km)	Paddy	
6	2.75	4.15	1.40	Kegalle	Ragala, Kahabiliyawal a	Private	Agricultural(0.2 5km) &Plantation (1.15km)	Paddy	
								Rubber	1250
7	4.15	6.15	2.00	Kegalle	Katukurund a	Private	Agricultural(0.8 0km) &Plantation (1.20km)	Paddy	
								Coconut	45
8	6.15	6.85	0.70	Kegalle	Talgama/ Matiyagane/ Weniwalwatt ha Rubber Estate	Private	Agricultural(0.3 0km) &Plantation (0.40km)	Rubber	1300
								Paddy	
9	6.85	7.20	0.35	Kegalle	Galkatiya Junction	Private	Agricultural (0.35)	Paddy	
10	7.20	8.90	1.70	Kegalle	Weragoda	Private	Agricultural(0.5 0km) &Plantation (1.20km)	Paddy	
								Rubber	1300
11	8.90	11.65	2.75	Kegalle	Jeewana/ Dewalegama	Private	Agricultural(1.8 5km)	Paddy	
								Coconut	18

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land (Private, Government, Forest)	Use of Land (Agricultural, Plantation, barren/fallow) & Plantation (0.95km)	Name of crops	No. of Trees under cutting/trimming
	From	To							
								Rubber	1282
12	11.65	12.25	0.60	Kegalle	Halloduwa	Private	Agricultural (0.60)	Paddy	
13	12.25	12.85	0.60	Kegalle	Dewalegama	Private	Agricultural (0.20km) Home gardens (0.40km)	Paddy	
								Coconut	20
								Mango	4
								Jak fruit	8
								Mahogany	12
								Alstonia	10
								Areca nut	11
								Kaju	3
14	12.85	14.05	1.20	Kegalle	Walagama	Private	Agricultural (1.20km)	Paddy	
15	14.05	15.60	1.55	Kegalle	Siyabalapitiya (near temple)	Private	Agricultural (0.850km) & Plantation (0.70km)	Paddy	
								Rubber	900
16	15.60	17.30	1.70	Kegalle	Pussella	Private	Home gardens (1.70km)	Mango	6
								coconut	27
								Mahogany	11
								Jak fruit	8
17	17.30	18.50	1.20	Kegalle	Kurunduhinna	Private	Agricultural (1.00km)	Rambutan	7
								Siymbala	3
								Weralu	2
								Areca nut	11
								Paddy	
18	18.50	19.95	1.45	Kegalle	Puwakdeniya	Private	Agricultural (0.55) & home gardens (0.95km)	Paddy	
								Coconut	19
								Jakfruit	7
								Rambutan	8
								Mahogany	11
19	19.95	21.20	1.25	Kegalle	Molagoda Kawdaulla road	Private	Agricultural (0.60) (1.00km) & home gardens (0.65km)	Paddy	
								Mango	12
								Coconut	25
								Mahogany	10
								Jakfruit	8
								Rambutan	4
20	21.20	22.45	1.25	Kegalle	Molagoda Annasigala road	Private	Agricultural (1.10km)	Paddy	

## Annexure 5 Environment Management Plan (EMP)

Project Activity	Potential Impact	Environmental	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
<b>Pre-construction</b>							
Temporary use of lands	Impact to the existing environment		Selection of lands adhering to local laws and regulations and in close consultation with LAs Construction facilities should be placed at least 100 m away from water bodies, natural flow paths, important ecological habitats and residential areas	Water and air quality	Air quality Standards and CEA water quality standards	CEB Contractor	Detailed design
Substation location and design	Noise generation to noise, Nuisance to neighbouring properties	Exposure	Substation designed to ensure noise will not be a nuisance.	Expected noise emissions based on substation design, noise levels	Noise control regulations in 1994 Noise levels to be specified in tender documents	CEB	Detailed design
	Disturbance to the adjacent lands and the people due to cut and fill operations		Maintain adequate clearance, construction of retaining structures, minimise cut and fill operations adjoining to the dwellings	Proximity to houses and other structures	Technical specification	CEB	Detailed design
Location of towers and transmission line alignment and design	Exposure to safety related risks		Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and line alignment selection with respect to nearest dwellings	Setback distances to nearest houses -	CEB	Part of tower sighting survey and detailed alignment survey and design
	Impact on water bodies / land/ residences		Consideration of site location at where they could be located to avoid water bodies or agricultural land as much as possible.  Careful site selection to avoid existing settlements	Site location, line alignment selection (distance to dwelling, water and/or agricultural land)	Consultation with local authorities and land owners, CEA water quality standards	CEB	Part of detailed project sighting and survey and design
Equipment specifications and design parameters	Release of chemicals and harmful gases in receptors (air, water, land)		PCBs not used in substation transformers or other project facilities or equipment.	Compliance with setback distances ("as-built" diagrams)	Setback distances to nearest houses	CEB	Detailed design
Encroachment into precious ecological areas	Loss of precious ecological values/ damage to precious species		Avoid encroachment by careful site and alignment selection Minimise the need by using existing towers and RoW wherever possible	Floral and faunal habitats loss	Flora and fauna protection act.	CEB	Detailed design
Involuntary resettlement or land acquisition	Loss of lands and structures		Compensation paid for temporary/ permanent loss of productive land as per GoSL procedures	Public complaints	Rates stipulated in the Resettlement plan/ Frame work for the project	CEB	Prior to construction phase
Encroachment into farmland	Loss of agricultural productivity		Use existing tower footings/towers wherever possible	Tower location and line alignment selection	Agrarian Service Act. Consultation	CEB	Part of detailed alignment survey and

Project Activity	Potential Impact	Environmental	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
			Avoid sighting new towers on farmland wherever.	Design/Implementation of crop and tree compensation (based on affected area)	with local authorities and design engineers		design
			Farmers compensated for any permanent loss of productive land trees that need to be trimmed removed along RoW.	Statutory approvals for tree trimming /removal			
Interference with drainage patterns/Irrigation channels	Temporally flooding hazards/loss of agricultural production		Appropriate sighting of towers to avoid channel interference	Site location and line alignment selection	Irrigation Act 1933. Consultation with local authorities and design engineers	CEB	Detailed alignment survey and design
Explosions/Fire	Hazards to life		Design of substations to include modern fire control systems/firewalls.	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications	CEB	Part of detailed substation layout and design /drawings
			Provision of fire fighting equipment to be located close to transformers, power generation equipment.				
<b>Construction</b>							
Removal or disturbance to other public utilities	Public inconvenient		Advance notice to the public about the time and the duration of the utility disruption Use of well trained and experienced machinery operators to reduce accidental damage to the public utilities Restore the utilities immediately to overcome public inconvenient	Disruption of other commercial and public activities / Public complaints	Technical specification	CEB/ PRDA / NWSDB/SLT	Throughout the construction period
Acquisition of paddy fields and other lands	Loss of agricultural productivity		Avoid farming season wherever possible for the project activities. Ensure existing irrigation facilities are maintained in working condition Protect /preserve topsoil and reinstate after construction completed Repair /reinstate damaged bunds etc. after construction completed Compensation for temporary loss in agricultural production	Land area of agriculture loss Usage of existing utilities Status of facilities (earthwork in m <sup>3</sup> ) Implementation of Crop compensation (amount paid, dates, etc.)	Agrarian Service Act. Regular monitoring compliance with regulations	CEB, Contractor through contract provisions	Throughout the construction period
Temporary outage of the electricity	Loss of power supply to the local community when the new transmission line are switched off		Advance notice to the public about the time and the duration of the utility disruption Restore the utilities immediately to overcome public inconvenient.	Houses and commercial premises of power disruption	Regular monitoring during the period of strengthening the conductors	Contractor CEB	Throughout the construction period
Equipment	Noise and vibrations		Selection of construction techniques and	Construction techniques	Minimal ground	CEB, Contractor	Construction period

Project Activity	Potential Impact	Environmental	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
layout and installation			machinery to minimise ground disturbance.	and machinery	disturbance	through contract provisions	
Substation construction	Loss of soil		Fill for the substation foundations obtained by creating or improving local drain system.	Borrow area sighting (area of site in m <sup>2</sup> and estimated volume in m <sup>3</sup> )	Laws and regulations of respective LAs	CEB, Contractor through contract provisions	Construction period
	Water pollution		Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season.	Seasonal start and finish of major earthworks (pH, BOD/COD, Suspended solids, other)	Timing of major disturbance activities - prior to start of construction activities	CEB, Contractor through contract provisions	Construction period
Construction schedules	Noise nuisance to neighbouring properties		Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(a)])	Daytime construction only	CEB, Contractor through contract provisions	Construction period
Provision of facilities for construction workers	Contamination of receptors (land, water, air)		Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities	CEB, Contractor through contract provisions	Construction period
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal		Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowners.	Location and amount (m <sup>3</sup> ) of fill disposal Soil disposal locations and volume (m <sup>3</sup> )	Appropriate fill disposal and dispersal locations	CEB, Contractor through contract provisions	Construction period
Wood/vegetation harvesting, cut and fill operations	Loss of vegetation and deforestation		Construction workers prohibited from harvesting wood in the project area during their employment.	Illegal wood /vegetation harvesting (area in m <sup>2</sup> , number of incidents reported)	Complaints by local people or other evidence of illegal harvesting	CEB, Contractor through contract provisions	Construction period
	Affect on fauna		Prevent his work force from disturbing to the flora, fauna including hunting of animal and fishing in water bodies	Habitat loss	Fauna and flora protection Act.	CEB/ DWC/ DoF	Construction period
			Proper awareness programme regarding conservation of flora, fauna including ground vegetation to all drivers, operators and other workers				
Site clearance	Vegetation		Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m <sup>2</sup> )	Felling of trees (Amendment Act. Nº 01 of 2000 and act of felling of trees control) Clearance strictly limited to target vegetation	CEB, Contractor through contract provisions	Construction period



Project Activity	Potential Impact	Environmental	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
	Soil erosion and surface runoff		Construction in erosion and flood-prone areas should be restricted to the dry season Treat clearing and filling areas against flow acceleration and construction work should be carefully designed to minimise obstruction or destruction to natural drainage	Soil erosion	Visual inspection (Turbidity and sedimentation)	CEB, Contractor through contract provisions	Construction period
Mechanised construction	Noise, vibration and operator safety, efficient operation  Noise, vibration, equipment wear and tear		Construction equipment to be well maintained.  Proper maintenance and turning off plant not in use.	Construction equipment - estimated noise emissions and operating schedules	Technical specifications, safety regulations, Noise control regulations in 1994	CEB, Contractor through contract provisions	Construction period
Construction of roads for accessibility	Increase in airborne dust particles  Increased land requirement for temporary accessibility		Existing roads and tracks used for construction and maintenance access to the site wherever possible.  New access ways restricted to a single carriageway width within the RoW.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible  Access restricted to single carriageway width within RoW	CEB, Contractor through contract provisions	Construction period
Transportation and storage of materials	Nascence to the general public		Transport loading and unloading of construction materials should not to cause nuisance to the people by way of noise, vibration and dust. Avoid storage of construction materials beside the road, around water bodies, residential or public sensitive locations Construction materials should be stored in covered areas to ensure protection from dust, emissions and such materials should be bundled in environment friendly and nuisance free manner	Water and air quality	National Environment Act Laws and regulations of respective LAs National Emission Standards and CEA water quality standards	CEB/ CEA/LAS	Construction period
Trimming/cutting of trees within RoW	Fire hazards  Loss of vegetation and deforestation		Trees allowed growing up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.  Trees that can survive pruning to comply should be pruned instead of cleared.  Felled trees and other cleared or pruned vegetation to be disposed of as authorised by	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in metres)  Disposal of cleared vegetation as approved by the statutory	Felling of trees (Amendment Act. No 01, of 2000 and act of felling of trees control)  Presence of target species in RoW following vegetation clearance.	CEB, Contractor through contract provisions	Construction period

Project Activity	Potential Impact	Environmental	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
			the statutory bodies.	authorities (area cleared in m <sup>2</sup> )			
Health and safety	Injury and sickness of workers and members of the public		Contract provisions specifying minimum requirements for construction camps  Contractor to prepare and implement a health and safety plan.  Contractor to arrange for health and safety awareness programmes	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Health and safety regulations	CEB (Contractor through contract provisions)	Construction period
Nuisance to nearby properties	Losses to neighbouring land uses/ values		Contract clauses specifying careful construction practices.  As much as possible existing access ways will be used.  Productive land will be reinstated following completion of construction  Compensation will be paid for loss of production, if any.	Contract clauses Design basis and layout Reinstatement of land status (area affected, m <sup>2</sup> ) Implementation of Tree/Crop compensation (amount paid)	Incorporating good construction management, design engineering practices  Consultation with affected parties immediately after completion of construction and after the first harvest	CEB (Contractor through contract provisions)	Construction period
<b>Operation and Maintenance Phase</b>							
Electric shock	Death or injury to the workers and public		Security fences around substation  Establishment of warning signs  Careful design using appropriate technologies to minimise hazards	Proper maintenance of fences and sign boards  Usage of appropriate technologies (lost work days due to illness and injuries)	Periodic maintenance	CEB	Throughout the operation
Noise generation	Nuisance to the community around the site		Provision of noise barriers	Noise level	Noise level (db)- Once a year	CEB	Throughout the operation
Maintenance of Transmission line	Exposure to electromagnetic interference		Transmission line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (metres)	Ground clearance -	CEB	Throughout the operation
Substation maintenance	Exposure to electromagnetic interference		Substation design to comply with the limits of electromagnetic interference within floor area	Required vibrations level, instrumentation	Technical specifications	CEB	Throughout the operation
Oil spillage	Contamination of land/nearby water bodies		Substation transformers located within secure and impervious bundled areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bounding ("as-built" diagrams)	National Environment Act, Bounding capacity and permeability	CEB	Throughout the operation

## Annexure 6 Environmental Parameters and Periodicity for Environmental Monitoring Plan

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (LKR)	Implementation	Supervision
1. Air Quality	A. Pre-construction stage (The project after assign to contractor)	CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	A single time	NAAQS of Sri Lanka	Per sample LKR 9,000	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	Two times	NAAQS of Sri Lanka	Per sample LKR 9,000	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	A single time	NAAQS of Sri Lanka	Per sample LKR 9,000	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA
2. Water Quality	A. Pre-construction stage (The project after assign to contractor)	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	A single time	CEA Water Quality Regulations	Per sample LKR 14,000	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	1 time/ 3 months	CEA Water Quality Regulations	Per sample LKR 14,000	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	1 time/ 3 months	CEA Water Quality Regulations	Per sample LKR 14,000	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA
3. Noise/ Vibration	A. Pre-construction stage (The project after assign to contractor)	Noise level (dB level)	Inside and outside (0.5 km) of the proposed substation	A single time	National Environmental (Noise Control) Regulations, NAAQS	Per sample LKR 6,500	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	Noise level (dB level)	Inside and outside (0.5 km) of the proposed substation	2 times year	National Environmental (Noise Control) Regulations, NAAQS	Per sample LKR 6,500	Contractor approved by engaging agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	Noise level (dB level)	Inside and outside (0.5 km) of the	3 times year	National Environmental	Per sample LKR 6,500	CEB by engaging approved monitoring agency(Sri	CEB/CEA

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (LKR)	Implementation	Supervision
			proposed substation		ental (Noise Control) Regulations, NAAQS		Lankan Government)	
<b>4. Soil</b>	A. Pre-construction stage (The project after assign to contractor)	P <sup>H</sup> · Sulfate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistively, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	A single time	Technical specifications	Per sample LKR 13,500	Contractor approved agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	P <sup>H</sup> · Sulfate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistively, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	Two times	Technical specifications	Per sample LKR 13,500	Contractor approved agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	P <sup>H</sup> · Sulfate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistively, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	A single time	Technical specifications	Per sample LKR 13,500	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA

**Abbreviations:**SO<sub>2</sub>- Sulphur Dioxide

Pb- Lead

EC- Electrical Conductivity

BOD- Biological Oxygen Demand

NWQS- National Water Quality Standards

NO<sub>2</sub>- Nitrogen Dioxide

PM10- Particulate Matter &lt;10

DO- Dissolved Oxygen

NAAQS- National Air Quality Standards

CEB- Ceylon Electricity Board

CO- Carbon Monoxide

TSPM- Total suspended Particulate Matter

TSS- Total Suspended Solis

CEA- Central Environmental Authority

**Notes:** Transport and Accommodation cost, NBT, VAT etc are not included for the EMoP. Rates valid for the period of 60 days. Information based on the quotation provided by NBRO (National Building Research Organisation).

## Annexure 7 Granting of Necessary Wayleaves for Electricity Networks in Sri Lanka - Guidelines for Licensees, Divisional Secretaries and Landowners and/or Occupiers

*(A DOCUMENT OF THE PUBLIC UTILITIES COMMISSION OF SRI LANKA dated 27th August 2009)*

### INTRODUCTION

- The enactment of the Sri Lanka Electricity Act N° 20 of 2009 (SLEA) has vested powers with the Public Utilities Commission of Sri Lanka (the Commission) to regulate the electricity industry of Sri Lanka.
- Acting on the powers derived, PUCSL has granted licenses to the Ceylon Electricity Board (CEB) and Lanka Electricity Company (Pvt) Ltd (LECO). Accordingly, it has become their statutory duty to develop, maintain and operate efficient and economical systems for transmission and distribution of electricity.
- Transmission networks are owned and operated by the CEB, whereas the distribution systems are owned and operated by CEB and LECO.
- With more than 80% of the population having access to electricity in Sri Lanka, electricity transmission and distribution systems have been made available in almost all areas where there is human habitat. In the process, electric lines and associated equipment are (such as poles, conductors, reclosers, sectionalisers, various types of switches, metering equipment, staywires, transformers, etc.) installed over or under private lands.
- GoSL target is to provide electricity to all by 2015 and with the economic development taking place, demand for electricity is growing at a steady pace. This will necessitate the licensees to use more and more private lands in future as well, to install their networks.
- The licensees need to have access to these lands for the purposes of erecting, inspecting, maintaining, repairing, adjusting, altering, replacing or removing the lines or other equipment.
- In these Guidelines, 'wayleave' in relation to a land means such interest in the land as consists of a right of a licensee, to install and keep installed, an electric line: on, under, or over that land; and to have access to that land for the purposes of inspecting, maintaining, adjusting, repairing, altering, removing or replacing such electric line.
- This document is intended to provide general guidance to:
  - a) electricity licensees (CEB/LECO) who will be the applicants for the grant of wayleave;
  - b) the land owners/occupiers whose land is or may be the subject of such application; and
  - c) Divisional Secretaries (who are empowered to act as representatives of the Commission)
- In terms of Section 3(5) of Schedule I of SLEA, the Commission is empowered to appoint a person to act on behalf of the Commission to carry out specified functions relating to the grant of wayleave clearances.
- Accordingly, in terms of the Gazette Extraordinary N° 1604/6 dated 1st June 2009, the Divisional Secretaries are appointed as representatives of the Commission, hereinafter referred to as "the Person Appointed by the Commission". Pursuant to the appointment as representatives of the Commission, the Divisional Secretaries are mandated to:
  - a) Look in to issues/objections of the relevant clearing of way-leaves and installation of electrical lines on lands owned by private parties by giving such parties fair hearing on behalf of the Commission and make recommendations to the Commission; and
  - b) Receive and acknowledge such issues/objections on the above from the relevant parties in writing on behalf of the Commission and to take appropriate actions as per above.

### PROCEDURES TO BE FOLLOWED UNDER SLEA

- The Sections 3 to 7 of Schedule I of the SLEA govern the wayleave clearances whereas the Sections 7 to 10 of Schedule II govern the entry into premises.
- There are two possible scenarios relevant to the grant of a wayleave: for the installation of a new electric line/apparatus; or when there is a request by a landowner/occupier to remove an existing line/apparatus. The Person Appointed by the Commission would also have to consider the matters referred to it in relation to the removal of trees which are/may obstruct, interfere or cause a danger to an electric line or plant.

## 1. Entry into Any Land or Premises

- Where a licensee wishes to enter a land or premises for the purpose of installing an electric line/plant, minimum of three (3) days notice (specimen notice: appendix 1) stating the nature and extent of the work intended to be carried out, has to be given to the occupier if the land is occupied and to the owner if it is not occupied.
- In cases where the land is not occupied and the name and the address of the owner cannot be ascertained, the notice referred to above should be exhibited at a conspicuous position of the land.
- If the land/premises is used/reserved for a public purpose, then the notice has to be given to the officer or any other person in charge of that land/premises.
- Licensee shall issue written authorisation to the person who is exercising the powers to enter the land/premises.
- If by way of entering the land/premises, if any damage is caused to the land or to any movable or immovable property or caused any disturbance to any person, then he/she may claim compensation from the licensees. The Commission will determine the extent of compensation to be paid.
- Where the efforts made by a licensee to enter any premises under the powers conferred to it by the SLEA were unsuccessful, the permission should be sought by applying to the Magistrate's Courts having jurisdiction over the place and its decision shall be final.

## 2. Obtaining a Wayleave for a New Electricity Line/Plant

- All efforts should be made by the licensee who requires the wayleave, to enter into an agreement with the landowner/occupier to obtain such wayleave. The terms and conditions of the agreement shall include, among others, the period for which the wayleave is granted
- (if it is not permanent) and the compensation to be paid by the licensee for the disturbances
- and/or damages caused by the installation of the new line/plant.
- Where the licensee is unable to reach an agreement with the landowner/occupier in relation to obtaining the wayleave, it shall give the landowner/occupier a minimum of twenty one (21) days notice (specimen notice: appendix 4) requiring the grant of wayleave.
- If the landowner/occupier fails to grant the wayleave within the period specified in the notice or grants the wayleave subject to the terms and conditions which are not acceptable to the licensee, within seven (7) days from the expiry of the period specified in the notice, the licensee may make an application to the Person Appointed by the Commission requiring the grant of the wayleave. (particulars to be submitted along with an application to grant of wayleave.
- In the application, it is necessary for the licensee to prove that the acquisition of the wayleave is necessary to carry out its licensed activities and most importantly that it has taken all possible measures to reach an agreement, but have been unsuccessful.
- The application shall not be considered, if the proposed line is to be installed over a land which is covered by an authorised dwelling or permission has been granted to construct a dwelling.
- On the receipt of a successful application, the Person Appointed by the Commission will hold an inquiry, to provide an opportunity for the occupier or the land owner (where the occupier is not the owner) to be heard, and forward his/her recommendations to the Commission relating to the application within fourteen (14) days of the receipt of such application.
- Within six (6) weeks of the application, considering the recommendation of the Person Appointed by the Commission:
  - a) the Commission may either authorise or prohibit the licensee any of the acts mentioned in the notice (issued to the land owner or occupier) either unconditionally or subject to such terms, conditions and stipulations as it thinks fit; or
  - b) if the Commission is satisfied that the acquisition of that wayleave is necessary for carrying on of the activities authorised by the license of the licensee, recommend to the Minister to acquire the wayleave under the Land Acquisition Act.
- If the Commission's recommendation to acquire the wayleave is approved, the Minister may by an

Order published in the Gazette acquire the wayleave under the Land Acquisition Act and transfer to the licensee. Wayleave acquired through the Land Acquisition Act shall not be subject to any provision of any enactment and shall bind any person who has been the owner/occupier of the land over which wayleave has been granted.

- In addition, the Person Appointed by the Commission will also recommend to the Commission the amounts of compensation payable to the owner or occupier of the land. Licensee is bound to pay compensation, as determined by the Commission, to the owner or occupier of the land. If the owner is unknown or the ownership is subject to dispute, licensee will deposit the sum to be paid as compensation in the district courts and inform the relevant parties accordingly or exhibit that notice at a conspicuous position of the land.
- Any person who is aggrieved by the Commission's determination on the subject of compensation could institute action in a Court of proper jurisdiction against the licensee.

### **3. When a Request is made by the Owner/Occupier of a Land to Remove an Existing Electricity Line or Plant**

- Where an existing wayleave:
  - a) is determined by the expiration of the period specified in the agreement;
  - b) is terminated according to a term contained in the wayleave agreement; or
  - c) ceases to be binding following a change in ownership or occupancy,
  - d) the landowner/occupier may request for the removal of the electricity line/apparatus by giving three (3) months' notice.
- On receipt of such notice, the licensee is required to comply with the notice and remove the electricity line/apparatus before the end of the specified period. However if it does not want to comply with the request, all efforts should be made by the licensee to enter into a fresh agreement with the landowner/occupier in order to secure such wayleave.
- Where the licensee is unable to reach an agreement with the landowner/occupier in relation to securing the wayleave, an application would have to be forwarded to the Person Appointed by the Commission to secure the wayleave (as explained in previous section), within three (3) months of the notice. (particulars to be submitted along with an application to secure the wayleave)
- In the application, it is necessary for the licensee to prove that the wayleave is necessary to carry out its licensed activities and most importantly that it has taken all possible measures to reach an agreement, but have been unsuccessful.
- On the receipt of a successful application, the Person Appointed by the Commission will hold an inquiry, to provide an opportunity for the occupier or the land owner (where the occupier is not the owner) to be heard, and forward his/her recommendations to the Commission relating to the application within fourteen (14) days of the receipt of such application.
- Within six (6) weeks of the application, considering the recommendation of the Person Appointed by the Commission:
  - a) the Commission may either authorise or prohibit the licensee to keep installed the electricity line/apparatus specified in the notice issued by the land owner/occupier either unconditionally or subject to such terms, conditions and stipulations as it thinks fit; or
  - b) if the Commission is satisfied that the acquisition of that wayleave is necessary for carrying on of the activities authorised by the license of the licensee, recommend to the Minister to acquire the wayleave under the Land Acquisition Act.
- If the licensee is prohibited to keep installed the electricity line/apparatus specified in the notice, the licensee will be required to remove the electricity line/apparatus within one (1) month from the date of the Commission's decision or such longer period as the Commission may specify.

### **4. Removal of Trees which are/may Obstruct, Interfere an Electric Line/Plant or Constitute an Unacceptable Danger to Public** (flow diagram showing the procedure: Appendix 8)

- When a tree is in close proximity to an electricity line/plant installed or to be installed and if the

licensee is of the opinion that it will obstruct or interfere with the installation, maintenance or working of an electric line/plant or is a source of danger to public, a notice is required to be issued to the occupier of the land with a copy to the owner (where the occupier is not the owner) of the land requiring him/her to fell or lop the tree or cut back its roots, within a period of three (3) days.

- If the occupier complies with the notice, licensee shall pay the reasonable expenses incurred by him/her in complying with the requirements of the notice.
- If within three (3) days of the notice the requirements of the notice are not complied with and neither the owner nor occupier of the land gives a counter-notice, the licensee may cause the tree to be felled or lopped or its roots to be cut back so as to prevent it from obstructing or interfering with the installation, maintenance or working of an electric line/plant or being a source of danger to public. In doing so, the licensee shall:
  - a) Do it in accordance with good arboricultural practices and so as to do as little damages as possible to trees, fences, hedges and growing crops;
  - b) Cause the felled trees, lopped boughs or root cuttings to be removed in accordance with the direction of the owner or occupier; and
  - c) make good any damage caused to the land
- However, if a counter-notice is received objecting to the requirements of the notice within the three (3) days, the matter shall be referred to the Person Appointed by the Commission to hold an inquiry, where all parties will be heard. (particulars to be submitted along with such referral: appendix 9)
- On the receipt of such referral, the Person Appointed by the Commission will hold an inquiry, and forward his/her recommendations to the Commission within fourteen (14) days of the receipt of such referral.
- Upon receipt of the recommendation of the Person Appointed by the Commission, the Commission may make an order:
  - a) allowing the licensee to cause the tree to be felled or lopped or its roots to be cut back, after notifying any person by whom a counter notice was given; and
  - b) determining any question as to what expenses (if any) are to be paid to the licensee by the owner or occupier of the land.



## A 16. Annex 16: IEE – Distribution System Improvement Component

1. Asian Development Bank (ADB) is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement to Ceylon Electricity Board (CEB) with a focus to identify the transmission and distribution projects for evacuation of renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.
2. The distribution components of the Clean Energy and Network Efficiency Improvement project include:  
Component B: Distribution projects.
  - Vavyunia-Kebithigollewa 33 kV.
  - Anuradhapura-Kahatagasdigiliya 33 kV.
  - Kiribathkumbura-Galaha gantry 33 kV.
  - Galmadu Junction-Akkirapaththu-Pothuvil 33 kV.
3. The selected 250 sq.m. plot of land required for gantry based switching stations for Kahatagasdigiliya, Galaha, Akkaraipaththu and Pothuvil will be based on government lands. Whereas, the Kebithigollewa land is private which will be purchased at market rates and acquisition of land will not be required from the surrounding communities. The Vavyunia-Kebithigollewa line (23 km) passes two forest reserves (Kapundkalipulam and Padaviya), home gardens, paddy fields, and crosses the Sinnapuluk Kulam and Dutuwewa dry zone tanks. The Kiribathkumbura-Galaha line (15 km) is based in hilly region and passes through home gardens, tea gardens, paddy, pinus and rubber plantations; New Anuradhapura to Kahatagasdigiliya (31 km) passes through paddy fields, home gardens, chena lands, scrub jungle and secondary forests; the Galmadu Junction-Akkaraipaththu line (18 km) passes through densely populated area, home gardens, paddy fields, and degraded lands; whereas the Akkaraipaththu-Pothuvil line (42 km) passes through paddy fields, home gardens, edge of tanks (Komari and Paladi), scrublands and degraded lands. All the forest reserve areas traversed by the lines are degraded forests which were cleared during the conflict period.
4. Impacts are manageable and can be managed cost effectively - Environmental impacts are likely to result from the proposed project development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts, that could not be specified or identified at this stage, are taken into account and mitigated where necessary. Those impacts can be reduced through mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites.
5. The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:
  - Significant improvement of the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact.
  - Removal of trees for the distribution line is the main negative impact to the proposed project area.
  - Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.
  - There will be loss of agricultural productivity due to obstruction and reduce the land of paddy fields as well as cutting of home gardens, coconut and rubber plantations; which will be compensated based on established rates by CEB.
6. Benefits far outweigh negative impacts - The proposed project will improve operational efficiency and quality of power, voltages, reliability of the system and at the same time will reduce losses. Supply of power to both the local areas and regions will boost economic development of the area by strengthening the power distribution infrastructure. Overall, the major social and environmental impacts associated with distribution projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best

- engineering and environmental practices.
7. Various mitigation measures to be taken prior to the project activities are listed in the project's IEE. Potential adverse environment impacts associated with distribution lines has been avoided or minimised through careful route selection. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignment passes through scrub-lands, cultivated paddy fields, rubber cultivations, rubber plantations, tea cultivations etc. The lines will also pass through degraded forest areas but avoid any national park or sanctuary. The alignments in this project have also avoided wetlands and geologically unstable areas, which can also pose foundation related problems. Land will only be purchased/acquired for one gantry based switching station but no land will be required for placing distribution towers on private land. However, any damage to the crops during the construction phase of the project will be compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will not be lost permanently at the base of the distribution tower. After construction, agricultural land within the distribution corridors can be used again for farming purpose.
  8. Since the project does not involve activities that have significant adverse impact, an initial assessment been done to determine the extent of impact as per the ADB's new Safeguard Policy Statement 2009 guidelines. Accordingly, the environmental classification for the sub-project component is "Category B". The IEE report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>33</sup> and the ADB Safeguard Policy Statement 2009.

## 1 INTRODUCTION

1. Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces. Asian Development Bank's (ADB's) focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka.
2. The power sector has undergone significant policy level and structural changes in the recent past:
  - Sri Lanka Electricity Act passed in Parliament in 2009;
  - Assumption of the role of electricity regulator in April, 2009 by the Public Utilities Commission of Sri Lanka (PUCSL);
  - Creation of Functional Business Units (FBU's) within the CEB with one unit each for generation and transmission and 4 geographical units for distribution function; and
  - All FBU's have been issued licenses by the Public Utilities Commission of Sri Lanka (PUCSL) and they have been filing the tariff petitions since 2010.
3. In January 2011, ADB approved the Sustainable Power Sector Support Project with focus on Clean Energy and Access Improvement Project with focus on distribution system strengthening, rural electrification and distribution improvement, energy efficiency and renewable energy development etc.
4. Asian Development Bank's (ADB) involvement in the Power Sector Development Program has been consistent with its country partnership strategy for Sri Lanka which focuses on:
  - Funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources,
  - Improving energy efficiency and reliability by strengthening the transmission network,
  - Expanding access to electricity by improving connectivity for the poor, and
  - Mitigating climate change by financing clean energy projects and supporting energy efficiency initiatives.
5. ADB is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement. The specific focus of this assistance is to identify the transmission and distribution projects, which could be funded. The projects identified for the ADB financing are focused on

<sup>33</sup> ADB 2003: *Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines*, Manila.

evacuation projects for renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.

6. Sri Lanka's electricity industry is managed by the Ministry of Power and Energy (MoPE). All electricity utilities remain under direct or indirect state ownership, whereas, there is significant private sector participation in power generation. The following institutions listed in Table 1 are active in the electricity industry. Table 2 lists the regulatory and facilitation agencies in Sri Lanka.

**Table 1: Institutions in the energy supply industry**

Institution	Functions and other information
<b>Government</b>	
Ministry of Power and Energy (MOPE)	Energy policy, project implementation and monitoring, supervision of state-owned electricity utilities.
Ministry of Petroleum and Petroleum Resource Development (MOPPRD)	Petroleum industry project implementation and monitoring, supervision of state-owned petroleum corporation, petroleum resource development and exploration.
<b>Electricity utilities</b>	
Ceylon Electricity Board (CEB)	State-owned corporation, engaged in power generation (one license, 23 power plants), transmission (one license), and distribution (four licenses, about 4.5 million customers).
Lanka Electricity Company (Pvt) Ltd (LECO)	State-owned company, engaged in power distribution (one license, 450,000 customers) along western and southern coastal regions.
<b>Independent Power Producers (IPPs)</b>	
Ten thermal IPPs to grid, two thermal IPPs in Jaffna mini-grid	Each IPP an individual company, eight diesel power plants and two combined cycles on the main grid, two diesel power plants on the Jaffna mini-grid.
About 100 small renewable energy IPPs (also known as Small Power Producers, SPPs)	Each SPP an individual company, small hydro (about 95), rice-husk (2), and waste-heat (1).
About 300 community small hydro-based distribution cooperatives	About 5000 households are served, in total.
About 120,000 solar home systems	Serving an equal number of households.

**Table 2: Regulatory and Facilitation Agencies**

Institution	Functions and other information
Sri Lanka Sustainable Energy Authority (SEA)	Policy, promotion and regulatory functions of (i) renewable energy (ii) energy efficiency, and (iii) energy planning, (iv) energy fund management.
Public Utilities Commission of Sri Lanka (PUCSL)	Infrastructure regulatory commission presently empowered to regulate (i) electricity industry (ii) bunker and lubricating oil industries. In future, Petroleum Industry regulation is likely to be assigned to PUCSL.

7. Ceylon Electricity Board (CEB) is a corporate body established for development and coordination of the generation, transmission, and distribution of electrical energy in Sri Lanka. It holds six separate licenses for these activities. The license for generation division caters for 66% of the power to the grid. The transmission network consists of 55 no. of GSS (132/33 kV, 220/132/33 kV, 220/132 kV and 132/11 kV) and 2,236 km of HV lines (both 220 kV and 132 kV) approximately.

8. The island is divided into four regions for power distribution, supply and sales, where each distribution division holds a license. These distribution licenses cover more than 97% of the geography of Sri Lanka. Lanka Electricity Company Ltd. (LECO), which is a subsidiary of CEB, covers the remaining areas catering to 478,500 customers. Electricity distribution network of CEB consists of MV lines (33 kV and 11 kV), primary substations (33 kV/11 kV), distribution substations (33 kV/400 V & 11 kV/400V), and LV lines (400V).

9. The proposed project will assist GoSL to develop a least-cost project implementation of the following project components: (i) transmission system strengthening to further improve its energy efficiency and enable rural electrification; (ii) distribution system improvement to expand access for the poor and rural household connection; and (iii) solar roof top and renewable energy component. The distribution component will include strengthening of the system in the Central, Eastern, and Northern

Central parts of the country. It will also enable to address post-conflict electricity needs and bring cheaper hydropower to the population in the Northern and Eastern parts of the country from the North, Northern Central, and Central Provinces.

### 1.1 Background

10. The Northern and Eastern Provinces are in urgent need of improving the infrastructure facilities and supporting services, which are prerequisites for accelerated development. The list of potential projects, which could be financed, has been finalized in discussion with CEB and MoPE. The criterion for shortlist of projects has been finalized in consultation with ADB and the benefits from identified projects established based on evacuation of clean energy (Solar, Wind, Small Hydro) and network efficiency improvement (loss reduction, voltage improvement, etc.). The technical feasibility of the shortlisted projects has been evaluated based on CEB's long-term distribution plan as well as additional load flow studies conducted by distribution planning wing. Also, according to SEA's report "Renewable Energy Resource Development Plan 1/2012", a total wind capacity of 1010 MW is likely to be available for grid electricity generation in Sri Lanka by the Year 2020. In order to harness the wind power potential in Mannar and other regions, a Wind Integration Study has been carried out by Grontmij A/S Denmark under World Bank TA. The objective of the study was to analyse the operational implications and cost associated with integrating the maximum prudent level of wind power penetration that the Sri Lankan electricity system can absorb up to year 2020. The final report, prepared in October 2011 recommends maximum prudent level of wind power capacity up to the year 2020 as 643 MW. A detailed review of the distribution sector projects that are currently under implementation as well as those, which have been completed in recent past, has been conducted by the TA to understand the key issues related to technical, project monitoring, time and cost overruns concerning the implementation of these projects. There are no technical issues concerning the implementation of the projects as CEB has adequate experience in this regard.

11. The main beneficiaries are inhabitants of the area displaced by war and conflict and the nation itself through social and economic development and employment. Social development includes health, education, community development, and empowerment while economic development would be achieved through cottage industries such as carpentry, weaving, garment, poultry and agro-activities such as irrigation, rice milling, grinding and processing the agricultural produce that would be greatly facilitated by electrification.

12. Since the project does not involve activities that have significant adverse impact, initial assessment has been done to determine the extent of impact as per the ADB's Safeguard Policy Statement 2009 guidelines. Accordingly, the environmental classification for the sub-project component is "Category B". The IEE report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>34</sup> and the ADB's Safeguard Policy Statement 2009.

### 1.2 Scope of Work and Methodology Adopted

13. The broad scope of the Environmental Assessment study is:
- i) To conduct field visits to collect data relevant to the study area and also collect secondary data so as to establish the baseline environmental status of the study area;
  - ii) To assess the impacts on environmental attributes due to the location, design, construction and operation of the proposed project;
  - iii) To prepare a mitigation plan outlining the measures for protecting the environment including institutional arrangement and environmental monitoring;
  - iv) To identify critical environmental attributes required to be monitored subsequent to the implementation of the proposed project; and
  - v) To carry out consultation with local people to identify the public perception of the project.
  - vi) To establish the Environment Monitoring Plan for the CEB to submit environmental monitoring reports to ADB at regular intervals.
14. This report is prepared based on survey, field study and with the help of available secondary data. The alignment of line may slightly vary after the exact demarcation of tower location. Accordingly, field

<sup>34</sup> ADB. 2003. Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines. Manila.

surveys were undertaken to assess physical and biological environment. Detailed assessment of the baseline environment has been conducted for distance up to 500 m. on the either side of proposed alignment and data collection from secondary source has been done to support the findings of the field survey. The field studies were supported by data collected from secondary sources such as internet, forest atlas.

15. The IEE report comprises baseline data on existing condition of physical, ecological, economic, and social information, together with the anticipated environmental impacts and proposed mitigation measures. Observations were made through transect walk along the proposed line locations, as well as in and around the proposed gantry locations between 15 March to 10 May 2012. Public consultations were held with the project affected communities, stakeholders, and government officers that relate to existing environmental conditions around the proposed line/ gantry and the potential impacts that could happen due to project implementation. In addition, secondary data was collected from published data from GoSL documents, 2001 population census statistics data, as well as from authorities such as CEB, MoPE and other departments.

### 1.3 Applicable Environmental and other Legislations

16. A large number of recurrent and non-recurrent activities under establishment of distribution lines and gantry switching stations are presently not covered by the National Environmental Act (NEA). Annexure 1 indicates the applicable laws and regulations, which are necessary for the proposed project activities.

## 2 DESCRIPTION OF THE PROJECT

### 2.1 The Project

17. The distribution components of the Clean Energy and Network Efficiency Improvement Project consists of:

#### Component B: Distribution Projects.

- I. Vavyunia-Kebithigollewa 33 kV.
- II. Anuradhapura-Kahatagasdigiliya 33 kV.
- III. Kiribathkumbura-Galaha gantry 33 kV.
- IV. Galmadu Junction-Akkirapaththu-Pothuvil 33 kV.

18. To improve MV network efficiency and provide system capacity to cater for load growth: Construction of these express lines provide virtual power injection points to improve reliability, improve line end voltages, reduce MV losses and increase line capacities, while also improving the system operation flexibility.

#### B-VI. Vavyunia-Kebithigollewa 33 kV.

19. The estimated energy savings per month is 45 MWh with this proposal. Around 18,000 consumers would benefit from this sub-project. The main components of the sub-project are:

##### VI.1 33 kV 23 km distribution line from Vavyunia GSS to Kebithigollewa.

20. The 23 km, 33 kV distribution line traverses through forest reserves, home gardens, paddy fields and also it crosses the Sinnapuluk Kulam and Dutuwewa, dry zone tanks. It runs parallel to the main road from Vauniya to Horowpatana, the nearest point to the road is 400 m. The line crosses Mamaduwa road, about 0.5 km from Vauniya- Horowpatana road, and then it runs parallel to the Vauniya- Horowpatana road up to Kebithigollewa. The line crosses about 4 km long stretch in the Kapundkalipulam Reserve Forest (8,432 ha) and about 6 km through the Padaviya Forest Reserve (48,151 Ha) both of which have degraded forests.

##### VI.2 33/11 kV Kebithigollewa Gantry.

21. The land identified for the construction of Kabithigollawa gantry is a private property and CEB will purchase 250 sq. m. of land. The gantry area has trees, which need to be cut, although it is situated 800 m away from the Padaviya Reserve Forest.

#### B-VII. Anuradhapura-Kahatagasdigiliya 33 kV.

22. The estimated energy saved per month is 23 MWh with this proposal. Around 12,500 consumers would benefit from this sub-project. The main components of the sub-project are:

*VII.1 33 kV 31 km distribution line from New Anuradhapura to Kahatagasdigiliya.*

23. The 31 km, 33 kV distribution line traverses through paddy fields, home gardens, chena lands, scrub jungle and secondary forests, edge and the bund (or dam) of dry zone tank. The line crosses A13 and A9 highway. Mihintale Preservation Area and the Mahakandra Sanctuary are 10 km from the line and no wildlife sanctuary, national parks, or ecologically sensitive areas are present in the nearby area of RoW.

*VII.2 33/11 kV Kahatagasdigiliya Gantry.*

24. The land identified for the construction of the Kahatagasdigiliya gantry on government land, which is part of an old burial ground and situated adjoining the school playground of the Kahatagasdigiliya Muslim Maha Vidyalyaya.

**B-VIII. Kiribathkumbura-Galaha gantry 33 kV.**

25. This proposal is directed at evacuating power generated from 5 MW Mul Oya mini hydropower station (MHP) (SEA's Energy permit EP-310401 dated 05/10/2009) and Environmental Certificate No.: CEA/CPO/NW/P&E/07/29, dated 21st July 2009 now under construction. The commissioning of this MHP will help in further improving the voltage of this gantry. The estimated energy saved per month is 648 MWh. Around 14,000 consumers would benefit from this sub-project. The main components of the sub-project are:

*VIII.1 33 kV 15 km distribution line from Kiribathkumbura GSS to Galaha gantry.*

26. The 15 km, 33 kV distribution line traverses through home gardens, tea plantations, paddy fields, pinus and rubber plantations, and scrublands. The line crosses Mahaweli River, A5 highway and railway line. No wildlife sanctuary, national parks, or ecologically sensitive areas are present in the nearby area of RoW.

*VIII.2 33/11 kV Galaha Gantry.*

27. The proposed location for the Galaha gantry is part of a burial ground in the Palle Deltota GND<sup>35</sup>. The land is vested with Land Reform Commission (LRC) and a request has been made to obtain LRC permission.

**B-IX. Galmadu Junction-Akkaraipatthu-Pothuvil 33 kV.**

28. The estimated total energy saved per month is 1,322 MWh with this proposal. Around 81,747 consumers would benefit from this sub-project. The main components of the sub-project are:

*IX.1 33 kV 18 km distribution line from Galmadu Junction to Akkaraipatthu.*

29. The 18 km, 33 kV distribution line from Galmadu junction to Akkaraipatthu gantry traverses through densely populated area, home gardens, paddy fields, and degraded lands. The line crosses A25 highway and passes the populated Waripathanchenai village. No wildlife sanctuary, national parks, or ecologically sensitive areas are present in the RoW.

*IX.2 33/11 kV Akkaraipatthu Gantry.*

30. The identified location for the Akkaraipatthu gantry (approx. 250 sq.m) is situated on government land at the 2<sup>nd</sup> Mile Post along Akkaripattu-Ampara road and is in the middle of paddy fields extending to more than 100 ha. Budhangala sanctuary (425.84 Ha) is 5 km away from the gantry location.

*IX.3 33 kV 42 km distribution line from Akkaraipatthu to Pothuvil.*

31. The 42 km, 33 kV distribution line from Akkaraipatthu to Pothuvil gantry traverses through paddy fields, home gardens, edge of tanks (Komari and Paladi), scrublands, and degraded lands. The distribution line is 2.5 km away from Panama Forest Reserve (38,119.49 Ha), and 1 km from Sagamam tank sanctuary (616 ha). The line runs parallel to the A4 highway but does not cross any lagoons.

*IX.4 33/11 kV Pothuvil Gantry.*

32. The identified location for the Pothuvil gantry (approx. 250 sq.m.) is a marshy land belonging to the

<sup>35</sup> GND is the lowest level of central government administration, in which the administration is headed by a *Gramaseva Nildari*. A GND normally consists of a town and/or several villages, although rarely a GND can comprise a single village or town. Each divisional secretary area comprises a number of GNDs (typically around a hundred), and the divisional secretary is normally the main decision-maker, implementing central government policy.



Land Reform Commission (LRC). It is situated adjoining the Pothuvil-Monargala road and is near to the Fertiliser warehouse. The gantry location is about 13 km from Lahugala- Kitulana National Park (1,554 ha) and the Kumbukkan Forest Reserve (26,322 Ha) is 10 km away from the gantry location.

## 2.2 Type of Project

33. The project implementation will lead to development of distribution projects, which involve distribution of power from clean energy sources and overall network efficiency improvement. CEB's distribution planning wing has identified a list of projects, based on the Long term Distribution Development Plan, which are critical for the overall development of the power system. Considering the requirements of Sri Lanka's power system with medium to long term, the prioritization of projects for the proposed loan has been undertaken based on following principles for sequence of preference criteria for distribution projects:

- a Medium Voltage network loss reduction and voltage improvement projects.
- b 33 kV distribution express feeders.
- c 33 kV distribution network strengthening for voltage improvement

## 2.3 Justification for the Project

### Vavyunia - Kebithigollewa

34. Load growth in the North Central Province (NCP) is forecasted at an average 7% over ten year planning period. Electrification ratio (2010) for NCP is 82% and energy losses in the MV system are 1.7%. MV tail end line voltage before and after implementing this proposal is 88.3% and 95.2% respectively.

### Anuradhapura-Kahatagasdigiliya

35. Load growth in the North Central Province (NCP) is forecasted at an average 7% over ten year planning period. Electrification ratio (2010) for NCP is 82% and energy losses in the MV system are 1.7%. MV tail end line voltage before and after implementing this proposal is 93.8% and 97.2% respectively.

### Kiribathkumbura - Galaha

36. Load growth in the Central Province (CP) is forecasted at an average 6% over ten year planning period. Electrification ratio (2010) for CP is 91% and energy losses in the MV system are 2.4%. MV tail end line voltage before and after implementing this proposal is 80.2% and 94.6% respectively. This proposal is directed at evacuating power generated from Mul Oya mini hydro power station (5 MW) now under construction. The commissioning of this station will also help in further improving the voltage of this gantry.

### Galmadu Junction-Akkaraipaththu-Pothuvil

37. Load growth in the Eastern Province (EP) is forecasted at an average 9.5% over ten year planning period. Electrification ratio (2010) for EP is 71% and energy losses in the MV system are 4.2%. MV tail end line voltage before and after implementing this proposal Akkaraipaththu is 89.7% and 96.3% respectively. For the Akkaraipaththu/ Pothuvil line section, MV tail end line voltage before and after implementing this proposal, Akkaraipaththu is 74.6% and 92.5% respectively.

## 2.4 Location

38. The proposed sub-projects are located in different area of the country including Northern, Northern Central, Central, and Eastern provinces. Table 3 indicates details of the proposed sub-project locations and Table 4 gives the Land ownership details for gantry based switching stations.

**Table 3: Different Locations of Proposed Subprojects.**

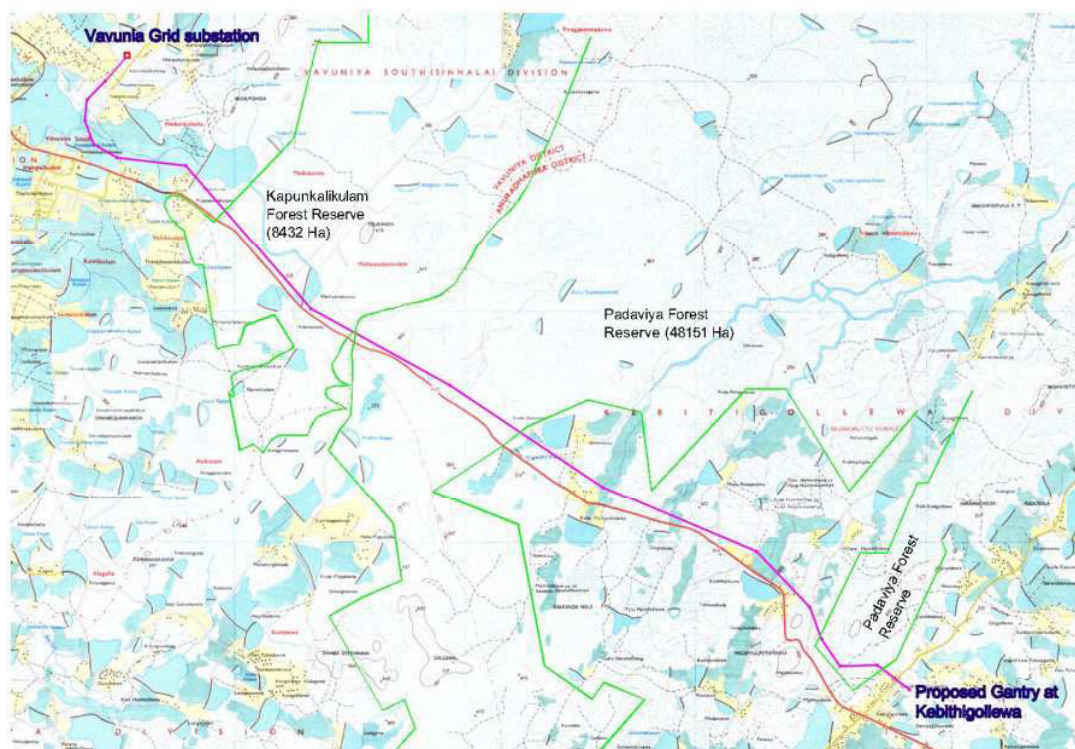
Sub-project	DS division	District	Province
Vavyunia - Kebithigollewa	Vavuniya South (Sinhala)	Vavuniya, Anuradhapura	Northern, Northern Central
Anuradhapura-Kahatagasdigiliya	New Town, Mihintale, Kahatagasdigiliya	Anuradhapura	Northern Central
Kiribathkumbura - Galaha	Kandy & Four Gravets Gangawata	Kandy	Central
Galmadu Junction-Akkaraipaththu-Pothuvil	Akkaraipaththu, Thirukkivil, Pothuvui Panama Pattu	Ampara	Eastern

**Table 4: Ownership Details Gantry based Switching stations.**

Sub-project	Gantry Name	Area	Ownership
Vavyunia - Kebithigollewa	Kebithigollewa	250 sq.m	Private land
Anuradhapura-Kahatagasdigiya	Kahatagadigiliya	250 sq.m	Government land- (with Divisional Secretary)
Kiribathkumbura - Galaha	Galaha	250 sq.m	Government Land (with Land Reform Commission)
Galmadu Junction-Akkaraipaththu-Pothuvil	Akkaraipaththu Pothuvil	250 sq.m	Government land (with Divisional Secretary) Government Land (with Land Reform Commission)

39. Figures 1 provides general location map for all projects proposed under the loan. Figures 2-5 provides topographical maps (1:50,000 scale) which show the proposed distribution line routes for i). Vavyunia-Kebithigollewa, ii). Anuradhapura-Kahatagasdigiya, iii). Kiribathkumbura-Galaha, and iv). Galmadu Junction-Akkaraipaththu-Pothuvil.

**Figure 1: Map of Sri Lanka showing details of proposed Distribution projects (refer Section 3.2 of main report)**



**Figure 2: Vavyunia – Kebithigollewa**



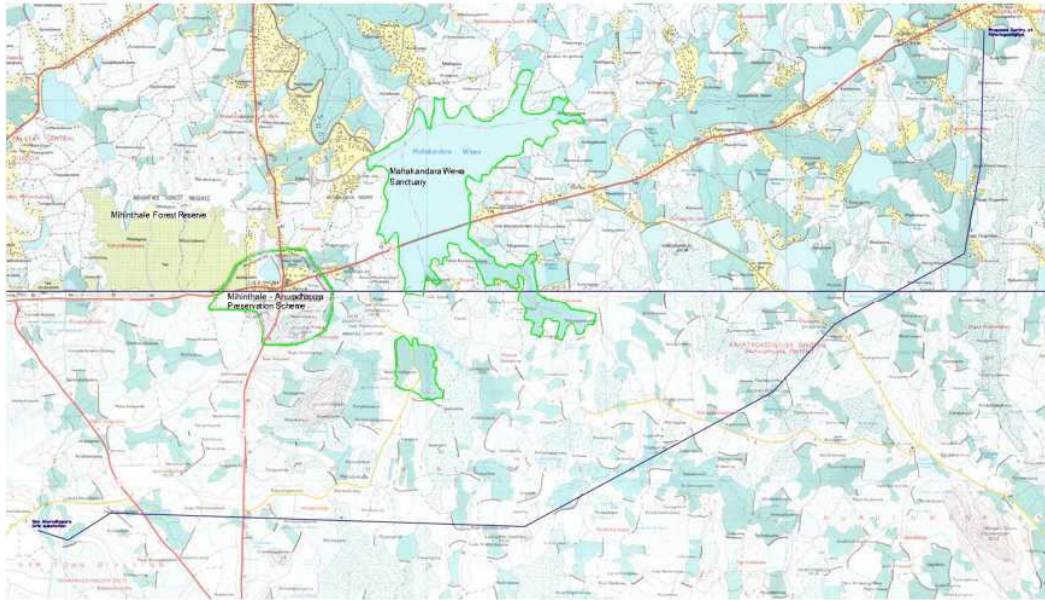


Figure 3: Anuradhapura-Kahatagasdigiliya

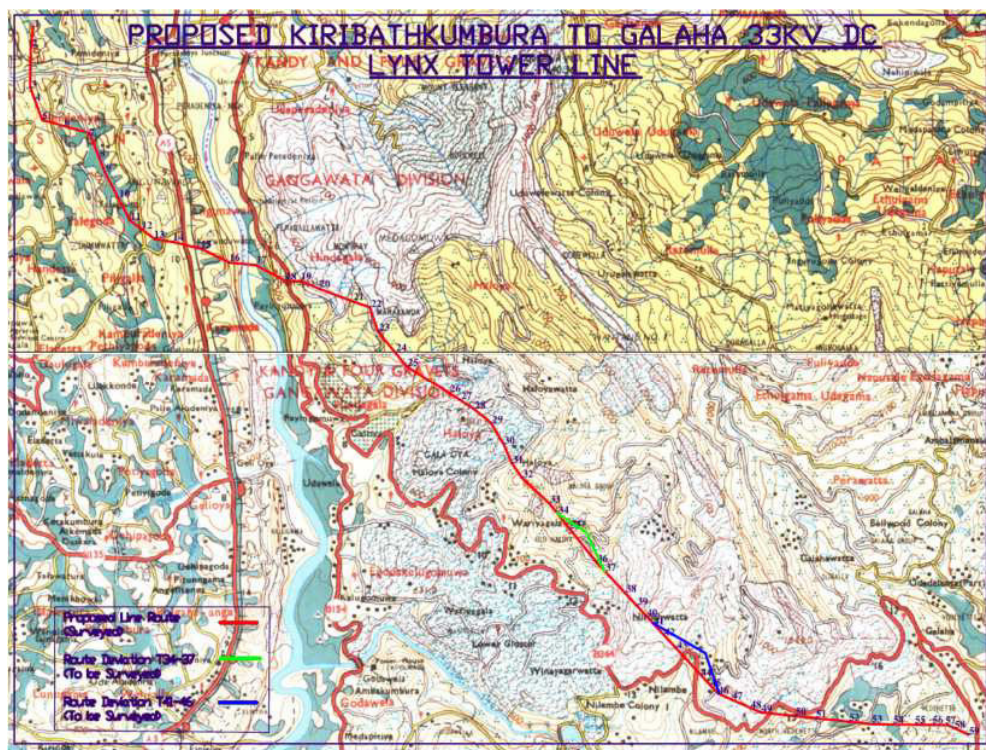


Figure 4: Kiribathkumbura - Galaha



Figure 5: Galmadu Junction-Akkaraipaththu-Pothuvil

## 2.5 Size and the Magnitude of the Operation

### B-VI. Vavyunia-Kebithigollewa (33 kV).

VI.1 33 kV 23 km distribution line from Vavyunia GSS to Kebithigollewa.

- Approximately the line has 100 nos. lattice towers<sup>36</sup>.
- The conductors shall be single Lynx per phase, double circuit line

VI.2 33/11 kV Kebithigollewa Gantry.

- Gantry shall require an area of about 250 sq. m. It has 2 nos., incoming lines and 4 nos. outgoing lines.
- At the gantry, incoming lines shall be with load break switches and the outgoing lines shall be with auto-reclosures.

### B-VII. Anuradhapura-Kahatagasdigiliya 33 kV.

VII.1 33 kV 31 km distribution line from New Anuradhapura to Kahatagasdigiliya.

- Approximately the line has 150 nos. lattice towers<sup>37</sup>.
- The conductors shall be single Lynx per phase double circuit line.

VII.2 33/11 kV Kahatagasdigiliya Gantry.

- Gantry shall require an area of about 250 sq. m. It has 2 nos., incoming lines and 4 nos. outgoing lines.
- At the gantry, incoming lines shall be with load break switches and the outgoing lines shall be with auto-reclosures.

### B-VIII. Kiribathkumbura-Galaha gantry 33 kV.

VIII.1 33 kV 15 km distribution line from Kiribathkumbura GSS to Galaha gantry.

- Approximately the line has 75 nos. lattice towers<sup>38</sup>).
- The conductors shall be single Lynx per phase double circuit line.

VIII.2 33/11 kV Galaha Gantry.

- Gantry shall require an area of about 250 sq. m. It has 2 nos., incoming lines and 6 nos. outgoing lines.
- At the gantry, incoming lines shall be with load break switches and the outgoing lines shall be with auto-reclosures.

### B-IX. Galmadu Junction-Akkaraipaththu-Pothuvil 33 kV.

IX.1 33 kV 18 km distribution line from Galmadu Junction to Akkaraipaththu.

- Approximately the line has 90 Nos. lattice towers<sup>39</sup>.
- The conductors shall be single Lynx per phase double circuit line.

IX.2 33/11 kV Akkaraipaththu Gantry.

- Gantry shall require an area of about 250 sq. m. It has 2 nos., incoming lines and 4 nos. outgoing lines.
- At the gantry, incoming lines shall be with load break switches and the outgoing lines shall be with auto-reclosures.

IX.3 33 kV 42 km distribution line from Akkaraipaththu to Pothuvil.

- Approximately the line has 135 nos. lattice towers<sup>40</sup>.
- The conductors shall be single Lynx per phase double circuit line

IX.4 33/11 kV Pothuvil Gantry.

- Gantry shall require an area of about 250 sq. m. It has 2 nos, incoming lines and 4 nos. outgoing lines<sup>41</sup>.
- At the gantry, incoming lines shall be with load break switches and the outgoing lines shall be with auto-

<sup>36</sup> Calculated on basis of @5 towers per km line).

<sup>37</sup> Calculated on basis of @5 towers per km line).

<sup>38</sup> Calculated on basis of @5 towers per km line).

<sup>39</sup> Calculated on basis of @5 towers per km line).

<sup>40</sup> Calculated on basis of @5 towers per km line).

<sup>41</sup> Calculated on basis of @5 towers per km line).



reclosures.

## 2.6 Implementation Plan

40. The proposed overall project implementation schedule is attached in Table 5.

**Table 5: Overall Project Implementation Schedule (Refer Figure 2: Implementation Schedule)**

## 3 DESCRIPTION OF ENVIRONMENT

### 3.1 Ampara District

#### Physical Resources

##### Topography, Geology and Soil

41. Land area distributed in the Ampara district is located within the first peneplane of the country (0-125 m above the mean sea level). The topography of the district is flat and slightly undulating. Geologically this area falls within the biotite gneiss, hornblende, magnetic and granitic in some parts during the precambrian era. In some areas of the Ampara district, granitic gneiss are present. The geology in the area belongs to vijayan complex. According to the agricultural soil classification, the soil types in area falls into the category of rock knob plain, non-calcic brown soils and low humic gley soils in the undulating terrain. The soil types present in the undulating terrain are reddish brown earths, non calcic brown soils and low humic gley soils in the area of akkareipattu, which is flat terrain, consists of solodized solonchaks and solonchaks.

##### Climate

42. The project-affected area is located within the dry zone of Sri Lanka. The mean annual temperature of the district is 25.0° - 27.5° C. The highest temperature recorded in the area is during April to October. During November to January, the mean monthly rainfall is 600 - 400 mm, during February to March - 200 mm, and during April - September - 100 mm. There are two dry periods in Ampara area from May to October and from mid-January to March. The North East monsoon lasts from November to the end of December.

##### Water Resources

43. In Gal Oya area, alluvial aquifer regions are available and most of the other areas of Ampara district are covered by shallow regolith aquifer region. The coastal area of the Ampara consists of coastal sand aquifer region. Gal Oya is the largest river in Ampara district. It flows from the south central hills of the country and passes through the dry eastern sector of the island to enter the Indian Ocean close to Kali Odai in Oluvil Village. The Gal-Oya River has a watershed size of approximately 500 km<sup>2</sup>. It was the first multi-purpose irrigation scheme started in post independent Sri Lanka. A dam across the river at Inginiyagala has created a reservoir called "Senanayake Samudraya." The reservoir has a capacity of 770,000 acre feet of water and feeds a large number of perennial and seasonal tanks in the northern part of the district. It has resulted in new settlements being established in a once dry forestland and with that a new administration for the district. The paddy lands that were cultivated only once per year can now be cultivated twice. The yearly flood in the coastal areas has been reduced with the additional water retention capacity. Gal Oya being a multi-purpose project not only provides hydro power, but also has made possible the commencement of sugar, tile production, rice milling, and various other industries. The other water reservoirs are Pannelagama, Ambanoya, Sangaman Kulam and Arakkaman kulam.

##### Air Quality

44. Most of the area in Ampara district is not affected by pollution of air due to lack of vehicular transport and industrial activities, but during the dry season, dust emission is relatively high. However, the studies or past literature about the quality of air within Ampara is lacking.

##### Ecological Resources

45. Ampara district consists of lesser extent of tropical thorn forests and degraded forests with moist monsoon forests. In addition, Yala East National Park, Ampara Sanctuary, Gal Oya National Park, Maduru Oya, Sellaka Oya Sanctuary, Lahugala - Kithulana National Park and Sagamam Forest Reserve are the main important biodiversity hotspots in the Ampara district.

46. Yala East National Park lies on the south - east coast in Eastern Province, 12 km south of Arugam Bay, and is accessible from the Wellawaya - Pottuvil road. The main feature is the world famous Kumana mangrove swamp, which is surrounded by plains and jungle. Numerous, rocky outcrops break the flat terrain of the coast. There are large saline lagoons along the coast, often surrounded by extensive plains. Its altitude ranges from sea level to 90 m height rocky outcrops. Total area of the Yala East NP is 18,149 ha, with 265.3 ha in block II and 17,863.4 ha in block I. The vegetation of this National Park comprises semi-arid thorn scrub with large areas of dense forest. Important species of tree are palu, weera, mayila, ehala, satin, and malithan. Around the marshy swamps kirala and hambu are prominent. Generally, fauna is similar to that is found in dry zone forests and this is very famous for avifauna due to the presence of large number of migratory and residential bird species. Common birds include pelican, painted stork, spoon bill, white ibis, open billed stork, purple heron, grey heron, pond heron, all species of egrets, which are in Sri Lanka, night heron, Indian darter, and different cormorant species, water cock, moorhen, purple coot, and pheasant tailed jacana. Black winged stilt, whistling teal and little grebe are also present in this area. Rare species such as Black necked stork can be seen in this area. Arugam Bay is ecologically and aesthetically important site located on the Indian Ocean in southeast coast of Sri Lanka. It is a popular surfing and tourist destination. The bay hosts a large fleet of fishing boats, which operate off the beach. The bridge is located at Arugam Bay is very famous landmark in the area, which links Arugam Bay with Pottuvil town famous for excellent elephant viewing. The sandy beach area of Arugam Bay provides nesting habitat for the sea turtle. Five species of turtles including Green turtle (*Chelonia mydas*), Hawksbill turtle (*Eretmochelys imbricate*), Loggerhead turtle (*Caretta caretta*), Leatherback turtle (*Dermochelys coriacea*) and Olive Ridley turtle (*Lepidochelys olivacea*) annually reach this coastal area for laying eggs. Arugam Bay lagoon is also very important habitat for water birds. Large numbers of residential and migratory birds are distributed in and around the lagoon.

47. Lahugala Kithulana National Park is in the basin of the Heda Oya, 16 km inland from the coastal town of Pottuvil in Eastern Province. The Pottuvil Moneragala trunk road runs through the South Eastern sector of the park. The terrain is flat with occasional rock outcrops. The park features three tanks, Lahugala (243ha), Kithulana and Sengamuwa, which ultimately drain into the Heda Oya. These tanks are largely silted up and support an abundance of Beru grass. The area of the park is 1554 ha. Vegetation surrounding the tanks is dry mixed evergreen forests with scrubs. Common species include weera, palu, halmilla, milla satin and ehala. Beru a tall reedy grass covers the tanks. Rivers are fringed by gallery forest. Lahugala is traditionally used as a feeding ground by elephants. Herds of up to 150, attracted by the beru grass was common sight at Lahugala tank during the period of July to August. Other mammals include endemic toque macaque, common langur, sloth bear, and jackal, rusty spotted cat, fishing cat, leopard, and wild boar, Indian muntjac, spotted deer, sambar, Pangolin, and black napped hare. The avifauna is diverse and includes a variety of waterfowl and the usual dry zone forest birds. Wetland species include pelican, purple heron, painted stork, teals, white bellied sea eagle, grey-headed fishing eagle, common kingfisher, stork billed kingfisher and white breasted kingfisher. The last recorded sighting of comb duck now thought to be an extinct species in Sri Lanka, was found at Lahugala. Other birds include the rare red-faced malkoha and the endemic Sri Lanka spurfowl. Amphibians include frogs such as the endemic *Bufo athukoralei*, *Rana limnocharis*, *Rhacophorus maculate*, *Kaloula pulchra* and *Micropyla rubra*. Noteworthy reptiles include python, rat snake, flying snake, cat snakes, whip snakes, and Russell's viper. Seruwila-Allai Sanctuary is another important marine protected area that is located in Ampara district. Literature about this place is very limited. The Kudumbigala Sanctuary 10 km south of Arugam bay is a large rock complex of ridges and huge granite boulders.

48. Though some project activities are located in environmental sensitive areas such as forest reserves, wild life parks, man and biosphere reserves, and plantation forests, none of the proposed project activities will affect existing biodiversity. None of the rare, endemic endangered and threatened species of flora and fauna will be affected by the project implementation.

### Economic Development

49. Rural poverty prevailing in Ampara district is mainly due to low land productivity. The causes for this low productivity are; the low rainfall and the poor support service extended to the farmers. Poor performance and the non-completion of irrigation infrastructure is another major factor that is contributing to the poverty situation in the district. Main mineral resources available in the area are clay and mineral

sands in coastal areas. Clay is mainly used for production of bricks, tile and ceramics. Paddy is the prominent cultivation in the Ampara district while the home gardens and chena cultivation giving the substantial level of extra income to the general public in the area.

#### Land Use and the Agriculture

50. The total area of the district is 4,415 km<sup>2</sup>. Of these 4,222 km<sup>2</sup> comprises of terrestrial lands and rest 193 km<sup>2</sup> covers by inland waters. In Ampara district, the biggest tank is the Senanayake Samudraya. It has a capacity of 770,000 acre-feet of water. It provides irrigation facilities to more than 38,000 ha of paddy lands. Its main channel network system is about 35 km long and conveys about 100 m<sup>3</sup> of water per second to the system. Historically, rice farming has been the main economic crop in the Ampara district. Over sixty percent of the population is dependent on rice cultivation or its related industries. The high incidence of rural poverty in Ampara district is associated with poor land productivity due to low rainfall, weak agricultural support services, and poorly performing irrigation infrastructure. In the Navithanveli D.S., the production in 2005 from the Yala season was 14,000 MT while the Maha season level of production was 104,000 MT. Many of the lands in this division do not have functioning irrigation schemes at the lower left bank of the Gal Oya system. The total paddy cultivated area during 2004/ 2005 within Ampara district is 75,071 ha. In addition to the paddy, coconut, minor crops such as banana, maize and some other home garden species are also cultivated in Ampara area. The total coconut cultivated land area of the Ampara district is 5,087 ha in year 2005.

#### Social and Cultural Development

##### Population and Community

51. Altogether, 19 DS divisions are located within the Ampara district of the Eastern Province. A total population of 592,997 is distributed within the 19 DS divisions representing all ethnic and religious groups in the country. Since proposed project activities distribute in all DS divisions of the Ampara district, mainly rural areas of the district will benefit from the proposed project. From the total population distributed in the district 39.9% is Sinhalese, 18.4% Sri Lankan Tamil, 0.1% Indian Tamil, 41.3% Sri Lankan Moor, 0.2% Burgher, and 0.1% others. Mainly four religious groups represented in the district as follows: 39.7% Buddhist, 16.9% Hindus, 41.3% Muslims and 1.3% Roman Catholics. Majority of the road sections selected for the improvement project is distributed in rural areas of the district. Table 6 indicates population sizes of the project different DS divisions of the Ampara district.

**Table 6: Population sizes of the project affected DS divisions of the district**

	DS Division	Population
1.	Addalachchenai	36,020
2.	Akkaripattu	34,939
3.	Alayadiwembu	22,627
4.	Amapara	38,166
5.	Damana	35,343
6.	Dehiatakandiya	63,908
7.	Eragama	11,344
8.	Kalmunai	70,465
9.	Karativu	16,365
10.	Lahugala	7,623
11.	Mahaoya	18,123
12.	Navithanveli	17,065
13.	Nnthavur	24,625
14.	Padiyathalawa	15,971
15.	Pothuvil	28,480
16.	Sainthamarathu	51,510
17.	Thirukkivil	23,700
19.	Uhana	52,609
	<b>Total</b>	<b>592,997</b>

#### Health and Educational Facilities

52. A total of 54 hospitals are distributed in different locations of the Ampara district. These include a single provincial general hospital at Ampara, single base hospital type A, at Kalmunai, 04 base hospitals type B at Dehiattakandiya, Potuvil, Mahaoya and Akkaraipattu. In addition, 8 district hospitals, 4 peripheral

units, 4 rural hospitals, 6 central dispensaries and maternity homes and 26 central dispensaries are also located within the district.

53. Altogether 402 schools including 388 government schools and a single special education unit are distributed in Ampara district. The literacy rate of the district is 85.9%. The educational level of the people within the district is shown in Table 7.

**Table 7: Educational Level of the People Distributed within the Ampara district.**

No schooling	Attending grade 1	Passed grade 1-5	Passed grade 6-10	Passed GCE(O/L)NCGE/SSC	Passed GCE(A/L) HNCE/HSC	Degree and above	Not stated
9.7	1.6	29.4	35.7	13.8	6.7	0.5	2.5

### **Sites of Cultural, Archaeological and Historical Significance**

54. Archaeological Department has identified several ancient Buddhist shrines and archaeological sites in Ampara district. Moodu Maha Viharaya is located on the seashore, near Pottuvil. Much of the remains at this site appears to be covered by sea sand. Pudukunava located at the boundary of the Galoya scheme on the Ampara-Mahiyangana road is on a large forested hill. On the southern scrap of the hill are a large number of drip ledged caves. In many of these caves are pre-Christian inscriptions. Samangala is located about five miles to the West of the Kohombana junction on the Ampara-Gonagala road. On a high boulder close to an ancient cave is incised the representation of a dagoba similar to the stupas at Sanchi.

55. Dighavapi, is another important archaeological, historical and religious site located in Ampara district. A total of 35 archaeological sites are distributed within Dighavapi complex. The archaeological area is a mere 42 square kilometres in extent. The area declared under the Archaeological Department is only four hundred yards in radius of each site leaving the other areas unprotected under the Antiquities Ordinance No. 9 of 1940. The Magul Maha Viharaya has been known as the Ruhunu Maha Vihara in ancient times. It was built by King Dhatusena (453-474 A.D.). In an area girt by a prakara of stone slabs are a Bodhigara, an image house, a dagoba and a sabbath house. At Kudumbigala, which is situated on the road from Panama to the Ruhunu National Park, there are a large number of drip ledged caves that bear inscriptions. Thiru Koneshwaram, the "Dakshana Kailash" of the ancients, "The Great Pagoda" or "The Pagoda with a thousand Pillars" of the Portuguese or simply Swami Rock" during the British regime, is the most ancient place of Hindu veneration in Ceylon. It has very interesting history behind it. The Okanda Devale is an ancient Hindu shrine dedicated to the god Skanda-Murukan - the war god most famously worshipped in Sri Lanka at Kattaragama. The shrine is located on a rocky outcrop overlooking the sea. The Okande Devale is an important place of worship for pilgrims undertaking the annual 'padi yatra' from Jaffna all the way along the east coast to Kattaragama.

56. Rataveli Viharaya, the remains of a very ancient dagoba of large dimensions have been found near the 73rd milepost on the Pottuvil-Panama road. At this site are dripledged caves, remains of ancient structures and Buddha statues of stone. The ancient name of the site was Bahogiri Nama Pavata according to an inscription of Mahadathika-Mahanaga (A.D. 7-19). According to the Archaeological Department, the site is Maninaga Pabbata Vihara of the Mahawansa.

## **3.2 Vavuniya district**

### **Physical Resources**

#### **Topography, Geology and Soil**

57. Vavuniya district is located in the southern part of the Northern Province of Sri Lanka covering a land area of 1,966 sq. km. the district is bordered by the Mullaitivu district to the north, north west and north east, Mannar district to the west and Anuradhapura district to the south west, south, south east and east. Mullaitivu district was carved out of the northern part of Vavuniya district in September 1978.

58. The district is divided into four DS Divisions namely, Nedunkerni (formerly Vavuniya North), Vavuniya South (Tamil), Vavuniya South (Sinhala) and Cheddikulam, and further sub-divided into 102 GN Divisions. Vavuniya district has five local authorities, out of which one is an Urban Council and the remaining 4 are Pradeshya Sabhas. The main township in the district is Vavuniya while Cheddikulam, Puliyanakulam, Kanakarayanakulam, Omanthai and Nedunkerni are the medium scale townships located within the district.

59. Physiographically the area covered by Vavuniya district belongs to lowest peneplain of Sri Lanka. The relief of the district varies from 100 – 200 m average mean sea level. Generally, the area comprises of

flat terrain with small-scattered hillocks. The topography becomes more pronounced in south-eastern sector while a flat terrain is identified in rest of the areas within the district. Madukanda, Thammannakanda and Velikanda are the prominent strike ridge structures identified within the south eastern sector, representing higher elevations in the district.

#### **Climate**

60. The district falls within the dry zone of Sri Lanka. The temperature is generally suitable for cultivation. The average temperature is 28.7°C and it is low during the period of October to January. The average rainfall of the district is 1310 mm. From early October to late January is the Maha rainy season and from late April to late May is the Yala rainy season. The soil of the district is highly fertile due to reddish brown earth, low humid clays and alluvial soil. There are concave valleys and bottomlands. Red-yellow latro soils are found in the northern part of the district, and that area is more fertile and has better ground water potential. In the other part of the district, there are hard crystalline rocks with limited ground water potential that determine the substrata.

#### **Water Resources**

61. There are 23 major irrigation schemes and 698 minor schemes. The water resources mainly depend on rainfall, as there are no perennial rivers. Major river systems are absent within the Vavuniya district. However, a number of small to medium scale streams are drained through the district and all of them are seasonal streams, which are active only during NE monsoonal rainy periods. Kanakarayan Aru, Chamali Aru, Kiul Aru, Chamalankulam Aru, Per Aru, Kal Aru and parts of Malwathu Oya are the main river systems draining within the district. These river systems show a remarkable variability in discharge during dry and wet seasons.

62. Out of the 698 minor irrigation schemes, 52 are abandoned. Under the World Bank funded project (NEIAP), it is proposed to improve 100 minor schemes and 28 were completed up to the end of year 2002.

#### **Ecological resources**

63. Out of the total land area of the district, more than 45% is covered with forest, which is 889 sq. km. The dense forest occupies an area of 83,390 ha whereas open forest occupies an area of 5640 ha. The major forest type found within the district is dry monsoon forest and the vegetation is semi deciduous. At present, large portions of the forest cover in the northern part of the district have been severely affected by the civil war. The aquatic biology in the district is mainly concentrated to the minor, medium and major tanks such as Pavatkulam and Vavunikulam found within the district. The Vavunikulam Sanctuary is an important protected area located in the district.

#### **Economic Development**

64. Agriculture is the main livelihood of the majority of the people. Paddy is the major food crop, which accounts for a total of 21,010 ha. Besides livestock farming (rearing cattle, cow, poultry, duck, pig, goat and sheep), approximately 15,000 households in Vavuniya depend on dairy farming as a source of secondary income. The people in Vavuniya district have been engaged in inland fisheries for a long period of time based on major and medium tanks in the district. There are about 500 active fishermen in 15 villages in the district. The annual fish production is 160 MT. Although, this is not a large sector, it provides a source of income generation and employment for the people in the district. The economy of the district is largely centered on small and medium scale industrial units. There is a state run industrial estate at Poonthoddam, which was established by the Industrial Development Board (IDB) in Sri Lanka. This industrial estate consists of 25 small scale and medium scale factories such as food processing, light metalwork that provide employment for a considerable number of people in the district. One of the major projects under the Uthuru Vasanthaya rehabilitation and development program of the north is “Mankulam Development Project”.

#### **Land Use patterns of Vavuniya district**

65. Recent surveys indicated that 40% of the total land is engaged in agriculture and 45% of the land is forest cover. About 21,000 ha land is used in paddy cultivation of which 10,900 ha is irrigated by minor irrigation schemes. In addition to this, there are about 10,000 ha under perennial and other crops. Cultivation of other field crops livestock farming, forestry and inland fisheries are the main components. 26,274 farm families are engaged in agricultural related activities. An aquaculture extension centre was established in 1998 in the Kachcheri premises by the Ministry of Fisheries and Aquatic Resources Development.



### Population

66. The district had a population of 95,425 as per 1981 census of population. No census was taken during 1991 due to unsettled condition. In 2001 census district had a population of 143,940 but this census was not held in the Vavuniya North D.S. division and part of Vavuniya DS division. The whole district had an estimated population of 144,220 as at 31.12.2002. Density of the population including displaced population is 73 people per sq.km. high density population is 163 people per sq. km in Vavuniya.

### Health and Educational Facilities

67. There are about 21 western medicinal hospitals and 20 ayurvedic medicinal hospitals available in the district. Out of the western hospitals, one government hospital (GH), five central dispensaries and maternity homes (CD& MH), one district hospital (DH) and one peripheral unit (pu) is located in the district. Apart from that, there is one chest and sexually transmitted disease (STD)/AIDS clinic. The General Hospital in Vavuniya district acts provided secondary health care services to people in many districts of Vanni region. Ground water is the most common source of drinking water in Vavuniya district despite the fact that the water available is hard water. In Vavuniya Medical Officer of Health (MOH) area, in the PHI areas of Nelukulam, Nochchimoddai and Omanthai, safe water was available in less than 10% of households. Since 1981, there was much improvement in the availability of latrines throughout the Vavuniya district. Except for few Public Health Inspector (PHI) areas, generally in Vavuniya and Vavuniya South MOH areas more than 80% of the households have safe latrines. The PHI areas, which have less than 80% households with safe latrines, were Sithamparapuram and Poovrasankulam in Vavuniya MOH area, Madukanthai in Vavuniya South MOH area and both PHI areas in Cheddikulam.

68. There are two education zones in the district, namely Vavuniya North and Vavuniya South with a total of 193 schools. According to the 2005 statistical data, 187 functioning schools with 17 Sinhala medium, 168 Tamil and 2 Tamil and English medium schools were identified in the district. There were about 42,697 pupils and 1,877 teachers in the district. However, at present, only 143 schools are functioning in their original places, leaving 43 schools displaced and 7 schools closed. There are about 900 teachers in the district. Apart from the schools, several higher educational institutes such as Vavuniya Campus of the University of Jaffna, Vavuniya National College of Education and Vavuniya Technical College can be found in the district.

### Archaeological, Cultural and Historical significant sites

69. There are several historically important sites in Vavuniya district which belong to the Pre Christian era up to the 7th Century AD. Vavuniya Madukanda temple and Samanalankulam Pillaiyar temple are the major historically important places in the district. Madukanda village itself has a historic significance because this is one of the places where Hemamali and Dantakumaru stayed with the "Tooth Relic" which was brought from India.

## 3.3 Anuradhapura district

### Physical Resources

#### Topography, Geology and Soil

70. Anuradhapura is one of the ancient capitals of Sri Lanka, famous for its well-preserved ruins of ancient Sri Lankan civilization. The city, now a UNESCO World Heritage Site, lies 205km north of the current capital Colombo in North Central Province, on the banks of the historic Malwathu Oya. It is one of the oldest continuously inhabited cities in the world and one of the eight World Heritage Sites of Sri Lanka. From the 4th century BC, it was the capital of Sri Lanka until the beginning of the 11th century AD. The ancient city, considered sacred to the Buddhist world, is today surrounded by monasteries covering an area of over 40 km<sup>2</sup>.

#### Water Resources

71. The total area of the district is 7,179 km<sup>2</sup>. Of these 6,664 km<sup>2</sup> comprises of terrestrial lands and rest 515 km<sup>2</sup> is covered by inland waters. This 515 km<sup>2</sup> extent of inland waters consist of 2600 small, intermediate and large scale tanks. Considering water resource of district, major resources are Kala Oya, Mee Oya, Yan Oya and Malwathu Oya. In addition to Oyas, 14 large scale tanks, 79 medium scale tanks and 2510 small tanks are located in the district. The soil of the district is highly fertile due to reddish brown earth, low humid clays and alluvial soil.

#### Climate

72. The west part of the district receives very less precipitation (1000 mm-1500mm) than east part of

district (1500mm - 2000mm). Highest precipitation is received in inter monsoon period from October to December. Throughout the year district has high temperature (29°C - 30°C). However, from December to January, temperature goes down to 26°C.

### **Economic Development**

73. For the economic development of the district, there are 55 State financial institutions and 110 private institutions. In the year 2008, 812,554 hectares were cultivated in the Anuradhapura district and the paddy harvest accrued amounted to 12,357 metric tons. 31,092 main irrigation schemes helped in this regard. In addition to paddy cultivation, a land area of 6324 hectares was cultivated with vegetable, additional crops, and pulses. The harvest reaped from these cultivations amounted to 3,513,000 kg. As per the land utilization in the district in the year 2008, 128,719.79 hectares were used for paddy cultivation and 59,084.05 hectares was used for Chena cultivation.

### **Social and Cultural Development**

74. Anuradhapura district is the capital of North Western province, which consists of 22 DS Division, 18 local government authority and 694 Gramaniladari divisions. The population of the Anuradhapura district by 2008 amounted to 886,945. The population density of Anuradhapura district is 100/km<sup>2</sup>. The male population representing 49.04% amounts to 434,936 persons. The female population accounts for 452,009. On a community basis Sinhalese accounts for 808,859 persons. This is 91.20% of the total population of the district. Muslims accounts for 72,289 persons and Tamils accounts for 4,502 persons. A minority of 1,295 persons belong to other religions. In categorizing the population on the basis of religions, 803,459 persons are Buddhists, 72,328 belong to Islam and Hindus and Christians account for 3,844 and 7,128 respectively. 24,592 of the population are employed in various industries. 7,632 persons are employed in 3453 small-scale industries, while 9,710 persons are employed in 53 large-scale industries.

### **Health and Educational Facilities**

75. During the last four years, the health sector received unprecedented boost in the Anuradhapura district. Accordingly one surgery hospital, 3 base hospitals, 4 district hospitals, 7 central hospitals, 24 rural hospitals, 20 clinics, were established in the district. The total number of schools in the district amount to 544, with 9,228 teachers serving in these schools. The student population amounts to 174,359 students.

### **Sites of Cultural, Archaeological and Historical Significance**

76. Sri Maha Bodhi Tree is the oldest historically authenticated tree in the world (2,250 years). The great ancient Sinhalese Buddhist monuments of Anuradhapura are clustered around this Peepal tree (*Ficus religiosa*) called Sri Maha Bodhi, a sampling of the Peepal Tree at Buddha Gaya, Northern India in whose shelter Gautama Buddha attained supreme enlightenment. The sapling was brought to Sri Lanka by Buddhist nun Sanghamitta, the daughter of King Asoka of India in the 3rd Century B.C. To the north of the well-protected and well-adorned tree are three great monasteries: the Mahavihara, the Abhayagiri and the Jetavana.

77. Aukana Buddha, the 13-meter high statue carved out of solid granite, goes back to the 5th century, to the reign of King Dathusena. (about 50 km south of Anuradhapura). The brick enclosure around and above was built recently to protect it from weather. Guard stone at Thuparama, Thuparama Temple Thuparama is considered the oldest dagoba in Sri Lanka and is believed to enshrine the collar bone relic of Lord Buddha. The guard stones like these are generally found in pairs at the entrance to temples, palaces and other revered sites.

78. Isurumuniya temple built in the 3rd century B.C. is noted for its rock carvings. Ruwanveli Seya, regarded as the greatest stupas at Anuradhapura, was raised in 2nd century B.C., a dagoba having the perfect water bubble shape. Abhayagiri is the largest monastery complex in the Anuradhapura kingdom. Founded in the second century BC by king Valagamba (also known as Vattagamini Abhaya) was an international institution by the first century AD. Covering an area of 200 ha., the monastery includes full components of a Buddhist temple as well as other buildings. The stupa at Abhayagiri is 108 m tall and one of the tallest brick buildings of the ancient world.

79. The finest Buddha sculpture in Sri Lanka the Samadhi Statue (3th century AD) is among its many fine stone carvings. Ritigala, a beautifully paved footpath, several elevated platforms, ruins of an old hospital and remains of a terraced pond were unearthed at this 180 BC Buddhist monastery at the foothill of 600 m high Ritigala Rock. Dating back to around 350 B.C., it is one of the oldest historical places mentioned in the ancient chronicles situated about 50 km southeast of Anuradhapura.

### 3.4 Kandy district

#### Physical Resources

##### Topography, Geology and Soil

80. Kandy is a district of the Central Province of Sri Lanka having an area of 1,906.3 km<sup>2</sup>. The district is bounded north by Ukuwela, Raththota, Laggala, Pallegama and Wilgamuwa Divisional secretary divisions of Matale district, East by Mahiyangana Divisional of Badulla district and walarane, Hanguranketha, Kothmale, Nuwara-Eliya and Ambagamuwa Korale Divisional Secretary Divisional of Nuwara-eliya district and west by Aranayake, Bulathkohupitiya, Mawanella and Rambukkana Divisional Secretary Divisional of Kegalle district and Mawathagama and Rideegama Divisional Secretary Divisions in Kurunegala district. It is located North Latitude between 60.56 and 70.29° and East Longitude between 80.25° and 80.0°.

##### Climate

81. Kandy district situated in the central uplands at 100-1600 m height from the sea level. It's eastern side is bounded to Mahaweli River and it is 100 m height from the sea level. General annual rainfall is 1840 mm. General temperature is between 20-22°C and smooth climate can be seen in most parts of the district throughout the year. Generally, temperature of the areas such as Delthota, Pasbage Korale, Ganga Inala Korale, Udadumbare, Panwila shows a low temperature relatively to the other areas of the district but the Minipe area which is located in the dry zone shows a higher temperature.

##### Water Resources

82. The Mahaweli river which flows across the Kandy district and covers 110 km within Kandy district. Two water streams initiate from two places-Hatton Ganga and Kothmale Oya connect together and give birth to Mahaweli ganga and flows down at the Polwathara village at Pasdbage. In addition to that, initiative stream of water of Dedura Oya also begins in the Poojapitiya Divisional Secretariat.

83. Stream of water that flows along the western slope of Yatinuwara and Udunuwara Divisinal Secretariats join with Maoya and increase its water capacity. Knuckles mountain range situated in Udadumbara, Medadumbara, Minipe and Panwila Divisional Secretariats is a unique environmental zone. Main mountain ranges such as Koboneela Gala (1553.87 m height) Dotalugala (1573.96 m height) are situated in the Kandy district. This zone is the main catchment area of the Mahaweli Ganga and Amban Ganga and gets high rainfall. Hantana, Ambuluwawa, Balana range, and Alagalla Mountain are situated in the Kandy district and the district harbours many water falls such as Kadiyanhele, Galaboda.

##### Population

84. There are 20 DS in Kandy district, which comprises 5 Municipal Council and 15 Pradeshiya Sabas. The population according to the 2001 census is 1,279,028 of which 74.1 % are Sinhalese, 13.1 % Sri Lankan Moors, 8.1 % Tamils of Indian origin and 4.1 % Sri Lankan Tamils. 73.3 % of the population is Buddhists, 13.6 % Muslim, 10.5 % Hindu and 2.6 % Christian. Highest population density can be seen in Gagawata koralaya DS (30.46) while lowest population density in Ududumbara DS (0.92).

85. Kandy is a city in the centre of Sri Lanka in the midst of hills in the Kandy plateau, which crosses an area of tropical plantations, mainly tea. It is the capital of the Central Province (which encompasses the districts of Kandy, Matale and Nuwara Eliya) and also of Kandy district. Kandy is the home of "Temple of the Tooth Relic (Sri Dalada Maligawa)", one of the most venerable places for the Buddhist community of Sri Lanka and all around the world. It was declared a world heritage site by UNESCO in 1988.

##### Education

86. Kandy is located in the mountainous and thickly forested hilly region. The city is located in between multiple mountain ranges including the Knuckles mountain range and the Hanthana Mountain Range, giving the city an elevation of 500m above sea level. It lies adjacent to the artificial Kandy Lake and south of Udawatta Kele Sanctuary. Kandy has now grown out to encompass Peradeniya, home to the University of Peradeniya and the Botanical Gardens, Katugastota to the north, and east to Kundasale, Tennekumbura and Gurudeniya.

#### Ecological Resources

##### Natural flora

87. About 41,521 ha, 21% out of the total land area in the Kandy district is covered with forest. Out of this 23,317 hectare is thick forest and the remaining 10,759 hectares is open forest cultivations. Randenigala - Rantambe Sanctuary is a district natural reserve and has high density of endemic plant and animals in Sri Lanka. Hamtana mountain range and Udawatte Kele is situated closely to the Kandy city.

Among them, the Hantana mountain range has been affected by strong environmental threats. Government has gazetted Hantana area as a high security environmental zone in the year 2010.

#### **Fauna**

88. A large number of animal communities live in the forests - elephant, leopard monkey, porcupine monkey, wild boar, koda diviya (a fishing cat), deer, barking deer are prominent. Wild elephants can be seen in the areas such as Udadumbara, Minipe, Randenigala Sanctuary and Udadumbara Meemure area frequently. Leopards in Gampola, Hantana, Pathahewaheta areas, monkeys, porcupine monkey, and wild boars live in each forest areas in the district. Animal species such as spotted deer, sambar and barking deer can be seen in Randenigala sanctuary. In addition, a large number of bird species have been reported.

#### **Socio-Economic**

##### **Health and Educational Facilities**

89. Altogether 298 hospitals which are located in Kandy district facilitated to 3,619,721 outdoor patients and 485,170 indoor patients. These include Kandy, Peradeniya Gampola and Nawalapitiya General Hospitals (teaching), 20 district hospitals, 1 rural hospitals and 26 medical center.

90. There are six educational zones namely Katugasthota, Waththegama, Theldeniya, Kandy, Denuwara and Gampola in Kandy district. Within the district, altogether 638 schools including national schools, private non-fee levying schools and other private schools are distributed. Generally, the education level of the district is considerably high. According to the census of Divisional Education Office 2010, 270,455 pupils of Kandy district studied in national schools (59,526), Grade 1AB schools (47,876), Grade I C schools (93,455), Grade 2 schools (49,786) and Grade 3 schools (21,196).

91. The country's second oldest university, University of Peradeniya is at Peradeniya, and the Open University of Sri Lanka in Kandy. The Sri Lanka Institute of Information Technology has a center in the city. Most of the private sector higher educational institutions also have their branches in Kandy. The Geology Department at the University of Peradeniya in Kandy is the only Earth Science Department in Sri Lanka.

##### **Land Use and the Agriculture**

92. The total area of the district is 194,000 ha. Of these 189,773 ha comprises of terrestrial lands and rest 4,227 km<sup>2</sup> covered by inland waters. According to the census, total extent of cultivated area was 57,462 ha while uncultivated area (95,017 ha) and forest 41,521ha can be seen in Kandy district. Considering land use pattern of the area, home gardens (52,900.11 ha), tea plantation (29,295.39 ha) and paddy land (20,117.48 ha) are the major land use pattern of district. Rubber (2,244.70 ha), coconut (5,891.51 ha) and cinnamon (549.50 ha) are cultivated as commercial level in Kandy. Considering permanent crops and semi-permanent crops cultivated in the district - cinnamon, coffee, cocoa, pepper, nutmeg, cloves, areca nut and cashew are the major income generating crops. Major seasonal crops cultivated in district in 2009/10 Maha and 2010 Yala season are vegetables (1435 ha/1650 ha), manioc (526.9/ 467.6 ha), ginger (334.4/307.2 ha) and maize (237.7/150.0 ha).

##### **Sites of Cultural, Archaeological and Historical Significance**

93. The monumental ensemble of Kandy is an example of construction that associates the Royal Palace and The Temple of the Tooth (Palace of the tooth relic). Originally part of the Royal Palace complex of the Kandyan Kingdom, it is one of the holiest places of worship and pilgrimage for Buddhist around the world. The Palace of the Tooth relic, the palace complex, and the holy city of Kandy are associated with the history of the dissemination of Buddhism. The temple is the product of the last peregrination of the relic of the tooth of Buddha and the testimony of a religion, which continues to be practised today.

94. The Royal Palace of Kandy is the last Royal Palace built in the island. Although only part of the original palace complex remains, the Temple of the Tooth was part of this complex, due to the ancient tradition that stated that the monarch is the protector of the relic. It today houses the National Museum of Kandy, which holds an extensive collection of artefacts from both the Kandy Kingdom and the British colonial rule.

95. The Lankatilaka Temple is considered one of the best-preserved examples of traditional Sinhalese temple architecture. Built on a rock, the temple is reached by a long series of rock cut steps. An arched passage of the image house leads through a Mandapa (hall) into the inner sanctum, which is richly decorated, with beautiful floral designs. The two sidewalls and the ceiling are decorated with paintings. In the inner sanctum is a colossal seated image of the Buddha.

96. The Gadadeniya Temple's design is of south Indian origin with a Devale attached to it, similar in

character to the Natha Devale and the Gedige of Adahana Maluwa. The main shrine room has a seated Buddha statue and the remains of some paintings of the Gampola period. Among other important temples around Kandy are Dodanwela Devale (shrine), Embakke Devale (shrine), Galmaduwa Vihara temple, Handagala Vihara temple, Lankatilaka Vihara, Medawala Vihara and Nalanda Gedige.

97. The Royal Botanical Garden, Peradeniya is situated about 5 km to the west of the city centre at Peradeniya and is visited by 1.2 million people per year. It is the largest botanical garden on the island. The Udawatta Kele (Udawatta Forest) is a protected sanctuary situated in the heart of the city, just north of Temple of the Tooth. Known as "Uda Wasala Watta" in Sinhalese meaning, "the garden situated above the royal palace" it was designated as a forest reserve in 1856, and it became a sanctuary in 1938.

## 4 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

### 4.1 CEB'S Approach for Route Selection

98. At the planning stage itself, one of the factors that govern the establishment of the distribution line is the infringement of populated/forest/cultivated area and scarce land. Wherever such infringements are substantial, different alternative options are to be considered. During route alignment, all possible efforts are made to avoid the populated/forest/cultivated area infringement completely or to keep it to the barest minimum. Whenever it becomes unavoidable due to the geographical locations/terrain, mitigation costs involved towards avoidance needs to be worked out. While identifying the distribution system for a generation project or as a part of distribution grid, preliminary route selection is done by CEB based on the interpretation and walk over surveys according to the 1:50,000 maps/topographical maps of the area.

99. For selection of optimum route, the following points are taken into consideration:

- i. The route of the proposed express lines does not involve any human habitation.
- ii. Any monument of cultural or historical importance is not affected by the route of the distribution line.
- iii. The proposed route of distribution line does not create any threat to the survival of any community with special reference to tribal community.
- iv. The proposed route of distribution line does not affect any public utility services like playgrounds, schools, other establishments etc.
- v. The line route does not pass through any sanctuaries, protected park etc.
- vi. The line route does not infringe with area of natural resources.

### 4.2 Alternatives for Line Alignment

100. The subproject will put up new gantry based switching station using Sulphur Hexa Fluoride (SF<sub>6</sub>) load break switches (if used) on feeders and auxiliary 33/0.4 kV transformer. The work will be carried out by setting up gantry based structures on poles and seek 20m RoW clearances for 33 kV express distribution lines. Apart from putting up gantry poles/lattice structures, there are few other safety and environmental issues associated with gantry switching stations.

101. For selection of optimum route, the following points are taken into consideration:

- i. As a principle, distribution alignments generally pass through major towns but whenever possible, to account for future urban expansion, the minimum RoW distance (total 20 m for 33 kV lines as per CEB norms) shall be kept 10 m away from any houses or structures.
- ii. Construction activities do not adversely affect the population living near the proposed lines and does not create any threat to the survival of any community with special reference to tribal community or any public utility services like playgrounds, schools, other establishments etc.
- iii. Similarly, plantations/forests are avoided to the maximum extent possible. When it is not possible, a route is selected in consultation with the Divisional Secretaries that causes minimum damage to existing plantation/forest resources.
- iv. The MV/LV line route does not infringe with area of natural resources. Alignments are selected to avoid wetlands and unstable areas for both financial and environmental reasons.
- v. The route of the MV/LV line does not affect any monument of cultural or historical importance.
- vi. Ensure that Polychlorinated Biphenyls (PCBs) are not used in the transformers installed in the project funded facilities.
- vii. In addition, care is also taken to avoid/minimise protected parks/national parks, bird sanctuaries and any other forest area rich in wild life. Proper care shall be taken to avoid areas of high density



of trees if the line passes through any forest reserve and appropriate approvals of Department of Forests and Department of Wildlife, Sri Lanka.

102. In order to achieve this, CEB has undertaken route selection for individual gantry based switching stations/33 kV lines in close consultation with representatives from Divisional Secretaries, Ministry of Land, Agrarian service Department, Department of Survey, Forest Department, and the local community. Although under the national law, CEB has the Right of Way (RoW), yet it considers alternative alignments during site selection, with minor alterations often added to avoid environmentally sensitive areas and settlements at the implementation stage.

103. Keeping above in mind, various alignments of lines were considered taking care of above factors. All such different alternatives were studied by the CEB officials before being proposed to ADB for funding to arrive at most optimum route which can be taken up for detailed survey and assessment of environmental and social impacts for their proper management. Annexure 2 gives the location analysis for the gantry, Annexure 3 gives an illustrative evaluation analysis of the alignments of 33 kV line. Annexure 4 gives the inventorization along the proposed 33 kV express lines. Table 8 gives the summary of the final evaluation of the site selection.

**Table 8: Summary of final alternative taken for Project Consideration**

SNo	Project Component	Alternative Chosen	Reason
<b>B-VI</b>	<b>Vavuniya-Kebithigollewa</b>		
B.VI.1	Vavuniya GSS to Kebithigollewa (23 km)	Parallel to Vaunia Horowapatana road.	Least distance covered in forest reserves. Forest is degraded.
B. VI.2	Kebithigollewa Gantry	Outside the school boundary.	800 m away from forest reserve.
<b>B-VII.</b>	<b>Anuradhapura-Kahatagasdigiliya</b>		
B.VII.1	New Anuradhapura to Kahatagasdigiliya (31 km)	Alternative which is 10 km away from the Mahakandra Sanctuary.	Avoids all sanctuaries and preservation areas.
B.VII.2	Kahatagasdigiliya Gantry	Gantry in the corner of old burial ground.	Away from the school boundary.
<b>B-VIII.</b>	<b>Kiribathkumbura-Galaha</b>		
B.VIII.1	Kiribathkumbura GSS to Galaha (15 km)	Alternative that avoids crossing of roads	Sides too steep and avoidance of tea gardens.
B.VIII.2	Galaha Gantry	Alternative location is in corner of burial ground.	No building in RoW or private land used.
<b>B-IX.</b>	<b>Galmadu Junction- Akkaraipatthu- Pothuvil</b>		
B.IX.1	Gantry Junction to Akkaraipatthu (18 km)	Near the Waripathanchenai village avoiding houses	The school playground avoided and least populated area used. Mostly paddy fields.
B.IX.2	Akkaraipatthu Gantry	2nd Mile Post along Akkaripattu-Ampara road	No land issues.
B.IX.3	Akkaraipatthu to Pothuvil (42 km)	No population along the alignment.	Away from all forest areas.
B.IX.4	Pothuvil Gantry	No land issues.	No land issues.

### Reasons for the final selection

104. Considering the various reasons based on information in the Annexures 2, 3, and 4, the alignments selected were found to be most suitable as they involved lesser populated area, plantation/forest areas, and minimum RoW problems. In addition, a minimum disturbance to the reserve forests has been caused as the route of the line shall be utilised which has more degraded forests.

### 4.3 Environment Impacts and Mitigation Measures

105. The potential environmental impacts associated with the subprojects occur during the pre-construction, construction, and operation phases, which will typically involve:

- Removal of vegetation, including trees and crops for access roads.
- Excavation of sites for project facilities (if at all), including transport and disposal of excavated materials, erosion at construction sites, possible noise/dust pollution, and management of workers and waste.
- Trenching activities breaking underground cables.
- Impacts of Polychlorinated Biphenyls (PCB)<sup>42</sup> during transformer replacement process, and improper disposal of

<sup>42</sup>Polychlorinated Biphenyls (PCB) are mixtures of man-made chemicals and due to their non-flammability, chemical stability and high boiling point have been used extensively as insulators. PCB's are highly stable, toxic and persistent chemicals. Their manufacture, processing and use has now been banned in many countries. (USEPA web page on PCBs).

transformer containing PCB.

- Spills of fuel and other lubricants at the construction site/workshop/repair site that may affect soils and water quality.
- Noise from construction equipment.
- Preservation of cultural sites and artefacts.

### **Environmental Impacts and Mitigation Measures Needed during the Design/Pre-Construction Phase**

#### **Route Selection**

106. As per the Forest Conservation Act, all the power lines infringing upon the ecologically sensitive areas have to be approved by the CEA. Approval from CEA had to be obtained well in advance for all the subprojects that infringed on forestlands. Forests were avoided as far as possible while selecting the distribution line route. Where it was not possible to avoid forests, the routing of the lines in the forest area was done in consultation with respective forest authorities to minimise damage to the forests and to ensure minimal impact on wildlife.

107. The natural terrestrial environment of the proposed project areas in Anuradhapura, Vavuniya, Kandy, and Ampara has already been significantly altered and disturbed by mankind for conversion into paddy fields, tea, rubber and other mixed cultivations, villages, semi-urban areas with infrastructure facilities such as roads, drains, homes and buildings etc. under various development projects. Therefore, besides cutting of plantation trees, tea and home gardens, the subproject should not cause any significant impacts to the existing environment nor affect any environmentally significant areas.

108. The overhead conductor must not affect any of the sewerage/drainage system, as well as no streams are disturbed. Apart from limited disturbance during construction, there should be no long-term effects on water quality.

109. Care must be taken that line routes must avoid wetlands and unstable areas especially in Ampara district as the line is near the coastal area. The routing of the lines is selected to avoid relocation of people and threats to common property resources. Engineering and biological measures must be taken to prevent soil erosion, impact on agricultural land en-route the line must only be restricted to the construction phase, and adequate compensation as determined by the district authorities must be paid to the affected persons.

110. The transformers and other equipment used in the project must be free from poly-chlorinated biphenyl (PCB). Production of PCBs has now been banned in most countries and it will be phased-out in 2025, therefore equipment (transformers), if procured under the loan should not contain PCBs. Procurement of new transformers will specify that PCB should not be used and only non-PCB coolant such as hydrocarbon mineral oil will be used. At any stage, during transformer replacement process, if presence of PCB in the existing transformers is confirmed, Engineering, Procurement, and Construction (EPC) contractor will adopt best industry practices with regard to handling of hazardous materials, implement it within its already existing work and safety handling procedures, and will recommend the appropriate disposal of these equipment in accordance with the applicable National and International standards.

111. Batteries and transformer oil must be disposed of through lead waste re-processors in accordance with the provisions of CEA and compliance with these provisions to must be reported to ADB/CEA through biannual reports.

112. No land acquisition nor resettlement requirements will be required for tower line. However, the selected 250 sq.m. plot of land required for gantry based switching stations for Kebithigollewa land is private, which will be purchased at market rates, and acquisition of land will not be required from the surrounding communities, the other three are based on government land.

113. No major sites of archaeological, cultural, or historic significance are present along the proposed alignment of the distribution lines and gantries.

#### **Environmental Impacts and Mitigation Measures Needed during Construction**

114. Environmental impacts identified during construction are limited in size and are temporary. The scale of the works is relatively minor and the project areas proximity to the work force means that no construction camps are required.

115. Fuel and other lubricants will need to be stored at the construction sites. Best industry practice will be required to ensure that accidental spills and discharge to the soil and aquatic environments are prevented. Any fuel (including drums and tanks, if any) should be placed at least 20 m away from waterways and no equipment is to be refuelled within this distance.

116. Trained personnel should only undertake handling of fuel and lubricants. In addition, machinery will be properly maintained and waste oil and oil filters must be disposed of to meet best industry practice. This will be the contractor's responsibility.

117. At the completion of work, the contractor will be required to rehabilitate and clean up all work sites. This includes repairing damage to pavements, roads, and drainage systems. All waste is to be removed from the sites. The contractor and the CEB will be responsible for implementing this requirement.

118. About 1,300 forest trees and 600 fruit/non-fruit/plantation trees would be removed from the proposed RoW of the lines. Several declared environmentally sensitive areas are located within the project affected area of the Vavuniya and Ampara districts, but the line routes have been demarcated avoiding all of these areas. Migratory paths of wild elephants and small mammals and reptiles may be affected due to construction activities. However, noise, vibration, and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner.

#### **Environmental Impacts and Mitigation Measures Needed during Operation**

119. Once gantry switching stations and lines are fully erected, fencing, danger signs must be installed at each that clearly identify and warn of the dangers of climbing into an operational substation. Signage meeting the IEEE<sup>43</sup> standards will need to be placed on all overhead towers warning of the electrical hazards. Erection, Procurement, and Construction (EPC) contractor will also need to advise the community about the location and associated dangers of the overhead feeder line.

#### **4.4 Environmental Management Plan**

120. The environmental management plan (EMP) has been prepared for the sub-project that discusses the anticipated impacts, monitoring requirements, and development of mitigation measures with respect to the following stages: (i) pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans were developed and will be implemented during the project implementation phase.

121. The Environmental Management Plan (EMP) for the project is attached as Annexure 5, which identifies feasible and cost - effective measures to be taken to reduce potential significant, adverse, impacts to acceptable levels. Here, proper mitigation measures are proposed for each potential impact, including details on responsible parties for implementation of mitigation measures and supervision.

122. A summary environmental impact matrix and the mitigation measures are given in Table 9 below.

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<sup>43</sup> Institute of Electrical and Electronics Engineers.



**Table - 9: Environmental Impact Matrix**

SI N <sup>o</sup>	Environmental Attribute	Potential Impacts	Nature of Impact	Magnitude of Impacts			Mitigation Measures	Implementation & Monitoring	
				Low	Medium	High			
A. Physical Resources									
1.	Topography	Change in the surface features and present aesthetics due to the construction of the project.	Direct/Local/irreversible		X		To minimise the impact of loss of vegetation as per existing norms.	Before construction phase	construction
2.	Climate	No impacts on the climatic conditions	Direct/Local/irreversible	X			No measurable impact on the climatic conditions, hence no mitigation is required		
B. Environmental Resources									
1.	Air Quality	Project will have marginal impact on air quality during the construction period due to increase in the dust emission.	Direct/Local/reversible	X			Watering at construction site, limited bare soils, maintenance of vehicles etc.	During activity	construction
2.	Noise	Noise due to general construction activities.	Direct/Local/reversible	X			Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers etc.	During activity	construction
		Noise arising from humming noise from transformers	Direct/Local/reversible	X			To maintain a safe distance or provide proper shielding near residential areas	During operational phase	
3.	Surface and Ground Water quality	Runoff from the construction site	Direct/Local/reversible	X			Careful siting of towers and gantry.	Before and during construction activity	
		Domestic wastewater from construction sites	Direct/Local/reversible	X			Domestic waste treatment by providing soak pits.	During construction and operation	
4.	Soils and Geology	Soil erosion due to erection and clearing of vegetation in the RoW.	Direct/Local/reversible				Avoiding sites, which are prone to soil erosion. Levelling of construction sites.	During and after the construction activity	
C. Ecological Resources									
1.	Terrestrial Ecology	Loss of vegetation	Direct/Local/irreversible		X		Compensation to the tree owners. Afforestation cost paid by CEB to the Department of Forests.	Before the construction phase	
2.	Terrestrial Fauna	Disturbance to the local fauna during construction	Direct/Local/reversible	X			Wildlife routes and their habitats have been avoided as far as possible during the route selection.	Before and during construction phase	
3.	Aquatic Ecology	No significant impacts envisaged	Direct/Local/reversible	X			No mitigation required	Before and during construction phase	
D. Human Environment									
1.		Fires, explosion and other accidents at the route alignment of MV line.	Direct/Local	X			Use of personal protective equipment during construction. By lopping of trees, fire hazards will be avoided during maintenance period. Regular inspection of lines for faults prone to accidents.	During construction and operation phase	

SI N <sup>o</sup>	Environmental Attribute	Potential Impacts	Nature of Impact	Magnitude of Impacts			Mitigation Measures	Implementation & Monitoring
				Low	Medium	High		
2.	Health and Safety	Exposure to electromagnetic fields	Direct/Local/continuous	X			MV lines do not cause too much EM fields	Before and after the construction phase.
3.	Agriculture	Permanent and temporary loss of agriculture land due to pole erection	Direct/Local/reversible	X			Avoid prime agriculture land. Assessment of land required and compensation. Construction activity after crop harvesting	Before and during construction phase.
4.	Socio-economics	Beneficial impacts from rural and urban electrification. Job opportunities during construction phase	Direct/regional		X		Unskilled labor and indirect benefits. Overall economic growth of the region.	During operational phase
5.	Resettlement	Resettlement of the house falling along the RoW.	Direct/Local/reversible	X			Route alignment is selected in such a way that there is no resettlement issue.	Before the construction phase.
6.	Cultural sites	No archaeological, historical or cultural important sites are affected by the construction of the lines.	Direct/Local/reversible	X			No archaeological, historical or cultural important sites are affected, hence no mitigation required	--
7.	Traffic and Transportation	Traffic congestion due to movement of construction vehicles	Direct/Local/reversible	X			Avoid high density traffic areas, proper traffic signs at the construction site, ensuring proper access roads	During construction phase
8.	Solid Waste Generation	Probability of Surface and ground water pollution	indirect/Local/reversible	X			Separated wooden and scrap will be collected and disposed of in compliance with applicable regulations and rules.	During operation phase

## 5 INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PROGRAMME

### 5.1 Institutional Arrangements

123. According to the National Environmental Act (NEA), there exists a mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for any kind of power plants of prescribed capacity and transmission lines over 50 kV in capacity, and above 10 km in length. Therefore, the Ministry of Power and Energy has established an environment cell in the Planning Division to implement the requirements of NEA. CEB has set up a Design & Environment Division (D&ED) for dealing with environmental issues at the corporate level to monitor and implement environmental good practices.

124. The Design and Environment Division is headed by Dy. General Manager who is qualified and also well aware of the project activities and its impacts on the environment. A Chief Engineer has been deputed to as the Head of the Environment Unit to give guidance to the project staff and contractors to adopt the environmental good practice while implementing the project. There is a need to strengthen the Division by hiring middle level executives who would be engaged in the field to work under the Chief Engineer to report project implementation.

125. The duties of the Environment Division at the corporate level:

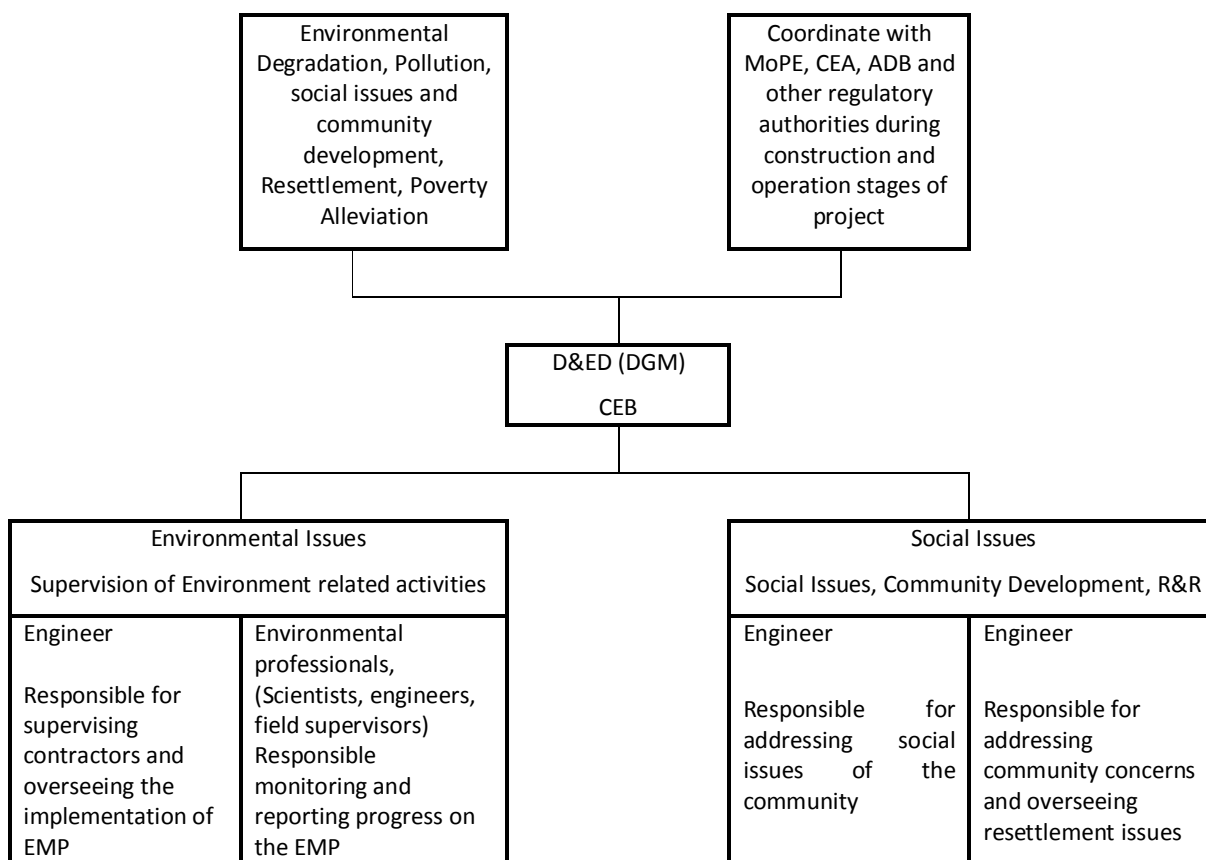
- Monitoring and implementation of mitigation measures during construction and operation phases of the project.
- Coordinate the preparation of suitable environmental management reports at various project sites.
- Advising and coordinating field environmental management cells activity towards effective environment management.
- Liaise with the Ministry of Power and Energy (MoPE) and Central Environmental Authority (CEA), and other relevant agencies and seek their help to solve the environment related issues of the project implementation.
- Advise project planning cell on environmental and social issues to avoid negative environmental impacts.
- Provide training and awareness on environmental and social issues related to power transmission projects to the project staff.

126. The duties of the Environment Division at the field level:

- Implement the environment policy guidelines and environmental good practices at the sites.
- Advising and coordinating the field offices activity towards effective environment management.
- Liaise with the forest department and seek help of forest officers in resolving environment monitoring related issues.
- Carry out environmental and social survey in conjunction with project planning cell to avoid negative environmental impact.
- Make the contractor staff aware on environmental and social issues related to power transmission projects so that EMP could be managed effectively.

127. The mitigation measures suggested requires monitoring of environmental attributes both during construction and operational phase of the project by the EED. The Figure 6 below depicts the institutional organisation structure showing the various entities within CEB and their role vis-à-vis- other government agencies.

**Figure 6: Institutional Structure and Responsibility for Environmental Management Plan at Ceylon Electricity Board (CEB)**



*D&ED = Design & Environment Division, EMP = environmental management plan, MoPE = Ministry of Power and Energy, PIU = Project Implementation Unit*

## 5.2 Environmental Monitoring Plan (EMoP)

128. During the construction and operation phase of this project, the monitoring of environmental aspects shall be done at the distribution line by a competent officer of the D&ED. During the construction phase, the contractor should ensure that activities like handling of earth works clearing work, access road construction, proper traffic signals is done properly to have minimum impact. This in turn should be monitored by the Engineer-in-Charge of the individual distribution project.

129. Monitoring of sanitary waste treatment at workers camp should be done periodically to avoid water pollution. Other environmental good practices include noise abatement, maintaining hygienic conditions, maintenance of fire and safety equipment etc. Monitoring report should be prepared once in six months with the corrective action plan for the problem areas. Overall, the environmental good practices should be followed as per environmental policy guidelines.

130. In addition to the EMP, to ensure that project would not be generating a negative impact to the overall environment quality, an EMoP will be prepared. The monitoring activities of the project include site supervision, verification of permits, monitoring of water quality, soil, noise and air. Monitoring of the quality of water, soil, air, and noise during the construction stage is a responsibility of the contractor by the approved government agency. PIU will supervise the contractor and the environmental monitoring report will be submitted by the PIU to the PMU, which will include the result of environmental monitoring into its environmental report. The environmental monitoring activities along with their periodicity for developing the EMoP for the project is summarised in Annexure 6.

131. As per ADB's Safeguards Policy Statement 2009, ADB requires the borrower to retain external qualified experts or qualified NGOs to verify monitoring reports with significant impacts and risks. This

external monitoring report will be on a semi-annual basis directly to ADB to verify whether sound environmental management practices are applied, and the set environment targets are achieved. In case the implementation of EMP measures is not satisfactory, these external monitoring experts/NGO will recommend actions to enhance environmental compliance.

### 5.3 Critical Environmental Review Criteria

#### (i) Loss of irreplaceable resources

132. The rural electrification projects do not involve any large-scale excavation and land lost is insignificant. The EMP includes compensation for the loss by minimising the impact of loss of vegetation as per existing norms under the Forest (Conservation) Act, 2002. There will be no net biodiversity loss in this project due to the afforestation being done by Department of Forests and the rule of planting two trees for cutting one tree.

#### (ii) Accelerated use of resources for short-term gains

133. The project will not use any natural resources occurring in the area during construction as well as its operation cum maintenance phases. The construction material such as tower material, cement etc. shall come from factories mostly from abroad, while the excavated soil shall be used for backfilling and revetment to restore the surface. Thus, the project shall not cause any accelerated use of resources for short-term gains.

#### (iii) Endangering of species

134. Endemic species of flora and fauna exist in the project area and adjoining forest areas, but the project activities will not threaten or cause their extinction.

#### (iv) Promoting undesirable rural-to urban migration

135. The project will not cause any submergence or loss of land holdings that normally trigger migration. It also does not involve acquisition of any private land holdings. Hence, there is no possibility of any migration.

#### (v) Increase in affluent/poor income gap

136. The distribution project will increase availability and reliability of power. Power is a key input to the economic development of any area. Experience indicates that economic development leads to generation of more jobs, which in turn should raise the living standards of poor. Thus, the project will contribute to reduction of affluent/poor income gap by providing opportunities for employment and rural based economic activities.

### 5.4 Environmental Management Plan Budget Costs

137. The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the project; (ii) providing offsets to negate project impacts especially ecological impacts. The compliance with the EMP has been prepared based upon optimum and reasonable costs that are derived upon minimisation of mitigation measures on a “least-cost” basis. Cost estimate for EMP implementation is approximately 0.5 million (estimated at approximate 2% of the project cost of USD 20.4 million) for environmental mitigation measures, and monitoring costs, independent audit costs for the project.

### 5.5 Associated Facilities

138. There are several existing large, medium and mini hydropower projects that supply to the national grid. There are also a number of micro hydropower developers who supply to the local grid (a 33 kV medium voltage line) which supplies to the rural areas in the vicinity. The large hydropower projects are run by the government and the mini hydro plants are owned by private operators. As per Sri Lankan law, these hydropower projects/power generator must bring the power to a common pooling point by building own power evacuation lines. From this pooling point, several distribution lines have been laid to feed the consumption centres. All the private sector hydropower generators have to meet the compliance requirements of the Ceylon Electricity Board and the Sri Lanka Sustainable Energy Authority (SEA). All hydropower developers have to adhere to the National Environmental Act and must meet the environmental guidelines of the Central Environmental Authority (CEA) to operate.

139. Mul Oya (5 MW) mini hydro power (MHP) will evacuate power to the Kandy grid through the Kiribathkumbura-Galaha line (15 km) connected at the Galaha end. The commissioning of this MHP will also help in further improving the voltage of Galaha gantry. MV tail end line voltage after implementing this

proposal would increase. Details of the Environment clearance certificate of Mul Oya MHP: Certificate No.: CEA/CPO/NW/P&E/07/29, date of issue: 21st July 2009, being administered by SEA through EP-310401 dated 05 Oct 2009.

## **6 GRIEVANCE REDRESS MECHANISM**

### **6.1 Awareness of Stakeholders**

140. During Public consultation sessions of the IEE study, the discussions with groups and individuals were conducted to make them aware of the proposed project. Thus, the project-affected community residing beside the proposed distribution line has gained a reasonable knowledge about the potential grievances, which will arise in the future.

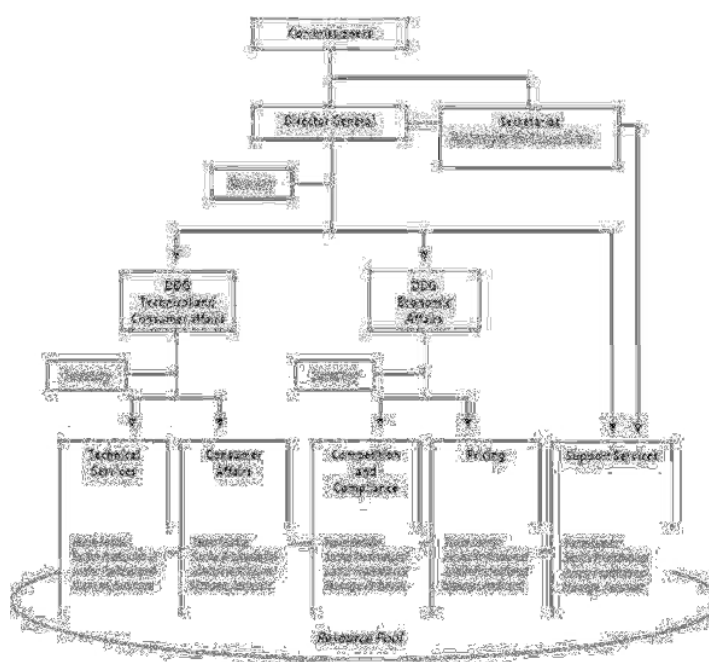
141. A community awareness programme must be conducted one month prior to construction by the Project Implementation Unit (PIU) of CEB regarding the scope of the project, procedure of construction activities, utility of resources, identified impacts and mitigation measures. These awareness programmes will help the community to resolve problems and clarify their distrusts related to the proposed project at initial stage.

142. The community should be informed about the Grievance Redress Mechanism (GRM), procedure for making complaints, including the place and the responsible person to contact is already established by the Public Utilities Commission of Sri Lanka (PUCSL). Almost all the stakeholders related to the GRM must be made aware of the established grievance process, the requirement of grievance mechanism, goals, benefits, relevant laws regulations etc. PUCSL Act lays down procedures for Grievance Redressal for lines as attached in Annexure 7.

### **6.2 Grievance Redress Mechanism and PUCSL**

143. The Grievance Redress Mechanism (GRM) for the infrastructure development project provides an effective approach for complaints and resolution of issues made by the affected community in a reliable way. This mechanism will remain active throughout the life cycle of the project. Thus, Public Utilities Commission of Sri Lanka (PUCSL) Act creates an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda of the country. PUCSL's mission is to regulate all the utilities within its purview, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner. Figure 7 depicts the PUCSL hierarchy.

144. All the members in PUCSL need to be informed by the PIU regarding procedures of GRM. The information should include procedures of taking/ recording complaints, handling of on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders etc. PUCSL has a standard mechanism of (i) informing the affected people GRM and its functions, (ii) how peoples representatives in the GRC will be selected, (iii) procedure and the mechanisms adopted for making the complaints, (iv) supporting the complainants in communicating their grievance and attending the GRM meetings and (v) implementing compliance to a GRMs' decision, its monitoring and communication to the people. Periodic meetings of PUCSL are to be conducted by the PIU so that all the members of the PUCSL are familiar with the problems and responses received by individuals in the PUCSL.

**Figure 7: Responsibility Hierarchy of PUCSL**

## 7 PUBLIC CONSULTATION AND INFORMATION DISCLOSURE

145. In line with National Environmental Act (2002) in Sri Lanka, public consultation and information disclosure will be undertaken through public notice prior to the approval by CEA for the particular project. According to ADB SPS 2009, public consultation and information disclosure is to be made during the initial stages by the client itself. This activity supports the view to understand the public's perception of the project and respond to their concerns and suggestions during the early stages of the project design. Incorporation on the environmental concerns to the decision making process through the public consultation will avoid or minimise conflict situation during the implementation process.

146. Public consultations were conducted in project-affected area between 15 March to 10 May 2012. The community aired their opinions freely on the project, its impact, and suggestions for mitigating adverse impacts. People participated in voluntary public consultation sessions to express their views about the proposed project. Table 10 indicates a summary of public consultations conducted during the field survey.

**Table 10: Public Consultations**

S.No	Name of the Component /Site	Name of the Village, Gramasevaka Division, District, Province	Distance from Project Location	Names of the Participants
1	Kiribathkumbura-Galaha	Sarasavigama, Galoya, Kandy, Central	0.5 km	S.S. Chandrasekaram, C.Pushparani, N. Wasantha, M. Raman, Siththi Sifaya, Mohamed Azad, F. Safana Fahim, H. Tikiri Banda, M. Premawathi Menike
2	Kitibathkumbura-Galaha	Hendeniya, Hendeniya West, Kandy, Central	0.4 km	S.A. Seetha Menika, H.B.M.G. Nandana, Gamini Kadangama, H.M. Bisomenike, T.A. Gihan Wijesinghe, Kusum Iddawala, Y.Panidhe, Annakody, B. Dhanasingham
3	Kiribathkumbura-Galaha	Nillamba, Palledelthota, Palledelthota (Doluwa DSD), Kandy, Central	0.5 km	Rev. Madahapola Anuruddha, Nimal Premajayantha, V. Thygaraja, Kavinda Gunawardena
4	Akkaripattu-Galmaduwa	Galmaduwa Junction, Galmaduwa, Ampara, Eastern	1 km	R.M.S. Thilina, R.M. Wijesinghe, R. M.A. Wijesinghe, M.K. Sisira
5	Vauvnia-Kabithigollawa	Kunchattuwa, Kunchattuwa Thulana – 26, Anuradhapura, North Central	0.5 km	P.B. Basnayake, K. Kamalawathi, Wasana Abeysinghe, Priyantha Kumara, Sumith Nadeesh
6	New Anuradhapura-	Wellaragama, Wellaragama - 580,	0.5 km	Lalitha Kumari, K. Sirisena, Priyanka, Priyadarshani, Jagath



S.No	Name of the Component /Site	Name of the Village, Gramasevaka Division, District, Province	Distance from Project Location	Names of the Participants
	Kahatagasdigiliya	Anuradhapura, North Central		
7	New Anuradhapura-Kahatagasdigiliya	Kasamaduwa, Kasamaduwa - 568, Anuradhapura, North Central	0.3 km	K. Dayawansa, D. Bandaramenike, Sumanadasa Bandara
8	New Anuradhapura-Kahatagasdigiliya	Thihogama, Rathmale - 199, Anuradhapura, North Central	0.5 km	W. Abeywickrema, Nimal Maithree
9	New Anuradhapura-Kahatagasdigiliya	Diganhalmillawa, Diganhalmillawa - 229, Anuradhapura, North Central	0.5 km	H.B.A. Rathnayake, H.B.A Jayasena, Shyama Kumari, D.B.P. Menike, K. Gunawardanage, L.G. Shantha, P. Anula
10	New Anuradhapura-Kahatagasdigiliya	Digan Halmillawewa, Digan Halmillawewa - 229, Anuradhapura, North Central	0.5 km	Jayasinghe , G. Illangasinghe, R.M.K. Dayarathne, P.B. Nandawathi, S. Abeypala, T.B. Gunadasa
11	New Anuradhapura-Kahatagasdigiliya	Kasamaduwa, Kasamaduwa -568, Anuradhapura, North Central	0.5 km	K.B. Pemawathi, Chamila Gayani, Darshana Kumara, J.M. Podimenike, J.M. Karunaratne, D.M. Bisomenike
12	Akkariapattu-Potuvil	Inspector Eethan, Potuvil 10, Ampara, Eastern	0.5 km	S.Sithrangane, T. Nirmala, S.L.Utumanlebbe, T. Rajeshwaree, M. Murugesan

## 7.1 Consultation Findings

### Vavyunia-Kebithigollewa 33 kV

147. The villagers felt that supply of electricity is very important for development of the area. There are several non-electrified villages/households that need to receive electric connection. People are very poor in the area and they want project to provide work. They have no objection to the installation of towers as CEB will avoid any settlements and have no problem if the line runs over the government forest and not through their property. The land identified for construction of proposed distribution gantry in Kabithigollawa belongs to a private party who is willing to sell the land at market prices. No major issue has been identified. Some felt that the Kunchuttuwa School should be avoided in the alignment, as it will be risky for children. The area is generally flat and there is landslide or soil erosion. They felt if the trees are cut, the environment in the area will change and deteriorate water resources.

### Anuradhapura-Kahatagasdigiliya 33 kV

148. The villagers felt that supply of electricity is very important for development of the area. There are several non-electrified villages/households that need to receive electric connection. They have no objection to the project provided CEB compensates any losses to them and the project is not harmful to people's lives, property and livelihoods. The lines should be installed away from the village without harming the houses and cultivations. They felt that if the lines run across the village, it could affect tall trees like coconut and rubber trees. Most of the villagers are dependent on agriculture. They would like to work as local labour for forest clearing, and masonry work, but they expressed that CEB would not recruit them as labourers as they do not have the necessary training for such work. Most of the lands cultivated by people are obtained on annual permits. They do not have permanent land titles. If this land is acquired for the project, people will not be entitled for compensation. They hoped that lines would not affect paddy and maize cultivations as the lines run above them. They also felt that the lines could affect the migrant birds, which come to this area because of the Heenna forest.

149. They want to get adequately compensated for the losses – they would prefer to get alternate land within the village instead of cash compensation for any loss of land and if a tower is installed on a paddy field, they expect LKR 100,000 as compensation as they have no other earning besides this land for the last several years. The land values will decrease and they may not be able to cultivate due to tower placement. In previous projects, lines were drawn across paddy fields but they were not paid compensation.



**Kiribathkumbura-Galaha gantry 33 kV**

150. The community will support the project since they want to see an improvement in electricity supply – which has frequent power failures during rainy season and voltage drops in the evenings. They felt that electricity line should be installed over mountains so that it would not run over their houses. They also did not want to install lines close to temples, which are of historical and archaeological significance. Existing lines are running low and touch the tall trees resulting in regular fires.

151. The villagers wanted the project to provide manual labour during project construction, as there were lot of unemployed youth who may be able to find temporary employment. There is no forestland in this area except for some pinus plantations of the Department of Forests. There are no migrant birds in this area. If lines run over land, land values will go down and people may not be able to sell their land; as well as people will not be able to construct any houses or plant tall trees under the RoW. This is a hilly/mountainous area. They strictly felt that if people lose any property or cultivations, compensation should be paid at market value.

**Galmadu Junction-Akkirapaththu-Pothuvil 33 kV**

152. The project will improve the electricity supply in the country and contribute to its development. The lines were installed earlier, but no previous land acquisitions were done and people were not paid compensation by previous projects for installing towers on private land. The people may not receive compensation because they live and cultivate encroached state land. Forests are situated far away from their villages. If towers are installed on paddy lands, it will reduce the cultivable area, and no structures can be built under the RoW. If fruit trees are cut down, a considerable number of coconut and mango trees will be affected. They wanted to provide labour if the project created such opportunities to recruit village labour.

**8 FINDINGS AND RECOMMENDATIONS**

153. Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed distribution system development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage, are now taken into account and mitigated where necessary. Those impacts can be reduced through mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

154. The proposed project will have a number of positive and negative impacts on the existing environment. Significant improvement in the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact. In addition, electricity supply will help agricultural activities, students and public, increase land value, create lot of income generating activities, enhancement of safety at night, and increase mobility during night.

155. Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.

156. Proper GRM will have to be implemented through PUCSL to overcome public inconvenience during the proposed project activities.

157. Benefits far outweigh negative impacts - the proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to the region will boost economic development of the area by strengthening the power distribution infrastructure. Overall, the major social and environmental impacts associated with distribution projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices. The impact matrix depicts that the project will not have significant negative environmental impacts and the project would help in improving the socio-economic conditions of this developing state. As the project falls in category B as per the ADB's guidelines, no detailed EIA study is required.

## 9 CONCLUSIONS

158. In accordance with the ADB's Safeguard Policy Statement 2009, the proposed distribution component is categorised as "Category B". Thus, a full Environmental Impact Assessments (EIA) for the project is not required. Distribution projects require land only for gantry based switching stations but do not require land for laying the distribution lines. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignment passes through scrub-lands, cultivated paddy fields, rubber cultivations, rubber plantations, tea cultivations etc. The lines will also pass through degraded forest areas but avoid any national park or sanctuary. The alignments in this project have also avoided wetlands and geologically unstable areas, which can also pose foundation related problems. Land will only be purchased/acquired for one gantry based switching station but no land will be required for placing distribution towers on private land thereby avoiding any relocation of project affected people.

159. The proposed construction activities will cause significant environment impact and most of the potential environment impacts are temporary in nature mainly restricted to pre-construction and construction periods. The Environment Management Plan (EMP) and the Environment Monitoring Plan (EMoP) have been prepared for the project and responsibilities for implementation assigned. The anticipated environmental impacts can be easily mitigated through implementation of EMP.

160. Overall, the social and environmental impacts associated with distribution project are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

## Annexure 1 Applicable Environmental Policy and Procedures

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
Agrarian Services Act (Nº 58 of 1979) Agrarian Development Act Nº 46 of 2000	To provide secure background to farmers and their agricultural premises	Regulates the acquisition of land that belongs to paddy and other activities which are related to agricultural areas.	The Ministry of Agriculture Development and Agrarian Services
Ceylon Electricity Board Act , 1969	To provide for the establishment of an electricity board for the development and co - ordination of generation	Enters with joint schemes by such board with any government department or approved body for the generation of electrical energy, the irrigation lands, control of floods or other like objects, and to make provision for all matters connected there with or incidental thereto.	Ceylon Electricity Board
Electricity Act 2009	To provide reliable and cheap electrical energy	Regulates the generation, transmission, transformation, distribution, supply and use of electrical energy	Ceylon Electricity Board
Fauna and Flora Protection (Amendment) Act 1993 (Nº 49 of 1993).	To provide greatest protection to fauna and flora	Makes provision for the establishment of protected areas, regulates human involvements to such areas and their fauna and flora.	Department of Wild Life and Department of Forest
Felling of Trees (Amendment Act Nº 01 of 2000 and Act to Amend felling of trees control)	The controlled removal of trees.	Regulates the removal of trees relevant to type and the compensation	Department of Forest
Fisheries and Aquatic Resources Act 1996	To provide for the management, regulation , conservation and development of fisheries and aquatic resources	Restricts detrimental or risk activities for aquatic fauna and flora	National Aquatic Resources Research & Development Agency (NARA) and CEA
Flood Act Nº 22 of 1955	Protection of areas subject to flood	Flood prevention	Department of Irrigation
Forest Ordinance Act Nº 13 of 1966 Forest (Amendment) Act Nº 65 of 2009	Conservation, protection and management of forest and forest resources for control of felling and transport of timber	Definition of Conservation Forest, Reserve Forest, Village forests	Forest Department
Irrigation Clauses Act 1973	To provide regulations for the construction of structures across the irrigation canals and water resources.	Regulates the construction of structures across the irrigation canals and water resources.	Department of Irrigation
Land Acquisition (Amendment) Act, Nº 13 of 1986	Establishes the procedure to be followed by the competent authorities for the acquisition of land for public purpose.	It includes, among other matters: investigations for selecting land to be carried out by a district officer appointed by the Minister; issue of notice of intended acquisition indicating the compensation to be paid for any damage caused during investigations; issue of notice of acquisition of land or servitude for a public purpose.	Department of Valuation
Monuments and Archaeological Sites and remains Act, 1958. Act Nº24 of 1958 Antiques Ordinance, 1960	An Act to provide for the preservation of ancient and historical monuments and archaeological sites and remains of national importance.	For the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects etc.	Department of Archaeology
Motor Traffic Act Nº 60 of 1979	To provide sustainable approach for vehicle traffic	Regulates vehicle traffic during transportation of construction materials and the construction activities	
National Environmental Act Nº 47 of 1980, amendment	Provide protection, management, enhancement of	Regulates sustainable utilisation of almost all natural resources such as	Central Environmental

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
Nº 56 of 1988, and other amendments	the environment with prevention and control of pollution	water, soil and air	Authority (CEA)
National Environmental (Protection & Quality) Regulations, No 01 1990.	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and effluents into inland surface water	CEA
National Environmental (Ambient Air Quality) Regulations, 1994.	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	CEA
National Environmental (Noise Control) Regulations Nº1 1996	To provide maximum allowable noise levels	Regulates noise pollution	CEA
National Involuntary Resettlement Policy	Land Acquisition Act does not deal with the broader social and economic impacts of the project. This policy was established to overcome these impacts.	To monitor land replacement, income restoration, relocation assistance and allowances, consultation and grievance redress, assistance to vulnerable groups and provision of resettlement sites and services.	Government of Sri Lanka / Land Acquisition and Resettlement Committee (LARC)
Public Utilities Commission of Sri Lanka Act , Nº 35 of 2002	Create an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda	Regulate all the utilities within the purview of the Public Utilities Commission of Sri Lanka, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner.	The Public Utilities Commission of Sri Lanka
Soil Conservation (Amendment) Act Nº 24 of 1996	Act for conservation of soil resources and productive capacity of land	Degraded land, prevent damage against salinity, water logging, drought, floods	Soil Conservation Board
Sri Lanka sustainable energy Authority Act, Nº 35 of 2007	To develop renewable energy resources; to declare energy development areas; to implement energy efficiency measures and conservation programmes; to promote energy security	Reliability and cost effectiveness in energy delivery and information management, function as a National Technical Service Agency of Clean Development Mechanism (CDM) in Sri Lanka that provides technical assistance to the Designated National Agency for Clean Development Mechanism and project developers, on energy sector clean development project activities	Sri Lanka Sustainable Energy Authority

## ASSESSMENT OF LEGAL FRAMEWORK AND INSTITUTIONAL CAPACITY

### Environmental Legislation

The requirement for Environmental Assessment in Sri Lanka is established by the National Environment Act No. 47 (1980), and the amendment to the act 1988, Act No. 56 Section 23A, for EPL procedure and the EIA regulation under Part 4C, under the provision of section 23Z. The procedures are defined in the environmental impact assessment (EIA) Regulations Gazette No. 772/22 (1993). The Prescribed Projects set out in the Gazette Extra Ordinary No. 772/22 of 24th June 1993, No: 1104/22 dated 6th November 1999, and No: 1108/1 dated 29th November 1999 for which environmental assessment is mandatory, and described as below:

#### Part I: Projects and undertakings if located wholly or partly outside the coastal zone as defined by Coast Conservation Act No. 57 of 1981

- (i) Reclamation of Land, wetland area exceeding 4 hectares.
- (ii) Extraction of timber covering land area exceeding 5 hectares
- (iii) Conversion of forests covering an area exceeding 1 hectare into non-forest uses.

- (iv) Clearing of land areas exceeding 50 hectares.
- (v) Installation of overhead transmission lines of length exceeding 10 kilometers and voltage above 50 Kilovolts.
- (vi) All renewable energy based electricity generating stations exceeding 50 Megawatts
- (vii) Involuntary resettlement exceeding 100 families other than resettlement effected under emergency situations.
- (viii) Development of all Industrial Estates and Parks exceeding an area of 10 hectares.

**PART III:** All projects and undertaking listed in Part I above irrespective of their magnitudes and irrespective of whether they are located in the coastal zone or not, if located wholly or partly within the areas specified in part III of the Schedule.

3. Within 100 m from the boundaries of or within any area declared under:
  - i. the National Heritage Wilderness Act No. 3 of 1988;
  - ii. the Forest Ordinance (Chapter 451);
 Whether or not such areas are wholly or partly within the Coastal Zone as defined in the Coast Conservation Act, No. 57 of 1981
4. Within the following areas whether or not the areas are wholly or partly within the Coastal Zone:
  - i. any erodible area declared under the Soil Conservation Act (Chapter 450)
  - ii. any flood area declared under the Flood Protection Ordinance (Chapter 449) and any flood protection area declared under the Sri Lanka Land Reclamation and Development Corporation Act, 15 of 1968 as amended by Act, No. 52 of 1982.
  - iii. 60 meters from the bank of a public stream as defined in the Crown Lands Ordinance (Chapter 454) and having a width of more than 25 meters at any point of its course.
  - iv. any reservation beyond the full supply level of a reservoir.
  - v. any archaeological reserve, ancient or protected monument as defined or declared under the Antiquities Ordinance (Chapter 188)
  - vi. any area declared under the Botanic Gardens Ordinance (Chapter 446)
  - vii. within 100 meters from the boundaries of, or within, any area declared as a Sanctuary under the Fauna and Flora Protection Ordinance (Chapter 469).
  - viii. within 100 meters from the high flood level contour of, or within, a public lake as defined in the Crown Lands Ordinance (Chapter 454) including those declared under section 71 of the said Ordinance.
  - ix. Areas declared under the Urban Development Authority Act No 41 of 1978 and Act No. 4 of 1982 section 29 (this indicates in its definition that laws are valid to the areas of the local authorities).

The requirement for EIA and the level of study required are determined by the Central Environment Authority (CEA) after submission by the proponent of a Project Information Document (PID), plus supporting information, if relevant. There are two possible outcomes:

**Categorical Exclusion:** The activity is not on the list of prescribed projects in the EIA regulations, is not in or near a sensitive area, has not been the subject of public protest, and it is clear from the PID and supporting information that the project will have no significant environmental impacts. Environmental clearance is granted (with or without conditions) and the project may proceed.

**Environmental Assessment:** All other projects require Environmental Assessment and the CEA establishes a Scoping Committee to decide on the level of study (IEE or EIA) and prepare Terms of Reference (ToR). Alternatively, if the project lies wholly within the jurisdiction of a single government agency, only if it is a gazetted PAA agency, CEA may refer the project to this authority (as the Project Approving Agency) to administer the EIA process. A Technical Review Committee (TRC) reviews the completed IEE or EIA report and recommends whether environmental approval shall be granted; the final decision is made by CEA.

There are further compliance requirements prescribed by other certain legislation, in particular the Coast Conservation Act, which requires clearance by the Coast Conservation Department (CCD) for any development activity or structure in the coastal zone<sup>44</sup>. An Environmental Protection License (EPL) from

<sup>44</sup>The coastal zone is defined in the Coast Conservation Act No. 57 of 1981 "as the area lying within a limit of 300 meters landward from mean high water line (MHWL). In the case of rivers, streams, lagoons or any other body of water connected to the sea, either

CEA, is required for the operation of the completed facilities (A list has been published by CEA).

No development or encroachment of any kind is permitted in archaeological reserves declared under the Antiquities Ordinance No. 9 of 1940 as amended (Section 34). The Director General of Archaeology is empowered to conduct an Archaeological Impact Assessment of areas that may be affected by development or other projects proposed by the government or any person.

No construction activities are permitted in national reserves (under the jurisdiction of the Department of Wildlife Conservation - the Fauna and Flora Protection Ordinance No. 2 of 1937, as amended) and forest reserves (under the jurisdiction of the Forest Department-see the Forest Ordinance of 1907 as amended). Sanctuaries, also declared under the Fauna and Flora Protection Ordinance, may include privately-held land. Clearance from the Department of Wildlife Conservation is required if construction is proposed in sanctuaries. Construction within 1 mile (1.6 km) radius of a national reserve, sanctuary or buffer zone needs permission from the Department of Wildlife Conservation (see the Fauna and Flora Protection Ordinance No. 2 of 1937, as amended). Any development activity within a fishery reserve<sup>45</sup> requires the permission and approval of the Director of Fisheries and Aquatic Resources (see the Fisheries and Aquatic Resources Act No. 2 of 1996). Any construction taking place in close proximity to a forest reserve must be approved and cleared by the Forest Department.

Using paddy land for a purpose other than agricultural cultivation without the written permission of the Commissioner General is a punishable offence under the Agrarian Development Act No. 46 of 2000 (Section 32). In addition to environmental clearance, approval from the local authorities and CEA for site clearance; and consent from all relevant *Pradeshiya Sabhas*, Provincial Councils, and Divisional Secretaries shall be obtained before construction begins.

Clearance shall be obtained for the proposed development activities, if the area is declared under the UDA Act or Sri Lanka Land Reclamation and Development Corporation (SLLR&DC) Act.

A summary of Government environmental compliance requirements applicable to the project is presented in **Table 1**.

**Table 1: Summary of Environmental Compliance Requirements of the Project Components**

	Subproject	Subcomponent	Applicable Legislation	Statutory Requirement	Authorizing Body
1.	New Transmission lines, Distribution lines, substations	All subcomponents in sensitive areas	National Environment Act (NEA)	Environmental Clearance (EC)	Central Environment Authority (CEA)
		All subcomponents falling within the coastal zone	Coast Conservation Act	Clearance	Coastal Conservation Department (CCD)
		All subcomponents that require site clearance	Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the <i>Pradeshiya Sabha</i> Act No. 15 of 1987 as amended	Clearance	Municipal Councils, Urban Councils and <i>Pradeshiya Sabhas</i>
		All subcomponents that require cutting of trees	Felling of Trees (Control) Act No 9 of 1951	Tree-cutting Permit	Forest Department
		All subcomponents within a 1 mile (1.6 km) radius of a national reserve, sanctuary, or buffer zone	Fauna and Flora Protection Ordinance No. 2 of 1937 as amended	Clearance	Department of Wildlife Conservation
		All subcomponents in close proximity of a reserve forest	Forests Ordinance No. 16 of 1907 as amended	Clearance	Forest Department

permanently or periodically, the landward boundary extends to a limit of 2 km measured perpendicular to the straight base line drawn between the natural entrance points thereof and includes waters of such rivers, streams and lagoons or any other body of water so connected to the sea."

<sup>45</sup>Certain areas adjoining earmarked reservoirs and water bodies can be declared as a fishery reserve with the concurrence of the Ministry of Wildlife and Natural Resources.

	Subproject	Subcomponent	Applicable Legislation	Statutory Requirement	Authorizing Body
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology
		All subcomponent in and around irrigation development	Irrigation Development Act	Clearance	Director, Irrigation Department
		All subcomponent in and around archaeological reserves around UDA declared areas	UDA Act No. 41 1978 and No. 4 of 1982	Clearance	Regional Director UDA
2	Solar Park, Wind Farm	All subcomponents in sensitive areas	NEA	EC	CEA
		All subcomponents falling within the coastal zone	Coast Conservation Act	Clearance	CCD
		All subcomponents that require site clearance	Municipal Councils Ordinance No. 29 of 1947, the Urban Councils Ordinance No. 61 of 1939 and the <i>Pradeshiya Sabha</i> Act No. 15 of 1987 as amended	Clearance	Municipal Councils, Urban Councils and <i>Pradeshiya Sabhas</i>
		All subcomponents that require cutting of trees	Felling of Trees (Control) Act No. 9 of 1951	Tree-cutting Permit	Forest Department
		All subcomponents within a 1 mile (1.6 km) radius of a national reserve, sanctuary, or buffer zone	Fauna and Flora Protection Ordinance No. 2 of 1937 as amended	Clearance	Department of Wildlife Conservation
		All subcomponents in close proximity of a reserve forest	Forests Ordinance No. 16 of 1907 as amended	Clearance	Forest Department
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology
		All subcomponents in and around fishery reserves	Fisheries and Aquatic Resources Act No. 2 of 1996	Clearance	Director of Fisheries and Aquatic Resources
		All subcomponent in proximity of archaeological reserves	Antiquities Ordinance No. 9 of 1940 as amended	Clearance	Department of Archaeology

CCD= Coastal Conservation Department, CEA = Central Environment Authority, EC = Environmental Clearance, NEA = National Environment Act, UDA = Urban Development Authority.

**Table 2** summarizes the application procedures for the main environmental permits.

**Table 2: Summary of Procedure for Obtaining Environmental Permits Required by the Government of Sri Lanka**

Legislation	Regulatory Agency	Summary of Procedure	Time scale
<b>1. Central Environmental Authority - Environment Impact Assessment/Initial Environmental Examination (IEE/EIA) Clearance</b>			
National Environmental Act No. 47 of 1980 and amended Act No. 56 of 1988; Government Gazette No. 772/22 of 24th June 1993 and No. 859/14 of 23rd February 1995	Central Environmental Authority (CEA)	9. Proponent to submit Project Information Document to CEA	During Feasibility Stage
		10. CEA to designate Project Approving Authority (PAA)	36 days
		11. PAA to appoint scoping committee; Issue of Terms of Reference (ToR) for the EIA/IEE	



Legislation	Regulatory Agency	Summary of Procedure	Time scale
		12. Proponent to conduct the environmental assessment and submit report to PAA	One and half years
		13. PAA to check adequacy	14 days
		14. For EIA, report will be open for public comments	30 days
		15. Technical Review Committee (TRC) to review report and forwarding comments	36 days
		16. PAA to recommend to CEA issuance of Clearance	
2. Coast Conservation Department Permit			
Under Section 5, 14, 15 and 16 of Coast Conservation Act No. 57 of 1981	Coast Conservation Department (CCD)	7. Proponent to submit application to CCD	During Feasibility Stage
		8. CCD to issue ToR for EIA/IEE	
		9. Proponent to conduct the environmental assessment and submit report to CCD	About 14 days
		10. For EIA, CCD will (i) invite Coast Conservation Advisory Council for comments; and (ii) open report for public comments	One and half years
		11. CCD to review comments	
		12. CCD to issue permit	
3. Environmental Protection License (EPL)			
National Environmental Act No. 47 of 1980 amended by Acts No. 56 of 1988 and No. 53 of 2000; Gazette Notification No. 1533/16 dated 25.01.2008	CEA	3. Proponent to submit application to CEA	Minimum of 30 days prior to the commencement of operation
		4. CEA to conduct field inspection and verification from relevant authorities	
		CEA to prepare Inspection Report with Recommendations	14 days
		TRC to review report	14 days
		Proponent to pay license fee	
		CEA to issue EPL	
4. Archaeological Impact Assessment Survey			
Under Section 47 read with Section 43(b) of Antiquities (Amendment) Act No. 24 of 1998; Gazette Notification No. 1152/14 dated 04.10.2000	Department of Archaeology	Proponent to submit application to Department of Archaeology.	During Feasibility Stage
		DA Regional Office to conduct Preliminary Observation and submit report to Department of Archaeology.	About 30 days
		(i) If there are no antiquities according to the recommendation and observation report, land will be released for the project.	
		(ii) If the preliminary observation report has proposed to carry out an archaeological impact assessment survey, steps will be taken to conduct the survey including scoping with other agencies.	30 days
		Department of Archaeology to call for quotations and award contract for Archaeological Impact Assessment (AIA) survey	
		Selected agency to conduct AIA survey and submit report to Department of Archaeology	42 days
		Department off Archaeology to submit AIA report to Minister in charge of approval	About 30 days
		Department of Archaeology to issue approval	
5. Clearance from Department of Forest Conservation			



Legislation	Regulatory Agency	Summary of Procedure	Time scale
Under the ordinance enacted in 1907 No. 16, and subsequent amendment No. 23, 1995 and No. 65 of 2009.	Department of Forest Conservation (DFC)	Proponent to submit application to DFC	During Feasibility Stage
		District Forest Office along with the DFC officials to conduct preliminary observation and submit report to Conservator General of DFC for approval	About 60 days
		(i) If the project is located within the core protected area, the application will be rejected;	60 days
		If the project will utilize resources from the forest (timber or related) the application will be rejected (even if it is located outside the boundary and the buffer);	
		If the project is outside the boundaries and buffers of any Forest Reserves (FRs), DFC's consent will be released.	
		DFC will refer to CEA if the proposed activities will cause negative impacts on forest conservation areas and there will be extraction of resources involved.	30 days
		- Under NEA, EIA will be conducted - DFC will become the project approving agency	116 days
		DFC will release the approval with the concurrence of the CEA.	

Notes: CEA = Central Environmental Authority, PAA = Project Approving Agency, CCD = Coast Conservation Department, ToR = Terms of Reference, EPL = Environment Protection License, EIA = Environmental Impact Assessment, IEE = Initial Environmental Examination, DA = Department of Archaeology, AIA = Archaeological Impact Assessment, UDA = Urban Development Authority, SLLR&DC = Sri Lanka Land Reclamation and Development Corporation, DFC = Department of Forest Conservation.

### Applicable International Environmental Agreements

In addition to national rules and regulations, international conventions such as the International Union for Conservation of Nature and Natural Resources (IUCN), Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), Convention on Migratory Species of Wild Animals (CMS) and Ramsar Convention on Wetlands of International Importance are applicable for selection and screening of subprojects under restricted/sensitive areas. Sri Lanka is a party to these conventions.

**International Union for Conservation of Nature and Natural Resources (IUCN).** The IUCN Red List of Threatened Species (also known as the IUCN Red List or Red Data List), founded in 1963, is a comprehensive inventory of the global conservation status of plant and animal species. The IUCN is an authority on the conservation status of species. A series of Regional Red Lists are produced by countries or organizations, which assess the risk of extinction to species within a political management unit. The IUCN Red List is set upon precise criteria to evaluate the extinction risk of thousands of species and subspecies. These criteria are relevant to all species and all regions of the world. The aim is to convey the urgency of conservation issues to the public and policy makers, as well as help the international community to try to reduce species extinction.

**Convention on Migratory Species of Wild Animals (CMS).** CMS was adopted in 1979 and entered into force on 1 November 1983. CMS, also known as the Bonn Convention, recognizes that local authorities must be the protectors of migratory species that live within or pass through their national jurisdictions, and aims to conserve terrestrial, marine, and avian migratory species throughout their ranges. Migratory species threatened with extinction are listed on Appendix I of the Convention. CMS parties strive towards strictly protecting these species, conserving or restoring the places where they live, mitigating obstacles to migration and controlling other factors that might endanger them. Migratory species that need or would significantly benefit from international cooperation are listed in Appendix II of the Convention, and CMS encourages the range states to conclude global or regional agreements.

**Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES).** It is an international agreement between governments. Its aim is to ensure that international trade in specimens of wild animals and plants does not threaten their survival. CITES was first formed, in the 1960s. Annually, international wildlife trade is estimated to be worth billions of dollars and includes millions of plant and animal specimens. The trade is diverse, ranging from live animals and plants to a vast array of wildlife products derived from them, including food products,

exotic leather goods, wooden musical instruments, timber, tourist curios and medicines. Levels of exploitation of some animal and plant species are high and the trade in them, together with other factors, such as habitat loss, is capable of heavily depleting their populations and even bringing some species close to extinction. Many wildlife species in trade are not endangered, but the existence of an agreement to ensure the sustainability of the trade is important in order to safeguard these resources for the future. Because the trade in wild animals and plants crosses borders between countries, the effort to regulate it requires international cooperation to safeguard certain species from over-exploitation.

**Ramsar Convention on Wetlands of International Importance 1971.** The Convention on Wetlands of International Importance, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. The Ramsar Convention is an international treaty for the conservation and sustainable utilization of wetlands. The Ramsar Convention is the only global environmental treaty that deals with a particular ecosystem. According to the Ramsar list of Wetlands of International Importance, there are five designated wetlands in Sri Lanka need to be protected. Activities undertaken in the proximity of Ramsar wetlands shall follow the guidelines of the convention. Sri Lanka presently has 5 sites designated as Wetlands of International Importance, with a surface area of 32,372 hectares.

**United Nations Educational, Scientific and Cultural Organization (UNESCO) World Heritage Convention.** The most significant feature of the 1972 World Heritage Convention is that it links together in a single document the concepts of nature conservation and the preservation of cultural properties. The Convention recognizes the way in which people interact with nature, and the fundamental need to preserve the balance between the two. The convention defines the kind of natural or cultural sites that can be considered for inscription on the World Heritage List. The convention sets out the duties of States Parties in identifying potential sites and their role in protecting and preserving them. By signing the Convention, each country pledges to conserve not only the World Heritage sites situated on its territory, but also to protect its national heritage. The states parties are encouraged to integrate the protection of the cultural and natural heritage into regional planning programs, set up staff and services at their sites, undertake scientific and technical conservation research and adopt measures, which give this heritage a function in the day-to-day life of the community. It also encourages states parties to strengthen the appreciation of the public for World Heritage properties and to enhance their protection through educational and information programs.

**Table 4: Environmental Criteria for Subproject Selection**

	Components	Environmental Selection Guidelines	Remarks
3.	Overall Selection Guideline (applicable to all components)	Comply with all requirements of relevant national, state, and local laws, rules, and guidelines.	
		Site selection process will avoid where possible land acquisition and involuntary resettlement where possible including impacts on vulnerable persons and indigenous peoples.	
		Site selection will avoid where possible locations in protected areas, including notified reserved forests or biodiversity conservation hotspots (sanctuary/national park, etc.).	Approval from concerned authority if unavoidable
		Subproject location shall not result in destruction/disturbance to historical and cultural places/values.	
		The subproject will avoid where possible, and minimize to an extent feasible facilities in locations with social conflicts.	
		The subproject will avoid where possible tree cutting and if any trees have to be removed, will plant two new trees for every one that is lost.	Approval from Forest Department
		Retain mature roadside trees which are important/valuable or historically significant and if any trees have to be removed, plant two new trees for every one that is lost.	
		The subproject will reflect inputs from public consultation and disclosure for site selection.	
4.	Transmission Lines, Distribution Lines, Substations	Comply with all requirements of relevant national law. Provincial and Local Authority regulations	
		Locate all new facilities at least 100 m from houses, shops or any other premises used by people, thus establishing a buffer zone to reduce the effects of noise, dust and the visual appearance of the site.	Distance restriction may be reviewed depending on site availability and buffer zone planning as well as by-laws of respective local authorities
		Locate Substations at sites where there is no risk of flooding or other hazards that might impair functioning or present a	Flood statistics data of the project area needs to be reviewed.

		risk of damage to its environs.	
		Consult the relevant national and/or local archaeological agencies regarding the archaeological potential of proposed sites and power lines to ensure that these are located in areas where there is a low risk of chance finds.	
		Locate towers/poles within the Right of Way (RoW) of other linear structures (roads, irrigation canals) as far as possible, to reduce the acquisition of new land.	
		Ensure that transmission routes do not require the acquisition of land from individual farmers in amounts that are a significant proportion of their total land holding (>10%).	
		Subproject will be implemented only with consent of CEA	
		Retain mature roadside trees, and if any trees have to be removed, plant two new trees for every one that is lost.	
3.	Solar and Wind parks, augmentation of substations	Only projects proposed or requested by the relevant agencies shall be considered for implementation.	
		Subprojects shall involve improvements within the boundary of existing facilities only.	
		Ensure that any facilities involving hazardous or polluting materials (e.g. waste oil disposal, SF6) are designed to national and international standards, to protect human health, both within and outside the facility.	
		Where new facilities are required, these shall be sited on vacant government land and ROWs where feasible.	
		Ensure that waste disposal in constructed facilities are designed to national and international standards.	

RoW = Right-of-Way

## Annexure 2 Route Analysis for 33 kV lines

Sr. No	Description	B.VI.1. Vavunia GSS - Kebithigollewa	B.VII.1. New Anuradhapura- Kahatagasdigiliya	B.VIII.1. Kiribathkumbura GSS – Galaha	B.IX.1. Galmaduwa- Akkaraipattu	B.IX.3. Akkaraipattu - Potuvil
1.	Length of line	23.00 km	31 km	15 km	15 km	42 km
2.	Canal / River crossings	No	yes	Yes	Yes	yes
3.	(i) Forest Area (in Hectare) (ii) Wild life Sanctuary/National Park (in Hectare) (iii) Distance from nearest Wildlife sanctuary/ National Park	28.60 ha	Scrublands (22.70 ha)  Secondary forest (3.40 ha)	Forest plantation (8.40 ha)	No None	Scrublands (23.70 ha)
4.	Development of Tower site - Number of towers - Land to be acquired for tower base	100 towers None	150 towers None	75 towers None	90 towers None	135 towers None
5.	Land Strata	Forest, Scrublands, Paddy, Home gardens	Home gardens, scrublands, secondary forest, Agricultural lands & Chena	Home gardens, agricultural lands, forest plantation, tea plantation & scrublands	Home gardens, & Agricultural lands	Home gardens, Scrubland, Rock out crops & Agricultural lands
6.	Road accessibility	A29	A9, A12 and A13	A1, A5, B116, B154, B364	A4 and A25	A4 and A25
7.	Private land (in ha.) (i) Agriculture:- a) Irrigated b) Non-irrigated (ii) Non-Agriculture / Private Waste land. (iii) House or Building: a) Residential b) Non-Residential	12 ha (Paddy fields)  3.2 ha (home gardens)	Irrigated (paddy) (20.6 ha)  Non-irrigated (Chena) (8.60 ha)  Residential (9.3 ha)	Irrigated (4.7 ha)  Tea Plantations (2.90 ha) Home gardens (10.5 ha)	Irrigated (paddy) (30.20 ha)  Residential (0.80 ha)	Irrigated (paddy) (53.40 ha)
8.	EHV Line Crossing	Yes	Yes	Yes	No	No
9.	HT line crossings	Yes	Yes	Yes	Yes	Yes
10.	No. of Forest Trees :- a) Trees to be felled b) Trees to be lopped	276 trees	712	354	None	198
11.	No. of private trees (i) Fruit Trees: a) Trees to be felled b) Trees to be lopped (ii) Non-Fruit Trees: a) Trees to be felled b) Trees to be lopped	78 trees	210	352	31	0
12.	Length of line in mountainous area	None	None	None	None	None
13.	Length of line in coastal area	None	None	None	None	None
14.	Length of line in cultivated area	7.6 km (home gardens &	19.25 km	9.00 km	15.4 km	26.70 km

Sr. No	Description	B.VI.1. Vavyunia GSS - Kebithigollewa	B.VII.1. New Anuradhapura-Kahatagasdigiliya	B.VIII.1. Kiribathkumbura GSS – Galaha	B.IX.1. Galmaduwa-Akkaraipattu	B.IX.3. Akkaraipattu - Potuvil
		agricultural lands				
15.	Length of line in un-cultivated area	1.10 km	14.25 km	4.20 km	Not applicable	12.90 km
16.	Highest altitude en-route the line	400 m (Viharahalmillawa)	128 m	900 M (Haloya colony)	30 m	20 m
17.	Nearest distance from airport	295 km	245 km	160 km	380 km	320 km
18.	Distance from nearest religious or archaeological sites	20 km to Weherabendigala	1- 30 km to Anuradhapura old city	10-30 km to Kandy, Temple of Tooth	Deegawapi 12 km	The distribution line is 2.5 km away from Lahugala- Kitulana National Park (1554 ha), and 3.5 km from Sagamam sanctuary (616 ha)
19.	Name of villages involved/Name of District	Vavuniya & Anuradhapura Districts	Kahatagasdigiliya, Anuradhapura district	Kandy	Ampara district	Ampara district
20.	Land to be permanently acquired: a) Area (in ha) b) Cost.	None	None	None	None	None

## Annexure 3 Locational Analysis for Gantry based Switching stations

S No	Description	B.VI.1. Kebelithigollewa Gantry	B.VII.1. Kahatagasdigiliya Gantry	B.VIII.1. Galaha Gantry	B.IX.2. Akkaraipattu Gantry	B.IX.4. Potuvil Gantry
1	Land Details					
1.1.a	Area of land	0.025 Ha	0.025 Ha	0.025 Ha	0.025 Ha	0.025 Ha
1.b	Slope/Plain Land	Flat terrain	Flat terrain	Undulating/ steep terrain	Flat terrain	Flat terrain
1.c	Approximate Amount of land cutting required	0.025 Ha	0.025 Ha	0.025 Ha	0.025 Ha	0.025 Ha
2.	Owner Ship of land (Private / Forest/ Other Govt. Department/ Other)	Private	Government, Divisional Secretary, Kahatagasdigiliya	Government, LRC Land	Government - Divisional Secretary, Akkaraipattu	Government, LRC land
3.	Private land (in ha.)					
	(i) Agriculture :- a) Irrigated b) Non – irrigated					
	(ii) Non - Agriculture/ Private Waste land / Banjar.	Non- Agriculture	Non- Agriculture	Non- Agriculture	Non-Agricultural	Abandoned Paddy fields
	(iii) House or Building: c) Residential d) Non – Residential	Home gardens	Near Muslim Maha Vidyalaya, part of an old burial ground	Non – Residential, part of a burial ground	Non – Residential	Non – Residential
4.	Distance from Nearest (With name )					
4.a	River (Name/Distance)	4.00 km to Kuda Oya		3.00 km to Nillamba Oya	1.50km to Tillial Aru	Arugam Kalapu (1.50 km)
4.b	Highway	0.50 km to B211	0.50 km to A12	0.10 km to B125	0.10 km from A4	10 m to A4
4.c	Forest Area	1.00 km to the Padaviya Forest Reserve	Not applicable	Not applicable	1.00 km to Marshland	8.00 km to Kumbukkan Forest Reserve
4.d	Village / town	Kebelithigollewa	Kahatagasdigiliya, Upuldeniya road	Palle Deltota	Akkaraipattu	Potuvil
4.e	Market/Area of Economic Activity	Home gardens	Home gardens	None	Paddy	None
5.	Road accessibility	A29 & B211	A12 , 500 m away from Kahatagasdigiliya town	B125	A4, B1 (2 <sup>nd</sup> mile post Akkaraipattu- Ampara road)	A4
6.	EHV Line Passing Near By (Distance)	Yes	Yes	Yes	No	No
7.	HT line Passing Near By	Yes	No	No	No	Yes
8.	No. of Forest Trees :- c) Trees to be felled d) Trees to be lopped	None	Not applicable	None	Not applicable	None
9.	No. of private trees					
	(iii) Fruit Trees:	6	8	10	3	None

S No	Description	B.VI.1. Kebilithigollewa Gantry	B.VII.1. Kahatagasdigiliya Gantry	B.VIII.1. Galaha Gantry	B.IX.2. Akkaraipattu Gantry	B.IX.4. Potuvil Gantry
	c) Trees to be felled d) Trees to be lopped					
	(iv) Non - Fruit Trees: c) Trees to be felled d) Trees to be lopped	None	None	None	None	None
10.	Distance from mountainous area	NA	NA	NA	NA	NA
11.	Distance from in cultivated area	0.20 km	20 m	0.10 km	100 m	100 m
12.	Altitude of Gantry	114 m	124 m	820 m	3 m	5 m
13.	Nearest distance from airport	295 km	245 km	160 km	395 km	345 km
14.	Distance from nearest religious or archaeological sites	20 km to Weherabendigala	30 km from Anuradhapura	32 km to Kandy, Temple of Tooth	35 km Deegawapi	None

## Annexure 4: Inventorisation along the Distribution Lines

## B-VI. Vavuniya-Kebithigollewa (33 kV).

Sl No	Kilometre		Distance (km)	No of Districts and Names	No of villages and names	Ownership of Land	Use of Land	Number of trees under cutting/trimming	Types and No of Trees
	From	To							
1	0.00	0.70	0.70	Vavuniya	Nedunkulam	Private	Home gardens (0.70km)	Kohomba	3
								Jackfruit	2
								Teak	6
								Coconut	5
								Tal	6
								kaju	4
2	0.70	1.70	1.00	Vavuniya	Nedunkulam (1.5km from Horowpaththana road)	Private	Agricultural (1.00km)	Paddy	
3	1.70	3.00	1.30	Vavuniya	Ambalangodalla	Private	Agricultural (1.30km)	Paddy	
4	3.00	4.20	1.20	Vavuniya	Near Madukanda wewa	Government & private	Agricultural (1.00) & Home gardens (0.20km)	Paddy	
								Mango	2
								Coconut	4
								Thal	6
								Kon	2
								Nebada	3
								Kumbuk	5
								Damba	2
								Kohomba	4
5	4.20	5.50	1.30	Vavuniya	Madukanda	Government	Secondary Forest & scrub land (1.3km)	Andara	6
								Godakaduru	2
								Kuratiya	2
								Thammanna	2
								Thal	4
								Palu	6
								Kohomba	5
								Andara	9
								Milla	4
6	5.50	6.40	0.90	Vavuniya	(4 km post) Kuda Kachchakudiya	Government	Scrub land & secondary forest (0.90km)	Eraminiya	3
								Burutha	1
								Hulanhik	2
								Seru	1
7	6.40	7.50	1.10	Vavuniya	Kuda Kachchakudiya	Government	Open area (abandoned paddy fields) & scrub land	Lolu	3
								Palu	3
								Burutha	2
								Kohomba	3
								Damba	1
8	7.50	8.80	1.30	Vavuniya	Etabagaskada	Government	Scrub land & secondary forest (0.90km)	Siyambala	1
								Weera	6
								Palu	7
								Kon	3
								Godakaduru	3
9	8.80	11.60	2.80	Anuradhapura	Dutuwewa	Government	Forest (2.8km)	Dunumadala	2
								Milla	4
								Weera	8
								Palu	10
								Kon	3
10	11.60	12.60	1.00	Anuradhapura	Dutuwewa	Government	Forest	Godakaduru	5
								Dunumadala	1
								Ehala	4
								Thimbiri	2
								Milla	4
								Kon	2



SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land (1.00km)	Number of trees under cutting/ trimming	Types and Nº of Trees
	From	To							
								Godakaduru	4
								Dunumadala	3
								Ahala	5
								Thibiri	1
								Milla	2
								Weera	6
11	12.60	13.80	1.20	Anuradhapu ra	Dutuwewa	Government	Forest (0.95km) & agricultural (0.25 km)	Palu	4
								Godakaduru	1
								Dunumadala	1
								Ehala	3
								Thimbiri	2
								Milla	3
								Weera	6
								Palu	7
								Nuga	1
								Paddy	
12	13.80	14.30	0.50	Anuradhapu ra	Dutuwewa	Government & private	Home gardens (0.10 km) & Scrub (0.40km)	Teak	3
								Weera	1
								Palu	2
								Kohomba	2
								Ehala	1
13	14.30	14.80	0.50	Anuradhapu ra	Kale- Puliyankulama	Private	Agricultural (0.50 km)	Paddy	
								Milla	2
								Jackfruit	1
								Teak	7
								Siyambala	2
								Kohomba	6
								Burutha	3
								Mango	8
15	17.40	18.20	0.80	Anuradhapu ra	Kunchuttuwa	Government	Secondary Forest (0.65km) & home gardens (0.15km)	Godakaduru	2
								Dunumadala	4
								Ehala	2
								Thimbiri	1
								Milla	1
								Mango	3
16	18.20	19.30	1.10	Anuradhapu ra	Wihara- Halmillawa	Government	Scrub land, secondary forest (0.15 km) & Agricultural (0.65km)	Dunumadala	1
								Ehala	2
								Thimbiri	4
								Milla	5
								Weera	2
								Palu	5
								Halmilla	2
								Teak	4
								Kaju	3
								Kohomba	1
								Mango	1
								Palu	1
18	19.80	22.40	2.60	Anuradhapu ra	Padaweya road 1.1km from Kebithigollewa	Government & private	Secondary Forest (2.40km) &) home gardens (0.20km)	Jackfruit	1
								Siyabala	2
								Kohomba	10
								Burutha	4
								Mango	3
								Teak	13
19	22.40	23.00	0,60	Anuradhapu ra	Kebithigollewa	Government & private	Secondary Forest (0.40km) & home gardens	coconut	2
								Jackfruit	2
								Teak	4
								Siyambala	1
								Kohomba	4

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land  (0.20km)	Number of trees under cutting/ trimming	Types and Nº of Trees
	From	To							
								Mango	1

**B-VII. Anuradhapura-Kahatagasdigiliya 33 kV**

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/ trimming
	From	To							
1	0.00	0.75	0.75	Anuradhapura	Pansala road/ Pahala Keerikkulama	Private	Home gardens	Coconuts	12
								Jackfruit	3
								Kohomba	4
								Dlum	2
								Mango	5
								WoodApple	3
								Nelli	1
								Teak	8
								Orange	1
2	0.75	1.00	0.25	Anuradhapura	Keerikkulama	Private	Agricultural (0.15km) & Chena (0.10)	Paddy	
								Maila	2
								Katakalla	1
								Welan	1
								Ehala	2
								Kohomba	3
								Siyambala	1
								Palu	4
3	1.00	3.30	2.30	Anuradhapura	Kawarakkulama	Private	Agricultural (1.00km) & Scrubland (1.30km)	Paddy	
								Maila	12
								Ketakela	4
								Welan	8
								Ahala	6
								Kohomba	7
								Siyambala	6
								Palu	12
								Hik	5
4	3.30	5.00	1.70	Anuradhapura	Wewa road Weweldigiliya	Private & Governmen t	Home gardens (0.50km), Agricultural (0.80km) & Scrubland (0.40km)	Coconuts	4
								Jackfruit	1
								Kohomba	3
								Kon	2
								Mango	2
								WoodApple	1
								Burutha	2
								Teak	6
5	5.00	6.10	1.10	Anuradhapura	Weweldigiliya	Private	Home gardens (0.80km) & Agricultural (0.30km)	Paddy	
								Coconuts	12
								Jackfruit	2
								Kohomba	8
								Mango	4
								Tal	9
								Palu	13
6	6.10	7.05	0.95	Anuradhapura	Karuwalagaswewa	Private & Governmen t	Agricultural (0.25km) & Scrubland (0.70km)	Siyambala	3
								Paddy	
								Maila	2
								Ketakela	3
								Welan	4
								Ehala	3
								Kohoba	5
								Siyambala	1

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name crops of	Number of trees under cutting/ trimming
	From	To							
								Palu	4
								Hik	2
								Kon	1
								Boradamiya	1
								Godakirilla	1
								Ficus	2
								Burutha	2
7	7.05	7.45	0.4	Anuradhapu ra	Wellaragama	Governmen t	scrubland (0.40km)	Kohomba	2
								Siyabala	1
								Palu	1
								Hik	2
								Kon	1
								Boradamiya	1
								Godakirilla	1
								Ficus	1
								Burutha	1
								Lolu	1
8	7.45	10.45	3.00	Anuradhapu ra	Maradankalla	Private & Governmen t	Secondary forest (0.70km), scrubland (1.15km) & Chena (1.15km)	Maila	12
								Katakalla	3
								Welan	5
								Ehala	6
								Kohomba	9
								Siyabala	4
								Palu	15
								Hik	3
								Kon	3
								Boradamiya	4
								Godakirilla	6
								Ficus	3
								Burutha	5
								Lantana	13
								Lolu	4
								Seru	1
								Kotadimbula	6
								Andara	12
								Mallotus	3
								Teak	14
9	10.45	11.85	1.40	Anuradhapu ra	Nochchikulama	Governmen t	Secondary forest (0.20km), scrubland (1.00km) &	Palu	5
								Hik	2
								Kon	2
								Boradamiya	3
								Godakirilla	5
								Ficus	4
								Burutha	6
								Lantana	14
								Lolu	6
								Seru	2
								Andara	10
								Mallotus	3
								Kotadimbula	5
10	11.85	12.30	0.45	Anuradhapu ra	Nochchikulama	Private & Governmen t	Agricultural (0.25km) & scrubland (0.20km)	Paddy	
								Palu	10
								Hik	2
								Kon	2
								Boradamiya	2
								Godakirilla	1
								Ficus	1
								Burutha	3
11	12.30	13.40	1.10	Anuradhapu	Tirappane	Private &	Home	Coconuts	6

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name crops	Number of trees under cutting/ trimming
	From	To							
				ra		Government	gardens (0.50km) & scrubland (0.45km)	Jackfruit	2
								Kohomba	5
								Kon	2
								Mango	3
								Palu	4
								Hik	1
								Kon	1
								Boradamiya	3
12	13.40	15.55	2.15	Anuradhapu ra	Near Tirappane wewa/ Tirappane	Private & Government	Home gardens (0.95km), Agricultural (0.35km) & scrubland (0.75km)	Paddy	
								Coconuts	14
								Jackfruit	3
								Kohoba	13
								Kon	4
								Mango	5
								Palu	8
								Hik	4
								Kon	4
								Boradamiya	5
								Mee	2
								Nabada	7
								Karada	4
								Welan	6
								Burutha	3
								Kubuk	9
13	15.55	17.05	1.50	Anuradhapu ra	Kasamaduwa	Private & Government	Agricultural (0.75km) & scrubland (0.75km)	Paddy	
								Palu	5
								Hik	6
								Kon	3
								Boradamiya	1
								Burutha	2
								Kumbuk	5
14	17.05	19.45	2.40	Anuradhapu ra	Near Kasamaduwa wewa/ Kasamaduwa	Private & Government	Home gardens (0.20km), Agricultural (1.00km) & scrubland (0.80km)	Kohomba	4
								Kon	4
								Mango	5
								Palu	3
								Hik	3
								Kon	4
								Paddy	
								Coconut	12
								Teak	4
								Tal	5
								Nelli	2
								Boradamiya	5
								Burutha	6
								Kumbuk	7
15	19.45	21.80	2.25	Anuradhapu ra	Galenbindunuwe wa	Private & Government	Home gardens (0.10km), Agricultural (0.90km) & scrubland (1.25km)	Kohomba	8
								Kon	4
								Mango	10
								Palu	16
								Hik	3
								Coconut	12
								Paddy	
								Ehala	4
								Teak	14
								Tal	5
16	21.80	22.00	0.20	Anuradhapu ra	Galenbindunuwe wa	Private	Chena (0.20km)	Palu	3
								Hik	2
								Kon	2
17	22.00	23.25	1.25	Anuradhapu	Tihogama	Private &	Home	Coconut	4

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name crops of	Number of trees under cutting/ trimming
	From	To							
				ra		Government	gardens (0.15km), secondary forest (0.75km) & Chena (0.35km)	Teak Tal Mango Kumbuk Nabada Kon Godakaduru Palu Weera	5 3 1 3 4 2 2 4 5
18	23.25	23.60	0.35	Anuradhapu ra	Tihogama	Private	Agricultural (0.20km), Chena (0.15km)	Paddy Palu Weera Welan	 4 2 2
19	23.60	23.80	0.20	Anuradhapu ra	Tihogama	Private	Agricultural (0.20km)	Paddy	
20	23.80	24.25	0.45	Anuradhapu ra	Rathmale	Private	Agricultural (0.20km)	Paddy	
21	24.25	27.10	2.85	Anuradhapu ra	Nelugollakada	Private & Government	Agricultural (0.70km), Chena (0.65km) and scrub land (1.50km)	Paddy Palu Hik Kon Boradamiya Godakirilla Ficus Burutha Lantana Lolu Seru Andara Mallotus Weera	 4 3 2 1 4 1 3 4 3 1 10 4 3
22	27.10	27.95	0.85	Anuradhapu ra	Nelugollakada	Private & Government	Agricultural (0.60km) and scrubland(0. 20km)	Paddy Ficus Burutha Siyambala Palu Weera Andara Acasia	 1 3 4 2 3 7 4
23	27.95	29.30	1.35	Anuradhapu ra	Digan Halmillewa	Private	Home gardens (0.30km), Agricultural (1.05km)	Paddy Coconuts Jackfruit Kohomba Teak Mango WoodApple	 3 1 3 4 3 1
24	29.30	29.95	0.65	Anuradhapu ra	Digan Halmillewa	Private	Home gardens (0.40km), Agricultural (0.25km)	Paddy Coconuts Jackfruit Kohomba Teak Mango Burutha	 5 1 3 4 4 3
25	29.95	32.35	2.40	Anuradhapu ra	Paluketuwewa	Private & Government	Agricultural (0.60km), & Chena (1.30km) scrubland(0. 50km)	Paddy Coconuts Jackfruit Kohomba Teak Mango	 4 3 5 6 4

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name crops of	Number of trees under cutting/ trimming
	From	To							
26	32.35	32.75	0.40	Anuradhapur a	Kuda Messallewa	Private	Chena (0.40km)	Burutha	2
								Palu	8
								Andara	6
								Welan	4
								Palu	5
								Tal	3
								Andara	2
27	32.75	33.50	0.75		Kahatagasdigiya	Private	Agricultural (0.75km),	Welan	6
								Paddy	

**B-VIII. Kiribathkumbura-Galaha gantry 33 kV.**

VIII.1 33 kV 15 km distribution line from Kiribathkumbura GSS to Galaha gantry.

VIII.2 33/11 kV Galaha Gantry.

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name crops of	Number of trees under cutting/ trimming
	From	To							
1	0.00	0.50	0.50	Kandy	Elugoda	Private	Home gardens (0.50km)	Alstonia	6
								Coconut	7
								Mahogany	8
								Sadikka	6
2	0.50	1.05	0.55	Kandy	Daulagala road	Private	Home gardens with Tea lands (0.55km)	Alstonia	4
								Coconut	5
								Mahogany	6
								Sadikka	4
								Avocado	2
3	1.05	1.45	0.40	Kandy	Hendeniya/ Yalegoda road	Private	Home gardens (0.20km) & Agricultural (0.20km)	Rabutan	1
								Paddy	
								Alstonia	5
								Coconut	6
								Mahogany	4
								Sadikka	2
4	1.45	2.70	1.25	Kandy	Meewathur a	Private	Agricultural (1.25km)	Jackfruit	3
								Sapu	2
								Paddy	
								Alstonia	4
								Coconut	6
								Mahogany	3
								Sadikka	2
5	2.70	3.20	0.50	Kandy	Anngunawa la	Private	Home gardens (0.45km) & Agricultural (0.05km)	Jackfruit	1
								Sapu	4
								Paddy	
								Alstonia	4
								Coconut	5
								Mahogany	3
								Sadikka	2
								Jackfruit	3
6	3.20	3.55	0.35	Kandy	Kuruduwa a	Private	Home gardens (0.45km)	Mango	4
								Rabutan	2
								Avocado	1
								Paddy	
								Alstonia	5
7	3.55	4.10	0.55	Kandy	Hindagala	Private	Home gardens		

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land  (0.45km) & Agricultural (0.05km)	Name of crops	Number of trees under cutting/ trimming
	From	To							
								Coconut	6
								Mahogany	3
								Sadikka	4
								Jackfruit	1
								Sapu	1
8	4.10	4.30	0.20	Kandy	Galaha road/Hinda gala	Private	Home gardens (0.20km)	Coconut	4
								Mahogany	3
								Sadikka	4
								Jackfruit	5
								Sapu	3
								Avocado	5
								Mango	5
								Avocado	4
								Weralu	1
								Arecanut	7
9	4.30	4.70	0.40	Kandy	Mowbray tea state/ Mahakandd a	Private	Home gardens (0.10km) & Scrublands (0.30km)	Durian	2
								Karabu	4
								Sadikka	3
								Alstonia	4
								Coconut	4
								Mahogany	4
10	4.70	5.95	1.25	Kandy	Haloya colony/ Sarasaviga ma	Private	Home gardens (0.20km), plantation (0.85km) & Forest plantation (0.20km)	Sadikka	2
								Alstonia	5
								Coconut	13
								Mahogany	4
								Pinus	15
								Acacia	13
								Sapu	3
								Avocado	6
								Mango	7
								Arcanut	4
11	5.95	7.05	1.10	Kandy	Watagoda	Government and private	Forest plantation (1.10km) &	Alstonia	6
								Lunumiddella	4
								Sabukku	22
								Eucalyptus	25
								Pinus	70
12	7.05	8.45	1.40	Kandy	Wariyagala	Private	Tea plantation (0.60km) & Forest plantation (0.80km)	Tea	5
								Pinus	56
								Rath kaliya	4
								Mara	2
								Na-Ibul	3
								Acacia	4
13	8.45	9.85	1.40	Kandy	Nillamba	Private Private	Home gardens (0.25km) and Forest (1.15km)	sabukku	3
								Coconut	5
								Mahogany	6
								Sadikka	3
								Jackfruit	1
								Sapu	4
								Na-Imbul	5
								Acacia	4
								sabukku	6
								Pinus	19
14	9.85	10.10	0.25	Kandy	Nillamba	Private	Home gardens (0.25km)	Avocado	4
								Rambutan	5
								Coconut	4
								Mahogany	3
								Sadikka	2
								Jackfruit	1

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/ trimming
	From	To							
15	10.10	11.00	0.90	Kandy	Halwatte	Private	Home gardens (0.25 km) and Scrub lands (0.65 km)	Sapu	4
								Avocado	5
								Alstonia	4
								Coconut	3
								Mahogany	2
								Sadikka	1
								Jackfruit	4
								Weralla	4
								Kekilla	13
								Dawata	4
								Walsuriyak-antha	12
								Acacia	3
16	11.00	12.00	1.00	Kandy	Palle Delthota	Private	Home gardens (0.60 km) & Agricultural (0.40 km)	Pinus	13
								Sabukku	1
								Karabuneti	4
								Sadikka	3
								Alstonia	5
								Coconut	12
								Mahogany	4
								Mango	5
17	12.00	13.2	1.20	Kandy	Palle Delthota	Private	Home gardens (0.80 km) & Agricultural (0.40 km)	Jackfruit	4
								Paddy	
								Areca nut	12
								Alstonia	5
								Lunumiddella	2
								Sabukku	10
								Eucalyptus	8
								Pinus	7
								Sadikka	2
								Jackfruit	2
								Paddy	

**B-IX. Galmadu Junction-Akkaraipaththu- Pothuvil 33 kV.**

IX.1 33 kV 18 km distribution line from Galmadu Junction to Akkaraipaththu.

SI Nº	Kilometre		Distance (km)	Nº of Districts and Names	Nº of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/ trimming
	From	To							
1	0.00	3.05	3.05	Ampara	Waripathancha nai	Private	Agricultural (2.85km) & Home garden (0.20km)	Paddy	
								Kohomba	3
								Coconut	2
								Mango	4
2	3.05	6.20	3.15	Ampara	9th Mile post, Ilukhena	Private	Agricultural (2.95km) & Home garden (0.20km)	Siyambala	1
								Paddy	
								Kottamba	1
								Arcea nut	2
								Pullun	1
								Mango	1
								Siyambala	1
3	6.20	7.40	1.20	Ampara	8th Mile post, Ilukhena	Private	Agricultural (1.00km) & Home garden (0.20km)	Kohomba	4
								Coconut	2
								Paddy	
								Kapok	1
								Mango	1
								Siyambala	1
								Kohomba	4
								Tal	2



SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/trimming
	From	To							
4	7.40	8.25	0.85	Ampara	Sinhapura	Private	Agricultural (1.20km)	Paddy	
5	8.25	9.75	1.50	Ampara	8th Mile post, Mohinipura	Private	Agricultural (1.50km)	Paddy	
6	9.75	14.60	4.85	Ampara	Mottalakattu	Private	Agricultural (4.85km)	Paddy	
7	14.60	15.40	0.80	Ampara	3.5 km from Akkaraipattu town	Private	Agricultural (0.80km)	Paddy	

## IX.3 33 kV 42 km distribution line from Akkaraipattu to Pothuvil.

SI N <sup>o</sup>	Kilometre		Distance (km)	N <sup>o</sup> of Districts and Names	N <sup>o</sup> of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/trimming
	From	To							
1	0.00	3.90	3.90	Ampara	Kannakipuram	Private	Agricultural (3.8km) & Marshland (0.10km)	Paddy	
2	3.90	8.45	4.55	Ampara	Near start point of Alikambe road	Private	Agricultural (4.50km) & Marshland (0.05km)	Paddy	
3	8.45	9.15	0.70	Ampara	Sagamam	Private	Agricultural (0.55km) & Rock out (0.15km)	Paddy	
								Kohomba	2
								Himmbutu	1
								Milla	5
								Welan	4
4	9.15	10.65	1.50	Ampara	Sagamam	Private	Agricultural (1.50km)	Paddy	
5	10.65	14.20	3.55	Ampara	Karaikalapu	Private	Agricultural (3.55km)	Paddy	
6	14.20	15.70	1.50	Ampara	Kannchirankuda	Private	Agricultural (1.50km)	Paddy	
7	15.70	19.05	3.35	Ampara	Kannchirankuda	Private	Agricultural (3.30km)	Paddy	
8	19.05	20.60	1.55	Ampara	In front of Thandiedi kalapu	Private	Agricultural (1.05km) & Scrubland (0.50km)	Paddy	
								Kohomba	3
								Hibutu	1
								Milla	2
								Welan	3
								Araminiya	3
9	20.60	22.25	1.65	Ampara	Kanchikudichchi aru	Government	Scrubland (1.45km)	Kohomba	3
								Hibutu	2
								Milla	5
								Welan	4
								Araminiya	2
								Ficus	2
								Weera	2
								Ehala	4
								Wood Apple	3
								Ahala	2
								Ranawara	1
								Tal	4
								Radaliya	4
								Lolu	3
								Hik	6
								Teak	4

SI N°	Kilometre		Distance (km)	N° of Districts and Names	N° of villages and names	Ownership of Land	Use of Land	Name of crops	Number of trees under cutting/trimming
	From	To							
10	22.25	28.65	6.40	Ampara	Near Komari Kalapu	Government & Private	Agricultural (1.05km) & Scrubland (5.35km)	Paddy	
								Hibutu	3
								Milla	2
								Welan	4
								Araminiya	2
								Ficus	1
								Weera	1
								Ahala	3
11	28.65	33.70	5.05	Ampara	Near Ureni Kalapu	Government	Marshland (0.75 km) & Scrubland (4.30km)	Palu	1
								Kohomba	9
								Hibutu	12
								Milla	13
								Welan	16
								Araminiya	9
								Ficus	3
								Weera	4
								Ahala	8
								Wood Apple	2
								Palu	2
								Ranawara	3
12	33.70	34.95	1.25	Ampara	Rotai wewa housing scheme	Government & Private	Agricultural (1.00km) & Scrubland (0.25km)	Radaliya	5
								Lolu	6
								Paddy	
								Ahala	4
								Ranawara	1
								Radaliya	2
13	34.95	39.15	4.20	Ampara	Near tamarakulam Wewa	Private	Agricultural (4.20km)	Lolu	1
								Tal	3
								Kohomba	3
14	39.15	39.85	0.70	Ampara	300m away from Police station	Government & Private	Agricultural (0.70km)	Paddy	

## Annexure 5 Environment Management Plan (EMP)

Project Activity	Potential Environmental Impact	Mitigation Action	Parameters to be Monitored	Standards	Institutional Responsibility	Implementation Schedule
<b>Pre-construction</b>						
Temporary use of lands	Impact to the existing environment	Selection of lands adhering to local laws and regulations and in close consultation with LAs Contraction facilities should be placed at least 500 m away from water bodies, natural flow paths, important ecological habitats and residential areas	Water and air quality	Air quality Standards and CEA water quality standards	CEB Contractor	Detailed design
Substation location and design	Noise generation Exposure to noise, Nuisance to neighbouring properties	Substation designed to ensure noise will not be a nuisance.	Expected noise emissions based on substation design, noise levels	Noise control regulations in 1994 Noise levels to be specified in tender documents	CEB	Detailed design
	Disturbance to the adjacent lands and the people due to cut and fill operations	Maintain adequate clearance, construction of retaining structures, minimise cut and fill operations adjoining to the dwellings	Proximity to houses and other structures	Technical specification	CEB	Detailed design
Location of towers and line alignment and design	Exposure to safety related risks	Setback of dwellings to overhead line route designed in accordance with permitted level of power frequency and the regulation of supervision at sites.	Tower location and line alignment selection with respect to nearest dwellings	Setback distances to nearest houses -	CEB	Part of tower sighting survey and detailed alignment survey and design
	Impact on water bodies / land/ residences	Consideration of site location at where they could be located to avoid water bodies or agricultural land as much as possible. Careful site selection to avoid existing settlements	Site location, line alignment selection (distance to dwelling, water and/or agricultural land)	Consultation with local authorities and land owners, CEA water quality standards	CEB	Part of detailed project sighting and survey and design
Equipment specifications and design parameters	Release of chemicals and harmful gases in receptors (air, water, land)	PCBs not used in substation transformers or other project facilities or equipment.	Compliance with setback distances ("as-built" diagrams)	Setback distances to nearest houses	CEB	Detailed design
Encroachment into precious ecological areas	Loss of precious ecological values/ damage to precious species	Avoid encroachment by careful site and alignment selection Minimise the need by using existing towers and RoW wherever possible	Floral and faunal habitats loss	Flora and fauna protection act.	CEB	Detailed design
Involuntary resettlement or land acquisition	Loss of lands and structures	Compensation paid for temporary/ permanent loss of productive land as per Sri Lankan procedures	Public complaints	Rates stipulated in the Resettlement plan/ Frame work for the project	CEB	Prior to construction phase
Encroachment into farmland	Loss of agricultural productivity	Use existing tower footings/towers wherever possible Avoid sighting new towers on farmland	Tower location and line alignment selection Design of Implementation	Agrarian Service Act. Consultation with local	CEB	Part of detailed alignment survey and design

		wherever Farmers compensated for any permanent loss of productive land trees that need to be trimmed or removed along RoW.	of Crop and tree compensation (based on affected area) Statutory approvals for tree trimming /removal	authorities and design engineers		
Interference with drainage patterns/Irrigation channels	Temporary flooding hazards/loss of agricultural production	Appropriate sighting of towers to avoid channel interference	Site location and line alignment selection	Irrigation Act 1933. Consultation with local authorities and design engineers	CEB	Detailed alignment survey and design
Explosions/Fire	Hazards to life	Design of substations to include modern fire control systems/firewalls.  Provision of fire fighting equipment to be located close to transformers, power generation equipment.	Substation design compliance with fire prevention and control codes	Tender document to mention detailed specifications	CEB	Part of detailed substation layout and design /drawings
<b>Construction</b>						
Removal or disturbance to other public utilities	Public inconvenient	Advance notice to the public about the time and the duration of the utility disruption  Use of well trained and experienced machinery operators to reduce accidental damage to the public utilities  Restore the utilities immediately to overcome public inconvenient	Disruption other commercial and public activities / Public complaints	Technical specification	CEB/ PRDA / NWSDB/SLT	Throughout the construction period
Acquisition of paddy fields and other lands	Loss of agricultural productivity	Avoid farming season wherever possible for the project activities.  Ensure existing irrigation facilities are maintained in working condition  Protect /preserve topsoil and reinstate after construction completed  Repair /reinstate damaged bunds etc after construction completed  Compensation for temporary loss in agricultural production	Land area of agriculture loss  Usage of existing utilities  Status of facilities (earthwork in m <sup>3</sup> )  Implementation of Crop compensation (amount paid, dates, etc.)	Agrarian Service Act. Regular monitoring compliance with regulations	CEB, Contractor through contract provisions	Throughout the construction period
Temporary outage of the electricity	Loss of power supply to the local community when distribution lines crossing the new line are switched	Advance notice to the public about the time and the duration of the utility disruption  Restore the utilities immediately to overcome	Houses and commercial premises of power disruption	Regular monitoring during the period of strengthening the conductors	Contractor CEB	Throughout the construction period

	off	public inconvenient.				
Equipment layout and installation	Noise and vibrations	Selection of construction techniques and machinery to minimise ground disturbance.	Construction techniques and machinery	Minimal ground disturbance	CEB, Contractor through contract provisions	Construction period
Substation construction	Loss of soil	Fill for the substation foundations obtained by creating or improving local drain system.	Borrow area sighting (area of site in m <sup>2</sup> and estimated volume in m <sup>3</sup> )	Laws and regulations of respective LAs	CEB, Contractor through contract provisions	Construction period
	Water pollution	Construction activities involving significant ground disturbance (i.e. substation land forming) not undertaken during the monsoon season.	Seasonal start and finish of major earthworks (pH, BOD/COD, Suspended solids, other)	Timing of major disturbance activities - prior to start of construction activities	CEB, Contractor through contract provisions	Construction period
Construction schedules	Noise nuisance to neighbouring properties	Construction activities only undertaken during the day and local communities informed of the construction schedule.	Timing of construction (noise emissions, [dB(a)])	Daytime construction only	CEB, Contractor through contract provisions	Construction period
Provision of facilities for construction workers	Contamination of receptors (land, water, air)	Construction workforce facilities to include proper sanitation, water supply and waste disposal facilities.	Amenities for Workforce facilities	Presence of proper sanitation, water supply and waste disposal facilities	CEB, Contractor through contract provisions	Construction period
Surplus earthwork/soil	Runoff to cause water pollution, solid waste disposal	Excess fill from tower foundation excavation disposed of next to roads or around houses, in agreement with the local community or landowners.	Location and amount (m <sup>3</sup> ) of fill disposal Soil disposal locations and volume (m <sup>3</sup> )	Appropriate fill disposal and dispersal locations	CEB, Contractor through contract provisions	Construction period
Wood/vegetation harvesting, cut and fill operations	Loss of vegetation and deforestation	Construction workers prohibited from harvesting wood in the project area during their employment.	Illegal wood /vegetation harvesting (area in m <sup>2</sup> , number of incidents reported)	Complaints by local people or other evidence of illegal harvesting	CEB, Contractor through contract provisions	Construction period
	Effect on fauna	Prevent his work force from disturbing to the flora, fauna including hunting of animal and fishing in water bodies  Proper awareness programme regarding conservation of flora, fauna including ground vegetation to all drivers, operators and other workers	Habitat loss	Fauna and flora protection Act.	CEB/ DWC/ DoF	Construction period
Site clearance	Vegetation	Marking of vegetation to be removed prior to clearance, and strict control on clearing activities to ensure minimal clearance.	Vegetation marking and clearance control (area in m <sup>2</sup> )	Felling of trees (Amendment Act. Nº 01 of 2000 and act of felling of trees control) Clearance strictly limited to target vegetation	CEB, Contractor through contract provisions	Construction period

	Soil erosion and surface runoff	Construction in erosion and flood-prone areas should be restricted to the dry season  Treat clearing and filling areas against flow acceleration and construction work should be carefully designed to minimise obstruction or destruction to natural drainage	Soil erosion	Visual inspection (Turbidity and sedimentation)	CEB, Contractor through contract provisions	Construction period
Mechanised construction	Noise, vibration and operator safety, efficient operation  Noise, vibration, equipment wear and tear	Construction equipment to be well maintained.  Proper maintenance and turning off equipment not in use.	Construction equipment - estimated noise emissions and operating schedules	Technical specifications, safety regulations, Noise control regulations in 1994	CEB, Contractor through contract provisions	Construction period
Construction of roads for accessibility	Increase in airborne dust particles  Increased land requirement for temporary accessibility	Existing roads and tracks used for construction and maintenance access to the site wherever possible.  New access ways restricted to a single carriageway width within the RoW.	Access roads, routes (length and width of new access roads to be constructed)	Use of established roads wherever possible  Access restricted to single carriageway width within RoW	CEB, Contractor through contract provisions	Construction period
Transportation and storage of materials	Nuisance to the general public	Transport loading and unloading of construction materials should not cause nuisance to the people by way of noise, vibration and dust  Avoid storage of construction materials beside the road, around water bodies, residential or public sensitive locations  Construction materials should be stored in covered areas to ensure protection from dust, emissions and such materials should be bundled in environment friendly and nuisance free manner	Water and air quality	National Environment Act Laws and regulations of respective LAs National Emission Standards and CEA water quality standards	CEB/ CEA/LAs	Construction period
Trimming/cutting of trees within RoW	Fire hazards  Loss of vegetation and deforestation	Trees allowed to grow up to a height within the RoW by maintaining adequate clearance between the top of tree and the conductor as per the regulations.  Trees that can survive pruning to comply should be pruned instead of cleared.  Felled trees and other cleared or pruned	Species-specific tree retention as approved by statutory authorities (average and maximum tree height at maturity, in metres)  Disposal of cleared vegetation as approved	Felling of trees (Amendment Act. No 01, of 2000 and act of felling of trees control)  Presence of target species in RoW following vegetation	CEB, Contractor through contract provisions	Construction period

		vegetation to be disposed of as authorised by the statutory bodies.	by the statutory authorities (area cleared in m <sup>2</sup> )	clearance.		
Health and safety	Injury and sickness of workers and members of the public	Contract provisions specifying minimum requirements for construction camps  Contractor to prepare and implement a health and safety plan.  Contractor to arrange for health and safety awareness programmes	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Health and safety regulations	CEB (Contractor through contract provisions)	Construction period
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.  Use existing access ways as much as possible.  Productive land will be reinstated following completion of construction  Compensation will be paid for loss of production, if any.	Contract clauses Design basis and layout Reinstatement of land status (area affected, m <sup>2</sup> ) Implementation of Tree/Crop compensation (amount paid)	Incorporating good construction management, design engineering practices  Consultation with affected parties immediately after completion of construction and after the first harvest	CEB (Contractor through contract provisions)	Construction period
<b>Operation and Maintenance Phase</b>						
Electric shock	Death or injury to the workers and public	Security fences around substation  Establishment of warning signs  Careful design using appropriate technologies to minimise hazards	Proper maintenance of fences and sign boards  Usage of appropriate technologies (lost work days due to illness and injuries)	Periodic maintenance  Number of programmes and percent of staff /workers covered	CEB	Throughout the operation
Noise generation	Nuisance to the community around the site	Provision of noise barriers	Noise level	Noise level (db)- Once a year	CEB	Throughout the operation
Maintenance of Distribution line	Exposure to electromagnetic interference	Distribution line design to comply with the limits of electromagnetic interference from overhead power lines	Required ground clearance (metres)	Ground clearance -	CEB	Throughout the operation
Substation maintenance	Exposure to electromagnetic interference	Substation design to comply with the limits of electromagnetic interference within floor area	Required vibrations level, instrumentation	Technical specifications	CEB	Throughout the operation
Oil spillage	Contamination of land/nearby water bodies	Substation transformers located within secure and impervious bundled areas with a storage capacity of at least 100% of the capacity of oil in transformers and associated reserve tanks.	Substation bounding (“as-built” diagrams)	National Environment Act, Bounding capacity and permeability	CEB	Throughout the operation

## Annexure 6 Environmental Parameters and Periodicity for Environmental Monitoring Plan

Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (LKR)	Implementation	Supervision
1. Air Quality	A. Pre-construction stage (The project after assign to contractor)	SO <sub>2</sub> , NO <sub>2</sub> , CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	A single time	NAAQS of Sri Lanka	Per sample LKR 9,000	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	SO <sub>2</sub> , NO <sub>2</sub> , CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	Two times	NAAQS of Sri Lanka	Per sample LKR 9,000	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	SO <sub>2</sub> , NO <sub>2</sub> , CO, Pb, PM10, TSPM	Inside and outside (0.5 km) of the proposed substation	A single time	NAAQS of Sri Lanka	Per sample LKR 9,000	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA
2. Water Quality	A. Pre-construction stage (The project after assign to contractor)	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	A single time	CEA Water Quality Regulations	Per sample LKR 14,000	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	1 time/ 3 months	CEA Water Quality Regulations	Per sample LKR 14,000	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	EC, TSS, DO, BOD, P <sup>H</sup> Oil and grease, Pb, E	Nearest wells (2 wells) around the substation	1 time/ 3 months	CEA Water Quality Regulations	Per sample LKR 14,000	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA
3. Noise/ Vibration	A. Pre-construction stage (The project after assign to contractor)	Noise level (dB level)	Inside and outside (0.5 km) of the proposed substation	A single time	National Environmental (Noise Control) Regulations, NAAQS	Per sample LKR 6,500	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	Noise level (dB level)	Inside and outside (0.5 km) of the proposed substation	2 times year	National Environmental (Noise Control) Regulations,	Per sample LKR 6,500	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA



Environmental component	Project stage	Parameters to be monitored	Location	Frequency	Standards	Rate (LKR)	Implementation	Supervision
	C. Operation Stage	Noise level (dB level)	Inside and outside (0.5 km) of the proposed substation	3 times year	NAAQS National Environmental (Noise Control) Regulations, NAAQS	Per sample LKR 6,500	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA
<b>4. Soil</b>	A. Pre-construction stage (The project after assign to contractor)	P <sup>H</sup> · Sulphate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistivity, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	A single time	Technical specifications	Per sample LKR 13,500	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	B. Construction Stage	P <sup>H</sup> · Sulphate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistivity, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	Two times	Technical specifications	Per sample LKR 13,500	Contractor by engaging approved monitoring agency(Sri Lankan Government)	Contractor/CEB /CEA
	C. Operation Stage	P <sup>H</sup> · Sulphate (SO <sub>3</sub> ), Chloride, ORP, Salinity, Resistivity, Organic Matter, Moisture Content	Inside and outside (just close to the proposed site, 2 locations) of the proposed substation	A single time	Technical specifications	Per sample LKR 13,500	CEB by engaging approved monitoring agency(Sri Lankan Government)	CEB/CEA

**Abbreviations:**SO<sub>2</sub>- Sulphur DioxideNO<sub>2</sub>- Nitrogen Dioxide

CO- Carbon Monoxide

Pb- Lead

PM10- Particulate Matter &lt;10

TSPM- Total suspended Particulate Matter

EC- Electrical Conductivity

DO- Dissolved Oxygen

TSS- Total Suspended Solids

BOD- Biological Oxygen Demand

NAAQS- National Air Quality Standards

CEA- Central Environmental Authority

NWQS- National Water Quality Standards

CEB- Ceylon Electricity Board

**Notes:** Transport and Accommodation cost, NBT, VAT etc. are not included for the EMoP. Rates valid for the period of 60 days. Information based on the quotation provided by NBRO (National Building Research Organisation).

## Annexure 7 Granting of Necessary Wayleaves for Electricity Networks in Sri Lanka - Guidelines for Licensees, Divisional Secretaries and Landowners and/or Occupiers

*Refer to Annexure 7*

## A 17. Annex 17: EDD: Solar Rooftop Power Generation Pilot Program

### EXECUTIVE SUMMARY

1. Asian Development Bank (ADB) is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement of Ceylon Electricity Board (CEB) with a focus to identify the transmission and distribution projects for evacuation of renewable energy (wind and solar) parks/projects and overall improvement of network efficiency as well as a Public Private Partnership (PPP) based model pilot rooftop solar component on private/public buildings/universities.
2. The pilot rooftop solar component of the Clean Energy and Network Efficiency Improvement Project will include options for installing the rooftop systems on public buildings/universities on a PPP basis i.e. installation, operation and maintenance handled by the private sector. In addition, the project will also help to facilitate a sustainable private sector participation in solar rooftop project development by involving private entities (hotels, private factories, commercial entities, etc.). The project will also have a component to provide project implementation and monitoring consultancy support to the Sri Lanka Sustainable Energy Authority (SLSEA) in its role as the implementation agency for the duration of the project implementation.
3. The projects on the public buildings/universities will be developed on a PPP mode through allocation of an investment grant portion by the government for installing solar rooftop power generation on selected university buildings. The financing by private sector solar rooftop projects will be undertaken by providing credit to eligible private developers from a credit line as part of the project loan. The proposed pilot solar systems are expected to be bid out to the private sector for designing, developing, installation and commissioning that may help to bring down capital costs to a reasonable level. The scope can include a maintenance contract for a period of 10 years. National Competitive Bidding (NCB) procedures would be adopted for the selection of service providers.
4. SLSEA will be supported by project management consulting services to ensure effective implementation and monitoring of the pilot project and contribute to capacity building in SEA. It is proposed to finance these consulting services (one national consultant for 24 person-months) from the grant proceeds.
5. Impacts are manageable and can be managed cost effectively - Environmental impacts are likely to result from the proposed rooftop solar PV power generation with net metering concept, which does not require battery storage. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design to be done by project proponent would ensure that inclusion of any environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites.
6. Benefits far outweigh negative impacts - Installation of rooftop solar power generation will improve operational efficiency and quality of power, reliability of the system in the building, introduce net metering concept and supply of excess power to the local area thereby reducing the load on the local grid and boosting economic development of the area. Overall, the major social and environmental impacts associated with such projects are very small and limited to the construction period and can be mitigated through best engineering and environmental practices. The project will not have any negative environmental impacts and the project would help in improving the socio-economic conditions in the area. As the project falls in "Category C" as per the ADB's guidelines, no detailed IEE or an EIA study is required.
7. Since the project does not involve battery storage activities, that have significant adverse impact, due diligence has been done to determine the extent of impact of net metering as per the ADB's Safeguard Policy of 2009 guidelines. Accordingly, the environmental classification for the sub-project component proposed is "Category C". The EDD report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>46</sup> and the new ADB Safeguard Policy 2009.

<sup>46</sup> ADB. 2003. Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines. Manila.

## 1 Introduction

1. Sri Lanka has experienced high economic growth in the recent past. With the end of civil conflict in 2009, the country requires sustained focus on post-conflict infrastructure development to remove disparities in economic and social status of the poorer Eastern and Northern provinces. Asian Development Bank's (ADB's) focus on development of power sector infrastructure in partnership with other development partners, contributes to the provision of reliable, adequate, and affordable power supply for sustainable economic growth and poverty reduction in Sri Lanka.

2. The power sector has undergone significant policy level and structural changes in the recent past:

- Sri Lanka Electricity Act passed in Parliament in 2009;
- Assumption of the role of electricity regulator in April, 2009 by the Public Utilities Commission of Sri Lanka (PUCSL);
- Creation of Functional Business Units (FBU's) within the CEB with one unit each for generation and transmission and 4 geographical units for distribution function; and
- All FBU's have been issued licenses by the Public Utilities Commission of Sri Lanka (PUCSL) and they have been filing the tariff petitions since 2010.

3. In January 2011, ADB approved the Sustainable Power Sector Support Project with focus on Clean Energy and Access Improvement Project with focus on distribution system strengthening, rural electrification and distribution improvement, energy efficiency and renewable energy development etc.

4. Asian Development Bank's (ADB) involvement in the Power Sector Development Program has been consistent with its country partnership strategy for Sri Lanka which focuses on:

- Funding transmission projects to remove grid constraints on absorbing additional capacity from renewable energy sources,
- Improving energy efficiency and reliability by strengthening the transmission network,
- Expanding access to electricity by improving connectivity for the poor, and
- Mitigating climate change by financing clean energy projects and supporting energy efficiency initiatives.

5. ADB is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement. The specific focus of this assistance is to identify the transmission and distribution projects as well as solar rooftop projects, which could be funded. The proposed 2012 Clean Energy and Network Efficiency Improvement Project will include developing a solar rooftop power generation pilot of about 1 mega-watt (MW) capacity on a public-private partnership (PPP) basis.

6. Sri Lanka's electricity industry is managed by the Ministry of Power and Energy (MoPE). All electricity utilities remain under direct or indirect state ownership, whereas, there is significant private sector participation in power generation. The following institutions listed in Table 1 are active in the electricity industry. Table 2 lists the regulatory and facilitation agencies in Sri Lanka.

**Table 1: Institutions in the energy supply industry**

Institution	Functions and other information
<b>Government</b>	
Ministry of Power and Energy (MOPE)	Energy policy, project implementation and monitoring, supervision of state-owned electricity utilities.
Ministry of Petroleum and Petroleum Resource Development (MOPPRD)	Petroleum industry project implementation and monitoring, supervision of state-owned petroleum corporation, petroleum resource development and exploration.
<b>Electricity utilities</b>	
Ceylon Electricity Board (CEB)	State-owned corporation, engaged in power generation (one license, 23 power plants), transmission (one license), and distribution (four licenses, about 4.5 million customers).
Lanka Electricity Company (Pvt) Ltd (LECO)	State-owned company, engaged in power distribution (one license, 450,000 customers) along western and southern coastal regions.
<b>Independent Power Producers (IPPs)</b>	
Ten thermal IPPs to grid, two thermal IPPs in Jaffna mini-grid	Each IPP an individual company, eight diesel power plants and two combined cycles on the main grid, two diesel power plants on the Jaffna mini-grid.

About 100 small renewable energy IPPs (also known as Small Power Producers, SPPs)	Each SPP an individual company, small hydro (about 95), rice-husk (2), and waste-heat (1).
About 300 community small hydro-based distribution cooperatives	About 5000 households are served, in total.
About 120,000 solar home systems	Serving an equal number of households.

**Table 2: Regulatory and Facilitation Agencies**

Institution	Functions and other information
Sri Lanka Sustainable Energy Authority (SEA)	Policy, promotion and regulatory functions of (i) renewable energy (ii) energy efficiency, and (iii) energy planning, (iv) energy fund management.
Public Utilities Commission of Sri Lanka (PUCSL)	Infrastructure regulatory commission presently empowered to regulate (i) electricity industry (ii) bunker and lubricating oil industries. In future, Petroleum Industry regulation is likely to be assigned to PUCSL.

7. The proposed project will assist GoSL to develop a least-cost project implementation of the following project components: (i) transmission system strengthening to further improve its energy efficiency and enable rural electrification; (ii) distribution system improvement to expand access for the poor and rural household connection; and (iii) solar rooftop and renewable energy component. These components will strengthen the systems in the Central, Eastern, and Northern Central parts of the country. It will also enable to address post-conflict electricity needs and bring cheaper solar and hydropower to the population in the Northern and Eastern parts of the country from the North, Northern Central, and Central Provinces through various transmission lines and substations.

### 1.1 Background

8. The project will aim to encourage development of a private sector market for solar rooftop power generation, contribute to increase in renewable power generation, encourage wide use of solar rooftop applications, and serve as a benchmark for replication. The pilot will address the following barriers for developing solar power in Sri Lanka:

- (i) excessive capital costs through use of a competitive bidding framework;
- (ii) general lack of awareness of the capabilities of solar photo-voltaic (PV) systems through a demonstration effect and use of net metering systems;
- (iii) need to dedicate large amounts of scarce land for solar power generation in Sri Lanka; and
- (iv) lack of opportunities for universities and research institutes to undertake research in emerging areas of renewable technologies.

9. Currently, net-metering with free energy banking facility is available to all electricity customers in Sri Lanka, provided the primary source is renewable. Few small rooftop solar PV systems are already in operation on net-metered basis along with two ground mounted solar projects of 500 kW and 737 kW capacity built through bilateral grants. The small rooftop solar PV systems presently operational on net metering basis have overcome the tariff barrier by effectively ignoring the economics, basing the investment on other benefits as perceived by such investors. Sri Lanka has no feed-in tariff for solar PV and the two ground mounted PV projects have thus used the non-cost reflective special tariff offered for technologies announced for projects signed up over a limited period in 2011. In the absence of a cost-reflective feed-in tariff, the only avenue for solar power project development in the current policy and regulatory regime is through existing net-metering regulations.

10. The Environmental Due Diligence (EDD) report comprises baseline data on existing physical, ecological, economic and social information, together with the anticipated environmental impacts and proposed mitigation measures. Site data was requested to be submitted by the pilot project participants at Colombo, Jaffna, Moratuwa, Galle, and Kandy. In addition, secondary data was collected from published data from GoSL documents, 2001 population census statistics data, as well as from authorities such as SEA, MoPE and other departments. However, no discussions or focus group meeting has been held at the site with stakeholder/owner and other adjacent building facility managers regarding installation of rooftop solar photovoltaic (RSPV) panels.

11. Since the project does not involve battery storage activities that have significant adverse environmental impacts during their disposal, due diligence has been done to determine the extent of impact of net metering as per the ADB's Safeguard Policy of 2009 guidelines. Accordingly, the environmental classification for the sub-project component proposed is "Category C". The EDD report conforms to the Ministry of Environment and Natural Resources guidelines and regulations and are consistent with ADB Operations Manual F1/BP and F1/OP (2003), Environment Policy, and Environmental Assessment Guidelines (2003)<sup>47</sup> and the new ADB Safeguard Policy 2009.

## 1.2 Applicable Environmental and other Legislations

12. A large number of recurrent and non-recurrent activities under establishment of Rooftop solar projects (below 1 MW) are presently not covered by the National Environmental Act (NEA). Annex 1 indicates the applicable laws and regulations, which are necessary for the proposed project activities.

## 2 Description of the Project

### 2.1 The Project

13. The government buildings identified for the purpose of developing solar rooftop power generation pilot subprojects include the key universities, including those with engineering departments, namely University of Moratuwa (Colombo, Western province), University of Peradeniya (Kandy, Central province), and University of Ruhuna (Galle, Southern province). Besides the above, three subproject sites are proposed at Jaffna which includes Central Hospital, Jaffna Hospital Building and one Hostel for Medical Students; and two private sector funded sites that include - Damro Showroom and Sri Nathiya Commercial Building in Jaffna (Jaffna, Northern province).

### 2.2 Type of Project

14. The expected capacity to be developed at each of these locations would be around 50 kW. The subprojects would be based on the net metering concept. The subprojects in universities of Moratuwa and Peradeniya may be extended for solar power research.

15. The subprojects proposed to be developed by the private developers would be selected on the basis of a transparent selection criteria but would be restricted to the locations in and around the cities of Colombo, Kandy and Jaffna. Around 3 sites would be selected in each of the identified geographical locations.

### 2.3 Need for the Project

16. Rooftop solar photovoltaic power generation schemes have good potential to raise public awareness and support for renewables. The impact will be greater with group or community schemes as individual schemes are rarer and tend to be out of public view. Rooftop solar power generation is largely non-controversial and does not cause any problems during its operation.

### 2.4 Location

17. The proposed rooftop solar projects are located at Moratuwa, Colombo (Western Province), Kandy (Central Province), Jaffna (Northern Province), Ruhuna (Galle, Southern Province), Jaffna (Jaffna, Northern Province). Figure 1 provides proposed locational map of Sri Lanka for the solar rooftop program.

**Figure 1: Proposed Location map of the Solar Rooftop Projects in Sri Lanka**

<sup>47</sup> ADB. 2003. Operations Manual, Environment Policy, Environmental Guidelines for Selected Industrial and Power Projects, and Environmental Assessment Guidelines. Manila.



## 2.5 Size and the Magnitude of the Operation

### Solar Rooftop Installations

18. A total of 8 rooftop installations are planned at Jaffna, Galle, Morutawa, Peradeniya, which were assessed by the consulting team for inclusion in the list of assisted projects (Table 3). The survey questionnaire and the survey results have been tabulated and inserted in this report.

**Table 3: List of Applicant Entities for Solar Rooftop Projects in PPP mode**

	Solar Panel Location	Type of Facility	Name of City, District	Capacity (kW)
1	University of Peradeniya	University	Peradeniya, Kandy	50 kW
2	University of Ruhuna, Faculty of Engineering	University	Hapugala, Galle	50 kW
3	Central Hospital –Jaffna	Government Facility	Jaffna	50 kW
4	Damro Show Room	Private Landowners	Jaffna	50 kW
5	Jaffna Hospital Building	Government Facility	Jaffna	50 kW
6	Hostel for Medical Students	Government Facility	Jaffna	50 kW
7	Sri Nathiya Commercial Building	Private Landowners	Jaffna	50 kW
8	University of Moratuwa	University	Katubedda, Moratuwa	50 kW

### Solar Radiation

19. Sri Lanka is situated close to the equator, therefore receives an abundant supply solar radiation year around. Solar radiation over the island does not show a marked seasonal variation, though significant spatial differentiation could be observed between the lowlands and mountain regions.

20. As estimated in the solar resource map developed by the National Renewable Energy Laboratory (NREL) of the USA, over most parts of the flat dry zone, which accounts for two-thirds of the land area, solar radiation varies from 4.5 – 6.0 kWh/m<sup>2</sup>/day. Solar radiation levels remain as low as 2.0 – 3.5 kWh/m<sup>2</sup>/day over the high plains of hill country due to the significant cloud cover over most parts of the day. Figure 2 gives the solar radiation pattern for Sri Lanka which shows that a substantial potential exists in the dry zone

of Sri Lanka for harnessing solar energy.

### **Net Metering**

21. To facilitate import and export of electricity from the facility, CEB will install a single, bidirectional meter where the customers can bank the excess electricity generated and trade the same against future consumption (period of banking 10 years). All consumer categories (industrial, residential, general purpose, religious) are eligible for applying for this scheme.

### **Features of the Solar rooftop model**

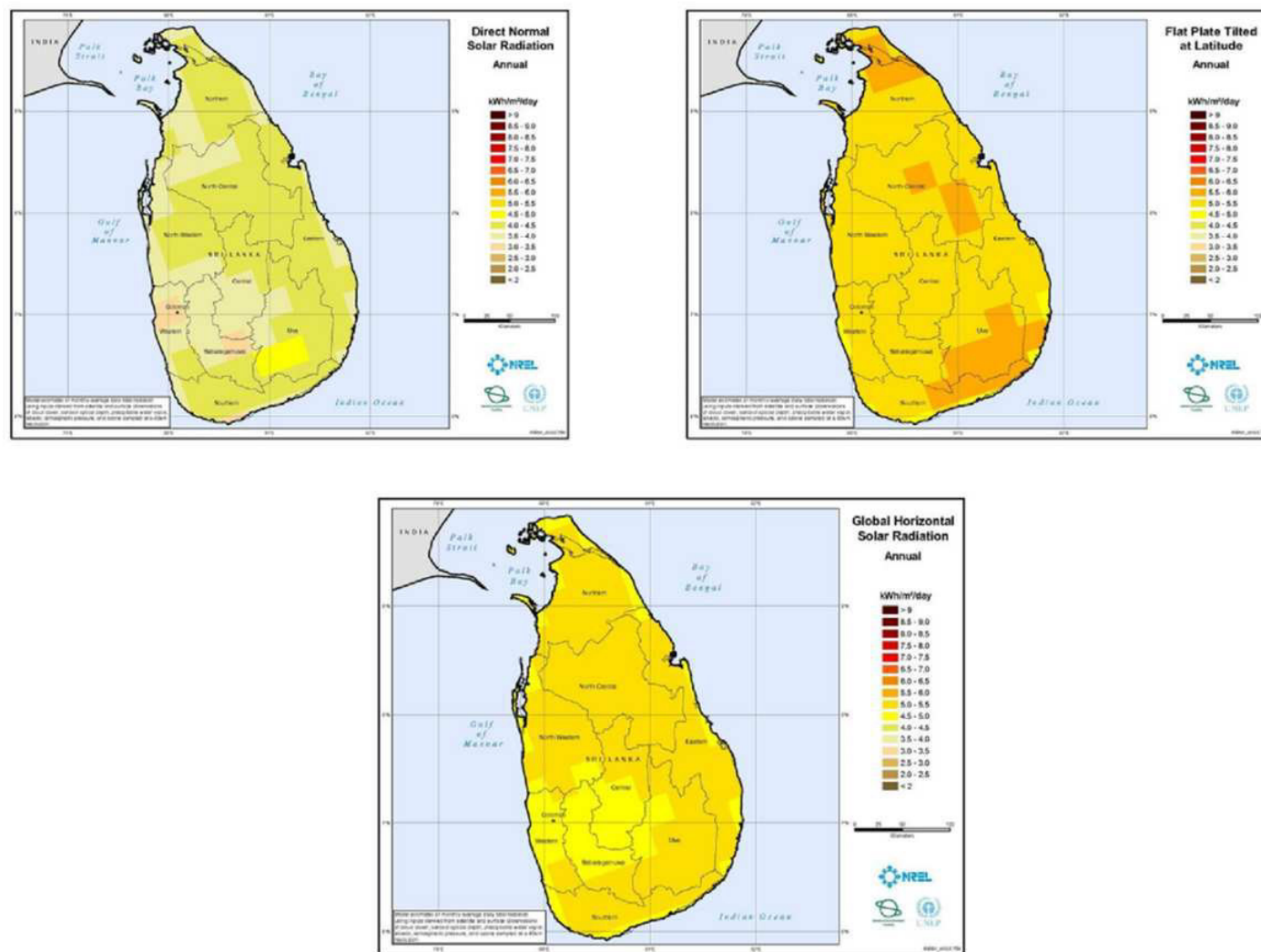
22. Site specific information on rooftop design, sizing of panels etc. was requested which has been tabulated in Tables 4 to 8 based on questionnaire in Annex 4. However, more specific information will have to be provided by PPP proponents to SEA in their project net metering proposals to be able to make any useful inferences for safeguards monitoring.

## **2.6 Implementation Plan**

23. Based on cost estimates, the total cost for PPP-based subprojects for the universities (4 x 50 kW) would be USD 580,000 to be funded completely from the grant. Around 800 kW will be developed through private sector participation. The remaining amount from the grant component (USD 820,000) would be provided to the private sector as a capital subsidy on completion of relevant subprojects and verification of the same by SEA based on actual installed capacity that has been made operational. The proposed capital subsidy to the private sector will be used as an incentive for the private sector to undertake the solar rooftop sub-projects and cover a portion of the incremental cost (gap between grid supply and the cost of solar PV generation). The disbursement of the capital subsidy will be done strictly after verification of actual installed capacity, which is made operational, by SEA. The capital subsidy will be disbursed by the Ministry of Finance and Planning from a relevant grant account upon recommendation of SEA. The credit line of USD 1,500,000 to the private sector would be provided from the Asian Development Fund (ADF) loan, which has concessionary interest rates.

24. The proposed overall project implementation schedule for the project is attached as Table 9.





**Figure 2: Solar Potential in Sri Lanka**

(Source: SEA presentation and NREL data for Sri Lanka)

**Table 4: Present Locational Status of the Solar Rooftop locations**

	Name and Address	Type of facility	Site locations near any bird sanctuary	Municipality: Name	Compliance with municipal bye laws:	Additional formalities are required for additional compliance applications
	(1)	(2)	(3)	(4)	(5)	(6)
1	University of Peradeniya Peradeniya 20400 Sri Lanka	Government Facility/University	Udawattakele sanctuary (3500 ha.) is about 6 km from the University	Urban Council Kandy	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
2	University of Ruhuna, Faculty of Engineering, Hapugala, Galle(80000), Sri Lanka.	Government Facility/University	Rumassala Sanctuary is (170 ha.) about 8 km from University	Urban Council Galle	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
3	Central Hospital –Jaffna	Private Landowners	Closest sanctuary is about 60 km away Cundikulam sanctuary – 11149 ha. )	Urban Council Jaffna	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
4	Damro Show Room- Jaffna	Private Landowners	Closest sanctuary is about 60 km away Cundikulam sanctuary – 11149 ha. )	Urban Council Jaffna	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
5	Jaffna Pvt Hospital Building- Jaffna	Private Landowners	Closest sanctuary is about 60 km away Cundikulam sanctuary – 11149 ha. )	Urban Council Jaffna	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
6	Hostel for Medical Students – Jaffna	Government Facility	Closest sanctuary is about 60 km away Cundikulam sanctuary – 11149 ha. )	Urban Council Jaffna	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
7	Sri Nathiya Commercial Building - Jaffna	Private Landowners	Closest sanctuary is about 60 km away Cundikulam sanctuary – 11149 ha. )	Urban Council Jaffna	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.
8	University of Moratuwa Address University of Moratuwa, Katubedda, Moratuwa (10400), Sri Lanka.	Government Facility/University	Bellawila- Attidiya sanctuary is approximately 6 km from University of Moratuwa.	Urban Council Moratuwa	Yes	Approval not needed from local authority /only CEB approval is needed for net metering.

Source: Data by Deloitte May 2012

**Table 5: Roof Type/Form**

	Name and Address	Module Orientation (N/S/E/W)	Floor Form details	Is building surrounded by other high rise buildings - Tilt Glare on to adjoining buildings	Roof Form (shape/size) used for layout and the Shading negatively impact the owners/ neighbors	Roof Form: Roof traffic management plan to facilitate system maintenance and worker safety.
	(1)	(8)	(9)	(10)	(11)	(12)
1	University of Peradeniya Peradeniya 20400 Sri Lanka	Roof ridge is along E-W and structure can be designed to acceptable orientation	No roof slabs	Yes, same level around except the 3 story portion. However selected place would not be affected by the higher sections of the building.  Glare will not affect the outside buildings.	No	Shall be designed from outside the building considering safety of personnel and the safety of the equipment.
2	University of Ruhuna, Faculty of Engineering, Hapugala, Galle, Sri Lanka	No effect as the place is pre-selected	No roof slabs	Yes, Higher level None – Further there will not be any annoying/harmful reflection from PVs	No	Shall be designed from outside the building considering safety of personnel and the safety of the equipment
3	Central Hospital -Jaffna	Could be oriented at fixed position		No higher buildings in the surroundings. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures required.
4	Damro Show Room- Jaffna	Could be oriented at fixed position.	roofslab	No higher buildings in the surroundings. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures required.
5	Jaffna Hospital Building- Jaffna	Could be oriented at fixed position.	roof slab	No higher buildings in the surroundings. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures required.
6	Hostel for Medical Students – Jaffna	Could be oriented at fixed position.		No higher buildings in the surroundings. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures required.
7	Sri Nathiya Commercial Building - Jaffna	Could be oriented at fixed position		No higher buildings in the surroundings. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures required.
8	University of Moratuwa Address University of Moratuwa, Katubedda, Moratuwa (10400), Sri Lanka.			No .Sumanadasa Building is higher than other buildings and trees etc. None – Further there will not be any annoying/harmful reflection from PVs	No	Same passage to rooftop slab will be used and no additional safety measures may be required as the slab passage is narrow.

Source: Data by Deloitte May 2012

**Table 6: Building Designat Solar rooftop locations**

	Name and Address	Designed capability of building to ensure no extra weight due to panels	Type of roof repair work required for installation of panels	Water proofing of floor tiles	Locations of invertor and electric fittings and interconnection with net metering	Water proofing of cables etc.:
	(1)	(13)	(14)	(15)	(16)	(17)
1	University of Peradeniya Peradeniya 20400 Sri Lanka	Will be adequate and the adequacy will be proven with the PV Panel and the structure Weights	May be a steel structure attached to the roof ridge and the panel holders supported on this.	Not Relevant	Not yet decided and will not be on rooftop.	Not required, cable ways from the rooftop will be adequately sealed
2	University of Ruhuna, Faculty of Engineering, Hapugala, Galle(80000), Sri Lanka.	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design. However these will not definitely be on rooftop.	Not required, cable ways from the rooftop will be adequately sealed
3	Central Hospital -Jaffna	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, service ducts are available and the cable ways up to service ducts will be sealed
4	Damro Show Room- Jaffna	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, service ducts are available and the cable ways up to service ducts will be sealed
5	Jaffna Hospital Building- Jaffna	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, Service ducts are available and the cable ways up to service ducts will be sealed
6	Hostel for Medical Students - Jaffna	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, Service ducts are available and the cable ways up to service ducts will be sealed
7	Sri Nathiya Commercial Building - Jaffna	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, Service ducts are available and the cable ways up to service ducts will be sealed
8	University of Moratuwa Katubedda, Moratuwa (10400), Sri Lanka.	Will be adequate and the adequacy will be proven in design stage	Will be decided at design stage	Will not be required however concern will be given to it at the design stage	Will be decided after the details of the equipment are obtained at the stage of design, however these will not definitely be on rooftop.	Not required, Service ducts are available and the cable ways up to service ducts will be sealed.

Source: Data by Deloitte May 2012

**Table 7: Design for Environment at Solar Rooftop locations**

	Name and Address	Height of top floor	Panel to hoisted manually/cranes to roof	Panel Loading/Unloading: Manually/Crane	Wind storms/electrical lightening in the area	Level of dust in the environment	Extent of Rainfall in the area
	(1)	(18)	(19)	(20)	(21)	(22)	(23)
1	University of Peradeniya Peradeniya 20400 Sri Lanka	4 m approximately from Ground to lower point of the roof	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 80	Not known	2700mm per year, average
2	University of Peradeniya Peradeniya 20400 Sri Lanka	14 m approximately from Ground to lower point of the roof	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 80	Not known	2500-3000 mm per year, average.
3	Central Hospital -Jaffna		Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 50	Not known	1270mm per year, average.
4	Damro Show Room- Jaffna	20m approximately from Ground	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 50	Not known	1270mm per year, average.
5	Jaffna Hospital Building- Jaffna	34m approximately from Ground	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 50	Not known	1270mm per year, average.
6	Hostel for Medical Students - Jaffna	16m approximately from Ground	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 50	Not known	1270mm per year, average.
7	Sri Nathiya Commercial Building - Jaffna	16m approximately from Ground	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 50	Not known	1270mm per year, average.
8	University of Moratuwa Katubedda, Moratuwa (10400) Sri Lanka.	14 m approximately from Ground	Manually by hand hoist	Manually	Max wind speed -145 km/Hr and Isokeraunic Level - 80	Not known	3800mm per year, average.

Source: Data by Deloitte May 2012

**Table 8: Waste Management and Safety at Solar Rooftop locations**

	Name and Address	Location of hazardous waste facility (HWF) in the city/area	Type of waste is handled currently at this HWF	HWF can accommodate any broken panels	Possible health and safety issues in the building regarding Installation	Panel can be dislodged and fly off during severe windstorm do you foresee any damage to the surrounding:	Role of Electrical Safety Inspector
	(1)	(30)	(31)	(32)	(33)	(34)	(35)
1	University of Peradeniya Peradeniya 20400 Sri Lanka	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen.	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB
2	University of Ruhuna, Faculty of Engineering, Hapugala, Galle (80000), Sri Lanka.	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB
3	Central Hospital -Jaffna	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.
4	Damro Show Room- Jaffna	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.
5	Central Hospital -Jaffna	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.
6	Hostel for Medical Students - Jaffna	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.
7	Sri Nathiya Commercial Building - Jaffna	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.

	Name and Address	Location of hazardous waste facility (HWF) in the city/area	Type of waste is handled currently at this HWF	HWF can accommodate any broken panels	Possible health and safety issues in the building regarding Installation	Panel can be dislodged and fly off during severe windstorm do you foresee any damage to the surrounding:	Role of Electrical Safety Inspector
	(1)	(30)	(31)	(32)	(33)	(34)	(35)
8	University of Moratuwa Address University of Moratuwa Katubedda, Moratuwa (10400) Sri Lanka.	No hazardous waste in PVs plastics or polymers will be disposed for recycling and the SI or other parts will be crushed and disposed	No specific method is in force currently	Yes	No	Yes, if the fixtures and structures are designed to max wind this may not happen. .	Chartered Engineers Report will be required before the connections and net metering etc., are established by CEB.

Source: Data by Deloitte May 2012

### 3 DESCRIPTION OF ENVIRONMENT

#### 3.1 Colombo district

##### Physical Resources

##### Topography, Geology and Soil

25. Colombo is the most populated district in Sri Lanka. According to the census reports in 2001 the population was 2,251,274. Colombo district is divided into 13 Divisional Secretariat Divisions and their activities are coordinated and supervised by the Colombo District Secretariat. Colombo district is a combined mixture of mountains, plains, and marsh lands. north and east parts of the district are mountainous whereas east and south-east parts are surrounded by marsh lands. The city of Colombo is connected by a network of canals and at the heart of the city is the Beira Lake. At the boundaries of the Colombo district are north-Kelani River (Gampaha district), south-Bolgoda River (Kalutara district), west-Coast line, and east-Sabaragamuwa Province.

##### Geography and climate

26. Colombo's geography is a mix of land and water. The city has many canals and, in the heart of the city, there is a 65-hectare Beira Lake. The northern and north-eastern border of the city of Colombo is formed by the Kelani River, which meets the sea in a part of the city known as the Modera (mōdara in Sinhala) which means river delta. Colombo's climate is fairly temperate all throughout the year. From March to April the temperature averages around 31<sup>0</sup> Celsius. The only major change in the Colombo weather occurs during the monsoon seasons from May to August and October to January. Colombo sees little relative diurnal range of temperature, although this is more marked in the drier winter months, where minimum temperatures average 22<sup>0</sup> Celsius. Rainfall in the city averages around 2,400 mm a year.

##### Population

27. The ethnic composition is 76.6% Sinhalese, 12.2% Tamil, 9% Muslim and 3% others. The literacy rate of the population aged 10 years and over is 93.6% (male 94%, female 93.1%). The labour force participation rate, expressed as the percentage of employed aged 10 years and over, is 47.5%. Employment rate is 93.6% and unemployment rate is 6.4%. The people tend to be engaged in craft and craft related work, manufacturing and wholesale and retail trade. The total number of households in the district is 507,678, there are 86.8% are permanent houses, 11.2% semi-permanent houses, 0.3% improvised houses and 1.8% not classified. Out of the occupied housing units, 71.6% are single houses, 9.2 % are flats, 6.4% are row houses/line rooms and 1.5% are huts.

##### Socio Economic Profile

28. The Colombo Metropolitan Region, defined by the districts of Colombo, Gampaha and Kalutara, has an estimated population of 5,648,000, and covers an area of 3,694.20 km<sup>2</sup>. As per the Provincial Gross Domestic Product-2010, the Western Province, which includes the cities of Colombo, Gampaha and Kalutara recorded GDP per capita of USD 3,808, the highest recorded GDP per capita for any region in south Asia. Colombo has the highest degree of infrastructure - electricity, water and transport etc. The majority of the major shopping malls in Sri Lanka are located in the city along with many luxurious hotels, clubs and restaurants. In recent times, there's been an outpour of high rise condominiums in the city mainly due to very high land prices.

##### Economy

29. The majority of Sri Lankan corporations have their head offices in Colombo. Some of the industries include chemicals, textiles, glass, cement, leather goods, furniture, and jewellery. In the city centre is located south Asia's second tallest building – The World Trade Centre. The 40 storey Twin Tower complex is the centre of important commercial establishments, situated in the Fort district, the city's nerve centre. Right outside the Fort area is Pettah which is derived from the Sinhalese word pita, which means out or outside as it is outside the Fort.

30. Pettah is more crowded than the fort area. Pettah's roads are always packed and pavements are full of small stalls selling products ranging from delicious sherbat to shirts. Main Street consists mostly of clothes shops and the cross roads, which are literally known as Cross Streets where each of the five streets specializes in a specific business - First Cross Street is mostly for electronic goods shops; the Second cross street is mostly for cellular phones and fancy goods. At the end of the main street further away from Fort is the Sea Street, Sri Lanka's gold market. This mile-long street is full of jewellery shops. The Colombo Metropolitan Region (CMR) encompasses the country's administrative capital Kotte and Colombo. Found



within the borders of the CMR is 80% of the country's industries and over 60% of all vehicles plying Sri Lankan roads. The per capita income of the Western Province stood at USD 3,808, making it one of the most prosperous regions in south Asia.

31. Colombo district has relatively high proportion of modern facilities such as teaching, provincial, and base hospitals while in Gampaha and Kalutara Districts these facilities are very limited. For example, there are 610 hospital beds per every 100,000 population in Colombo district, compared with 260 beds in Gampaha and 210 in Kalutara. In terms of doctors per 100,000 populations, Colombo district average is 68 while the average for Gampaha and Kalutara are 17 and 22 respectively.

### 3.2 Galle district

#### Physical Resources

##### Topography, Geology and Soil

32. The project-affected area is located within the district of Galle in first peneplane, which has an elevation from Mean Sea Level (MSL) of 125 m. The terrain of the project-affected area is rolling, undulating and steep. Geologically, Galle district falls within the rock formations of the Southwestern group and is made up of shists, gneisses and granulites of meta-sedimentary origin, as well as migmatite and granitic gneisses. The south-western group is believed to be formed during the Archaeozoic period. In accordance with the agricultural soil classification the project affected area is located within Wet Zone of Low Country region - 4. Thus the main soil types are Red, Yellow podzolic, Red yellow podzolic soils with strongly mottled sub-soil, low humic gley and bog and half-bog soils. The low humic gley soils occupy the lower parts of the slope and upper parts of the valley bottoms.

##### Climate

33. The local rainfall pattern is influenced by the monsoon winds of the Indian Ocean and Bay of Bengal. The annual average rainfall of the island varies from below 1,000 mm over a small region in the arid parts of north west and south east to over 5,000 mm in the very wet regions. Galle district is located within the wet zone of Sri Lanka and experiences an annual rainfall of more than 2,400 mm. The peak rainfall period is associated with the precipitation from the south west monsoon during May to September, which brings the moisture from the Indian Ocean. The lowest rainfall is recorded during December to February of north-east monsoon period. There is only a slight annual range of temperature for the island, but this is exceeded by the diurnal range of temperature. Average daily temperatures of the district range between 25°C and 30°C, remaining fairly constant throughout the area. The highest temperature is observed during February to April season. Humidity is typically higher in the south west region of the country and depends on the seasonal patterns of rainfalls. Daytime humidity stays above 70 -80% throughout the year, rising to almost 90 % during the monsoon season.

##### Water Resources (Ground Water and Surface)

34. The ground water availability varies within the district depending on the geology and the rainfall. Ground water is the main source of potable water in rural areas of the Galle district. During the dry season, majority of the shallow wells located within coastal areas experience salinity intrusion. The quality of the ground water is fairly good in rural and some semi-urban areas in the district. Surface water resources in Galle district are abundant with rivers that radiate from the central highlands.

35. Halwathura Ganga, Gin Ganga, Holuwagoda Ela, Madampe Lake, Keembiya Ela are the main natural water resources located in and around the proposed project area. Surface water quality of the main streams located in rural sections is fairly good while urban areas are contaminated with industrial and other waste. The intensive rainfall causes flood in Galle district during the southwest (May to September) and northeast (November to February) monsoon seasons. Madampe Lake is connected to very famous Ramsar wetland, which is known as Madu Ganga. Thus any construction activity that has adverse environmental impact to the Madampa Lake will lead to cascade adverse impact on the Madu Ganga.

##### Air Quality and Noise

36. Concentrated road traffic or presence of air polluting industries in the area can result in a significant decline in air quality. the ambient air quality measurements along the project road are within the limits of national ambient air quality standards. national ambient air quality standards, diurnal pattern of ambient air quality parameters such as CO, SO<sub>2</sub> and NO<sub>2</sub> indicates that mobile sources have made major contributions to air pollution in these locations. Noise levels attributable to traffic and industrial activities are lower in rural areas, while noise level is high in industrialised areas and urban centres where the traffic

volume is high along the Class A Colombo-Galle road.

### Ecological Resources

37. The aquatic and terrestrial ecosystems distributed in Galle district provide important ecological and biological habitats for variety of floral and faunal species. A single National Park (Hikkaduwa) and several sanctuaries (Telwatta, Honduwa island, Eluwilayaya, Rumassala) are located within the coastal zone of the district. However, Hikkadduwa National Park and abovementioned sanctuaries are located more than 10 kilometres away from the project area. Beruwala, Hikkaduwa, Galle and Unawatuna are famous coral habitats among the coastal ecosystems. Kottawa forest reserve is situated in northeast of Galle along the main road to Udugama Township.

38. Hiyare rainforest is a reservoir bounded by 600 acres of secondary lowland and an excellent spot for over 80 species of birds, out of which 10 are endemic and can be seen in Hiyare. None of the above-mentioned environmentally sensitive areas are located in the vicinity of the proposed project. Thus proposed project activities will not affect the fauna and flora of environmentally sensitive areas. However, there are some mammal species which have to be protected under the existing legal measures in Sri Lanka (Fauna and flora protection ordinance). The available fauna and flora of the project-affected area are mainly common home garden species of the Southern Province (low country wet zone of Sri Lanka).

### Economic Development

#### Land Use and Agriculture

39. Land use pattern in the project area varies from semi-urban to rural. The semi-urban areas include townships and built up dwellings. Few ribbon type developed commercial centres are also located within the project influence area of semi-urban section. Outside the semi-urban areas, settlements become rural, featuring more residential use, agricultural land including paddy, large scale tea, rubber, cinnamon, coconut and mixed agricultural lands. The economy of Galle district is mainly based on tea, rubber, coconut, paddy, and cinnamon cultivations with a long history of cultivation for exports. A total of 24,920 hectares of tea, 6,518 hectares of rubber, 12,543 hectares of coconut and 23,912 hectares of paddy was cultivated in 2002 within the Galle district.

#### Industries

40. There are 789 industrial establishments in Galle district and nearly 15,000 people are engaged in these industries. Main industrial operations in the district are concentrated in Galle which include- cement, garment factories, wood and food processing industries. Koggala is the second pre trade zone of Sri Lanka located within the district. Large numbers of agro-processing industries (tea, rubber and cinnamon) are also distributed in semi-urban and rural areas of the district. Industries in the vicinity of the transmission line mainly consist of garment manufacturers, tea and rubber factories including other agricultural based factories. The project-affected area comprises of private sector hotel industries and footwear industry closer to the university area.

#### Tourism

41. The southern coastal belt is the most popular among the tourists who visit mainly from October through April when the monsoon moves northeast and the sea becomes calm with blue skies.

#### Infrastructure Facilities

42. Electricity and telecommunication facilities are available for almost all project-affected area within the Galle district. Pipe-borne water facility is available for most of the urban and semi-urban places except rural areas of the district. Pipe-borne sewerage facilities and proper pit latrine facilities are available in urban areas of the Galle district. Sanitation facilities in the project area are available mainly for onsite facilities for homes and institutions.

### Social and Cultural Development

#### Population and Community

43. The population of district of Galle is 990,487 out of these 481,849 are male and 508,638 female. Out of the total population 94.4% are Sinhalese, 1.1% are Sri Lankan Tamil, and 0.9% are Indian Tamil.

#### Education

44. In 2005, 492 Government schools were functional in Galle district. Literacy rate of population in district of Galle is at a significantly higher level at 92.3% as compared with other districts (Anuradhapura, Polonnaruwa, Badulla Monaragala, Hambantota etc.)

### Health Environment

45. The project site is situated in very good climatic condition; there is no air, noise, water and industrial pollution. Health environment is very good.

### Historical, Cultural and Archaeology Sites/Places

46. There are no archaeological, historical important sites or protected monuments in the study area along the alignment. However, there are some locally important religious places on either side of the access roads in project area.

## 3.3 Kandy district

### Physical Resources

#### Topology, Geology and Soil

47. Kandy district forms a substantial and integral part of the central highlands, straddling the south-western, Northern and north-eastern parts of the mountain complex. The major part of the land surface has an elevation range of 300 - 1,000 m and therefore much of the district falls in the category called mid-country, whereas only small parts fall in the other two elevation categories namely low and up country. Consequently, Kandy district has a dissected and intricate pattern of ridges and valleys and much of the land is sloping but with a fair proportion in valleys of varying shape, width and extent. Larger valleys are in extreme north-east and in the east of varying shapes, width and extent. There are three types of soils available in Kandy district - red yellow podsoles, low humic clay and reddish brown lassoic soils. Dolomite depositions are also available in Kandy district. Composition of the soil is a grey brown to yellowish brown top soil and mostly a yellowish red sub soil. The top soil is sandy loam, sandy clay loam, or loam while the subsoil is sandy clay loam or clay.

#### Climate

48. Annual average rainfall of the Kandy district is above 1,760 mm. In most parts of the district, three rainy months are October, November and December except the southern part of the district where May, June and July are the rainy months. In Eastern parts of the district, highly wet months are December, January and February. In general, dry months are January, February and March. Consequent to the abundant and uniform distribution of sunlight, there is a fairly uniform seasonal temperature in the district. Temperature largely depends on the altitude. The difference between the lowest and the highest point in the Kandy district is 11 °C. Daily temperature variation is greater during the cool months of the year and particularly when the air is dry and sky is clear. The relative humidity of the district is 63% to 83% in day time and in night it varies between 88% and 97%.

#### Water Resources

49. About 90% of Kandy district falls in the basin of the Mahaweli Ganga, which flows through the Central part of the district slightly beyond Kandy, then, turns south –Eastward for about 40 km and then eastward for another 50 km to Minipe forming the southern boundary of the district. Finally it flows northwards for about 60 km forming the eastern boundary Mahawle Ganga and its watershed is the most important physical feature in the district. There are a number of tributary streams contributing to the Mahaweli which entirely lie within the district. The important tributary streams are Atabage Oya, Nilambe Oya, Nanu Oya, Pinga-Oya, Kota-Ganga, Hulu-Ganga and Maha Oya. River Mahaweli has dams at Polgolla and Teldeniya. Polgolla is a storage dam for Ukuwela hydropower plant and serves as the starting point of the Mahaweli irrigation for the North-Central province. Springs are very common in high elevation of curving ridges of the arenas. Most of the high ridges are crowned by protected forests which contribute immensely to the potentiality of these springs. In some villages in Kandy, springs are used as the source for village water supply schemes. The Mahaweli development project is a multi-purpose river valley which leads to energy production, storage reservoirs, canals, irrigation schemes, and settlement/resettlement programmes within the district.

#### Ecological Resources

50. There are 21 waterfalls located in district of Kandy. Ahupini Ella is one of them with a height of 30 m. The surrounding area is rich with fauna and flora adapted to moist environment conditions. The Adams Peak Falls, 10 m high fall, flows from the aquifers of Sri Pada and later on to Maskeli Oya Reservoir. Huluganga Falls (75 m in height) is one of many created by the streams originating from the Knuckles mountain range. The cascading water sprinkles the villages of Elliyadda and Aratthana, before flowing to

the Victoria Reservoir. It is popular with both local and foreign visitors and villagers regard it as part of their Dumbura heritage. The fall is situated below the Town of Hulu River, near Panwilla, (Kandy district, and Panwilla Provincial Secretariat Division) Ratna (Navarathna) fall. The 101 m fall is the highest in the Kandy region and the stream that serves it irrigates the paddy fields of the surrounding villages. Balakaduwa Falls, Dehigolla Falls, Diyakerella Falls, Hunnas Falls and Upper Hunnas Falls are some falls in Kandy district.

## **Economic Development**

### **Land Use and Agriculture**

51. The district of Kandy is situated south of the island, surrounded by five districts- Matale to the north, Nuwara Eliya to south, Badulla to the east, Kegalle to the west and Kurunegala to the north-west. The extent of the district is about 1,905 km<sup>2</sup> which is about 3% of the island. Kandy district has a total land area of 3,275 km<sup>2</sup> including 39 inland water bodies. Pattern of human settlements around the roads vary from rural to semi-urban. Rural environment mainly consists of residential places, home gardens and agricultural lands. The most important plantation crop in the district at present is tea, but its extent is declining rapidly. Rubber accounts for only less than 2%. Among the non-plantation crops, paddy occupies a dominant position. Nearly 20% of the district is covered with home gardens. There is a considerable variation in the extent of home gardens in the district. Some DS divisions have over 50% of land under cropping system and hardly any home garden. In some DS divisions, home gardens are distributed in small plots in close association. The total extent of tea in the district is 15% and it is rapidly declining. The tea plantation in Kandy belongs to mid country. Most of the communal forests and crown forests that existed in the pre-colonial period have been converted to tea plantations. The district forest cover has been reduced to a level that is substantially below the national average.

52. The plantations around Kandy, the ancient capital of Ceylon (Sri Lanka), supply what are known as mid country teas. These are notable for full bodied strong tea, which appeal to everyone who likes a good thick colour brew. The tea plantations are located from 600 m to 1,200 m and is the region where tea was first grown in Sri Lanka. A range of hills extends to Nilambe, Kotmale and Gampola areas. The valley is protected from strong monsoon rains and the teas are darker and stronger. Those plantations in Hewaheta, which experience weather changes associated with the south-west monsoon winds, acquire a flavour character during the eastern monsoon season. According to 2002 census data, 21,975 ha of tea, 1,163 ha of rubber and 7,888 ha of coconut were cultivated within the district of Kandy.

## **Social and Cultural Development**

### **Population and Community**

53. A total of 20 DS divisions are located within the Kandy district representing all ethnic and religious groups in the country. From the total population distributed in the district, 74.1% Sinhalese, 4.1% Sri Lankan Tamil, 8.1% Indian Tamil, 13.1% Sri Lankan Moor, 0.2 % Burgher, 0.2% Malay and 0.2% others. Mainly four religious groups are represented in the district as follows: 82.9% Buddhist, 3.3% Hindus, 9.9% Muslims and 0.5% Catholics.

### **Health and Educational Facilities**

54. A total of 78 hospitals are distributed in different locations of the district. These include 3 Teaching hospitals, one district general hospital, 2 base hospitals Type B, 11 district hospitals, 9 Peripheral units, 26 rural hospitals, one prison hospital, 24 central dispensaries and a single central dispensary and maternity home. Out of these hospitals, 3 teaching hospitals are located at Kandy and Peradeniya (2 hospitals), a single district general hospital locates at Nawalapitiya, 2 base hospitals are located in Gampola and Teldeniya.

55. Within the district, altogether 721 schools including 645 government schools, 5 private fee levying schools, 1 private non fee levying school, and 69 Pirivenas are distributed. Overall, the education level of the district is significantly high. The literacy rate of the district is 91.8%.

### **Cultural Significance**

56. Kandy, the last royal capital of Sri Lanka is a major tourist destination. Famous for the Temple of the tooth and many other temples in the city, Kandy could be called the cultural capital of the island. Kandy is surrounded with many major Buddhist temples. On the shores of the lake are Malwaththa and Asgiri temples. Fine painted murals of Buddhist stories in these temple buildings are a good example of the arts in the Kandy period while paintings of the Hindagala temple at Peradeniya are of the 7th century. Lankatilaka temple is a magnificent building built on rock at a scenic location which also has fine paintings. Gadaladeni

Viharaya, a 14th century temple is situated about 15 km from the town. The structure of the temple is influenced by the south Indian architecture and built on a rock. The stupa is on a high stone platform. Embekke temple's main attraction is the intricate wooden carvings of this 14th century shrine dedicated to God Kataragama. There is also a Buddhist temple there. Entire structures of some wooden buildings are decorated with dancers, musicians, wrestlers, legendary beasts and birds. Nearby are the ruins of an ancient rest house with similar pillars carved in stone.

### 3.4 Jaffna district

#### Physical Resources

##### Topography and Soils

57. The area of the peninsula land mass is 1,129.9 square kilometres (km<sup>2</sup>) of which lagoons occupy 45.7 km<sup>2</sup>. The project area lies in the lowest peneplain, which is gently undulating to rolling, mantled plain stretching down to the coast. The highest ground level is 11 m above mean sea level (AMSL). The land forms include floodplains, coastal plains, sand dunes, and beaches.

58. The soil is sandy along the coast but sandy clay or clayey sand in the interior with high infiltration rates. The peninsula overburden mantle is covered with three different types of soils classified according to agricultural suitability. They are Calcic Red Yellow Latosols; Solodized Solonetz and Solonchaks; and Regosols on recent beach sands.

59. There is an obvious and expected correlation between land use and soil characteristics. The Red Yellow Latosol soils (RYL) are agricultural soils, highly suitable for crops. They are found extensively in Valikamam (Chunnakam aquifer) and Vadamaradchi areas. These soils are deep and well drained. Regosols support horticulture, mainly coconut; and sandy soils sustain palm trees such as coconut and palmyra and in some areas paddy rice is grown during the wet season under rain-fed conditions. There are pockets of loam earth (mixture of sand, clay, silt, and humus) suitable for some crops scattered throughout the peninsula.

60. Alluvial soils are found in a strip along the Kanakarayan Aru spreading towards Paranthan area. In general the richest dry zone vegetation occurs on these soils and tall trees with other mesophytic species of the dry zone are found. The catchment area of Iranamaduru Tank mainly consists of reddish brown earth and low humic gley soils in which the natural vegetation is mainly dry mixed evergreen forest that may consist of thorny scrub jungle with stunted emergents.

##### Climate

61. Jaffna district is in Sri Lanka's dry zone. The average temperature is 28.2 °C, and maximum and minimum averages are 33.3°C and 21.4°C, respectively. The mean annual rainfall over the past decade is 1,357 millimetre (mm). Peak rainfall occurs during the months of October to January with the north-east monsoon producing about 75% of total annual rains. Scattered rains are experienced during April to May when the inter-monsoon rain is uncertain. The dry season in the region extends from June to September. Monthly average wind speed varies from 12.1 to 4.4 km/h and the highest level is recorded in May and lowest in November.

##### Air Quality

62. No air quality measurements have been conducted in the study area. Considering the project area, where no highly polluting industries exists and the number of vehicles is much less than in other areas, except in Jaffna town, the ambient air quality is expected to be within the National Ambient Air Quality Standards. Moreover, most of the project area being coastal, the potential to attenuate any air pollutants is very high due to wind movement between land and the sea.

##### Surface Water

63. Throughout Jaffna district there are several seasonal streams, natural ponds and man-made storage "tanks" (normally created by building earth bunds across streams), but no permanent rivers. The drainage originating in Tellipalai and terminating at Araly channel drains a considerable part of Valikamam area and winds its way from Tellipalai through Kantharodai and Sandilipay and flows out through a salt water exclusion structure at Araly. The Valukai Aru is about 25 km long and has several regulators across the stream to facilitate flood irrigation of adjoining land, intermittent flood detention in the rainy season, and groundwater recharge. The Vadamaradchi, Uppu Aru, and Valukkai Aru lagoons have been converted to hold freshwater, and are also major devices for rain water harvesting and rain water detention.

64. Jaffna peninsula has a characteristic and peculiar surface drainage system, comprising a cascade



system of ditches (drainage canals) and ponds. This system is credited to the Dutch who colonised Sri Lanka in the 17th and 18th centuries. Geologists believe that ponds are limestone caves with collapsed roofs. The canals and ponds have been de-silted and maintained as drainage and detention devices and more importantly as sources of groundwater recharge.

65. During intense rainfall, the drainage channels first fill the paddy fields and village ponds (usually sited in the middle of paddy fields) in sequence. Water then spills over and flows down to fill the next lower pond down the cascade and so on, ultimately draining into the sea or lagoons. The Provincial Irrigation Department has constructed ring spill structures at road crossings to impede this drainage and promote groundwater recharge.

66. There are about 630 large ponds in the Jaffna system, along with about 2,400 minor ditches with interconnecting drainage channels. However, many more ponds that existed in urban areas have been obliterated as they have been used as dumping areas for solid waste. A large proportion of the surface water of Jaffna (45.7 km<sup>2</sup>) consists of coastal lagoons, containing seawater, or brackish water where there are inputs of excess irrigation water.

#### **Groundwater**

67. There are two types of aquifer: karstic limestone and sand aquifers. The geology geomorphology, climatic conditions, and proximity to the ocean combine to create a balanced dynamic groundwater system that is vulnerable to a variety of factors. In the limestone aquifer, the infiltrating rainwater forms fresh water lenses floating on the denser sea water. After infiltration into the ground, there is subterranean flow through solution channels in the limestone aquifer, draining part of the infiltrated water into the sea. However, the cavernous nature of the limestone provides a large storage reservoir, but it's extremely high permeability causes a rapid dissipation of any recharge with rapid movement of fresh water to discharge points around the coastal fringe. The soil cover and sand deposits originating from ocean and wind activity in turn become sand aquifers providing a limited amount of storage for monsoonal rainfall. These formations are useful and widely exploited for small water supply facilities. The sand aquifers are also underlain by Jaffna Limestone, into which the water in the sand will drain over a longer period of time.

68. The people of the Jaffna peninsula have developed water supply facilities that are well-suited to the conditions. The numerous shallow, low-yielding wells distributed over large areas did not have the capacity to cause an imbalance of the dynamic conditions maintaining the fresh water lens. In more recent years however, the increased demand for water has led to pumping rates that have, in places, caused problems. These problems can often be attributed to high pumping rates concentrated in small areas. An additional problem with the widely distributed shallow well system is that the groundwater is vulnerable to pollution in the absence of appropriate waste disposal arrangements.

#### **Geology**

69. Geological units exposed in the Jaffna area are part of a sequence of tertiary aged rocks which rests on a basement of Precambrian crystalline rocks. The total thickness is approximately 250 m, made up of three main units: Mannar sandstone at the base, Jaffna limestone, and a thin discontinuous surficial cover. The basal Mannar sandstone comprises about half this total but is not exposed in the project area. Jaffna Limestone, which is 50-90 m thick, overlies the Mannar sandstone and is extensively exposed in the western part of the peninsula in the Chunnakam area and in a small area to the west of Point Pedro. The limestone is also extensively exposed on the islands off the west coast.

70. Jaffna Limestone is of Miocene age coral reef formation and the easily soluble limestone also gives rise to a number of underground solution caverns. The upper surface of the limestone slopes gently to the south-east from the relatively high areas in the north-west where it forms the land surface in the general vicinity of Chunnakam. To the east of the Uppu Aru lagoon, the limestone is generally obscured by younger formations.

71. The youngest geological unit is a thin discontinuous cover of unconsolidated deposits. In the Chavakachcheri-Palai area to the south-west of the Vadamaradchi lagoon these deposits are yellow and brown sand, which is fine to medium grained and sub-rounded, with a maximum reported thickness of about 15 mm. Similar sand deposits occur in limited areas on the islands off the western end of the peninsula, and in the western part of the Chunnakam area north of Jaffna City.

72. On the north east side of Vadamaradchi lagoon there is a long almost linear belt of coastal sand dunes increasing from less than 2 km wide at the southern extremity to about 3 km at the northern end near Point Pedro. The sand beds appear to range from about 8 m to about 17 m thick with a maximum

elevation of about 10 m above sea level. They are clearly a recent coastal feature and in places are currently mobile.

73. A third main type of surficial deposit is present in the central part of the Chunnakam area. The unit is very thin, with a reported maximum depth of about 3 m. There is an upper sandy part and a lower gravely part, and the characteristic reddish brown color is imparted by a coating of haematite on many of the constituent grains. The unit is not important as a potential aquifer, but may have an influence on recharge processes in the areas where it is present.

## Ecological Resources

### Fisheries

74. The fisheries sector in Sri Lanka is considered one of the major potential fields for expansion of the economy. Previously nearly 89% of the country's fish production was obtained from coastal fisheries, but this dropped to around 65% after 1990 because of the conflict in the north. Until the mid-1980s the fisheries sector grew at a higher rate in Jaffna district than in other parts of the country. For example in 1983 Jaffna district contributed 26% (49,740 metric tons [MT]) of the total fish production and 57% (5,484 MT) of total dry fish production and provided employment for 24,840 people and indirectly to another 500 people. Fishing was then severely restricted due to security risks and has been almost totally prohibited since October 1995. A large number of craft and fishing gear were damaged by shelling and bombing; and many fishers left the area, resulting in further damage to craft from a lack of maintenance. Service infrastructure such as boatyards, ice plants, net factories, processing plants, jetties, cooperative buildings, trucks, etc., were also damaged or destroyed. As a result, in 2003 total fish production in Jaffna district was 5,311 MT and only 14,862 people were employed. Although the catch increased to almost 34,000 MT in 2004, the tsunami destroyed much of the operable infrastructure at that time so catches subsequently declined again.

75. Despite the many setbacks, rehabilitation of the fisheries sector is now underway, even though fishing is prohibited in the High Security Zones operated by armed forces. It has been estimated that the Northern Province now accounts for 21% of the total fishers in the country while the fish production was 12% and 5% in 2006 and 2008 respectively. Carangids, blood fishes, sharks, skates, mullets, shore seine fish and prawns are the most abundant fish types in the area.

### Aquatic Ecology

76. Most of the lagoons are important for fisheries because the young stages of many shrimp and fish spend much of their early life history in protected shallow waters such as these. They also attract considerable numbers of birds, particularly flamingos, ducks, and some shore birds. The lagoons are as follows:

- (i) Delft island, with several shallow lagoons and a few fresh water ponds;
- (ii) Pungudutivu lagoon is a 390 ha shallow brackish to saline tidal lagoon with extensive mud flats;
- (iii) Wetlands of Jaffna peninsula, occupy 20,000 ha of shallow sea bays, intertidal mud flats, mangrove swamps, saline marshes, and a large shallow lagoon;
- (iv) Uppu Aru lagoon is a 3,000 ha brackish water lagoon with fringing mangroves, extensive mud flats and salt marshes. This is located in interior of the peninsula and is surrounded by human settlements;
- (v) Thondamannar lagoon is a 7,787 ha shallow brackish to saline tidal lagoon with extensive mangrove swamps, sea-grass beds and mud flats. This is located in interior of the peninsula and is important for fisheries and as a source of fuel-wood from mangroves;
- (vi) Jaffna lagoon is 40,000 ha of shallow tidal lagoon with extensive intertidal mud flats and fringing mangroves. This is important for fishing and is the most important site in Sri Lanka for greater flamingos (*Phoenicopterus roseus*). There are also salt-pans in the east of the lagoon; and
- (vii) Chundikkulam lagoon is a 13,500 ha large brackish lagoon with sea-grass beds and fringing mangroves. Pawn fishing, salt production and cultivation of palmyrah palms in the adjacent areas were common before the conflict and the lagoon supports a wide variety of waterfowl, notably migratory ducks, shore-birds, gulls, and terns.

77. The lagoons are also used as harbors and for ferry services and provide anchorage for fishing vessels. Compared to other lagoons in the country, those around Jaffna are somewhat less disturbed by anthropogenic activities. However, the wetlands of Jaffna peninsula are threatened by destruction of mangroves, severe pollution and in-filling; and Thondamannar lagoon is threatened by reclamation of land

for agriculture and aquaculture, and pollution by pesticides. Thondamannar and Uppu Aru lagoons have been converted into freshwater lakes for rainwater retention and harvesting by concrete salt water exclusion barrages built across the mouths.

### Wildlife

78. Jaffna peninsula and islands, with extensive lagoons, mudflats, sand-flats, sea-grass beds and shallow shores, is the most important area for migrating water birds in Sri Lanka, and regularly records the greatest numbers of birds, compared with the Hambantota-Bundala area in the south-east, which records the greatest number of species. There are three flying routes across India and the Bay of Bengal through which migrating birds come to Sri Lanka. Birds found here include the following:

- (i) Indian Reef Heron (*Egretta gularis schistacea*) with two morphs (grey and white) occurs in very small numbers along the coast, particularly in Jaffna peninsula;
- (ii) Greater Flamingo (*Phoenicopterus roseus*) is the only member of the Flamingo family found in Sri Lanka and inhabits lagoons on the peninsula and islands;
- (iii) The most common migrating ducks are Pintail (*Anas acuta*) and Garganey (*Anas querquedula*); and Widgeon (*Anas penelope*) is also found;
- (iv) Common waders include Oystercatcher (*Haematopus ostralegus*), Black-winged Stilt (*Himantopus himantopus*), Avocet (*Recurvirostra avosetta*);
- (v) Common gulls include Great Black-headed Gull (*Ichthyophaga ichthyophaga*) and Lesser Black-headed Gull (*Larus fuscus*);
- (vi) Caspian Tern (*Hydroprogne caspia*) is most common along the north-west coast of the island, between Puttalam and Jaffna.

79. Despite their importance, there is little formal protection of the wetlands of the Jaffna peninsula, apart from the Chundikulam lagoon sanctuary, which includes adjoining land areas and retains its major importance and value despite inadequate physical protection and policing of activities. Elsewhere the ongoing destruction of wetlands emphasizes the need to provide greater protection, for example in the extensive Uppu Aru lagoon between the peninsula and Kayts island, the Poonalai mud and sand flats, Punkuditivu lagoon and the wetlands on Delfts.

### Forests

80. In the Jaffna peninsula there are no forests in and around the populated areas, except for Palmyra (*Borassus flabellifer*) plantations found as scattered patches and Casuarina plantations established by the Department of Forest Conservation along the sand dunes in Vadamarachchi area. However, the north-eastern part of the mainland, including parts of the Kilinochchi district, has large areas of forests and contains a large percentage of the forest cover of the country. Forests in the seasonally dry northern and eastern plains (transition between the wet and dry zones) consist of tropical semi-evergreen forests with their own characteristic species as well as some common to the adjacent zones. The major part of the dry zone has tropical dry mixed evergreen forests, where the dominant species seldom exceed 20 m in height and do not form a closed canopy.

### Rare or Endangered Species

81. For more than three decades the conflict has prevented any detailed ecological assessments in the project area, and the only recent data collected on rare and endangered species is from some individual studies carried out by the universities. A herpetological survey in 2002-2004 revealed 18 species of terrestrial snakes belonging to five families, with seven of the species being recorded for the first time on the Jaffna peninsula. Four species were highly venomous, two were mildly venomous and the rest were non-poisonous. Two species were endemic to Sri Lanka: the variegated kukri snake (*Oligodon taeniolata ceylonicus*) and the Sri Lankan Rat Snake (*Ptyas mucosa maximus*), both of the family Colubridae.

82. Another recent survey in and around the Thondamanaru lagoon confirmed the presence of crocodiles. Two species are found in Sri Lanka: the marsh or freshwater crocodile (*Crocodylus palustris*) and the salty or estuarine crocodile (*C. porosus*), which is the largest living reptile. In Sri Lanka, the two species would meet the IUCN criteria for being “endangered” and “critically endangered” respectively. Both species are recorded from northern extension of the Chandikulam sanctuary, while freshwater crocodiles were known to be present in Palai. In the past crocodiles were known in a variety of places, including Nagarkovil, Varani, Ampan, Maruthankerni, Maanviluntha, Kooru, Mullian and from the extensive mangroves along the Thondamanaru lagoon. Today, the lagoon and its mangroves represent the last stronghold of the crocodiles in the Jaffna peninsula. Reclamation of swamps, draining of coastal wetlands, conversion of



mangroves to prawn farms, and the removal of riverine forests are some of the reasons for the decline.

83. Amongst the peninsula's flora, Wild yam (*Dioscorea*), a large climber, with slender, cylindrical, twining stems, is a globally endangered species according to the Red Data Book of Sri Lanka. There are two species on the island: *Dioscorea koyamae* and *Dioscorea trimenii*, both of which are endemic and highly threatened. Recently some specimens were found at Sanguvely, close to Manipay.

#### Protected Areas

84. The protected area located in the area include the Chundikkulam sanctuary, which is a terrestrial cum aquatic (include parts of the Chundikkulam lagoon) bird sanctuary covering 11,140 ha. Available information for the period before the conflict showed that it is used for aquaculture in some parts and for cultivation of palmyrah trees around the lagoon. This sanctuary is located at a distance from the A9 road passage considered for transmission mains and also from other works related to water supply schemes. The Pariativu island sanctuary is of 18 ha size and occupies the uninhabited island, where no activities related to the project are planned. Further, Important Bird Areas (IBA) – potential Ramsar Sites – have been identified by Bird Life International, many of which are important breeding and feeding areas for threatened bird species out of these, there are 3 of 24 such sites in Sri Lanka located in Jaffna peninsula: Jaffna lagoon (14,912 ha); Araly south, Ponnalai (550 ha); and Kayts island, Mandativu (900 ha).

#### Coastal Resources

85. The coastal resources in the project area include near-shore and lagoon fisheries, minerals resources such as Miocene limestone, cement raw material, silica sands, etc. The places of scenic beauty constitute places that provide aesthetically appealing views of the beach with uninterrupted vistas of seascape and landscape. Manatkadu Sand Dunes are such a place. There are also sites of scenic beauty: Senthakulam Beach, Casuarinas Beach, Castle Beach, and Kalmunai Point. In addition to the above, bird watching is also possible in Pariathivu and Chundikkulam sanctuaries.

### Economic Development

#### Industries

86. At present, there is limited number of industries operating in Jaffna peninsula which includes lime stone crushers, toddy bottling industries, vehicle service stations etc. There were only 3 industries in Jaffna registered under the Ministry of Industrial Development and the Board of Investment of Sri Lanka as of end of 2008. The major irrigation schemes and other minor irrigation schemes spread out in the Northern Province will facilitate the agricultural and livestock development. Even under the conflict situation, the Northern Province produced 10 % of the total annual paddy production of the country. Production of Other Field Crops (OFCs) such as Red Onions were 40% of country total; Chilies, 10%; Green Gram, 14%; Ground Nut, 25%, etc. Main agro industries operating in Jaffna and Killinochchi are rice and flour mills, and oil extraction mills.

#### Land Use

87. In the Jaffna peninsula, land use is mainly for settlements and in red soil areas cash crops are grown intensively under lift irrigation from shallow dug wells. In sandy soils either coconut plantations or seasonal rainfed paddy cultivation is common. The extent of agricultural land uses has declined during the period of conflict but it has begun to increase. The land use change in Jaffna district is shown in Table 10.

**Table 10: Land use of Jaffna district (in ha.)**

Category	1986	%	2003	%
Paddy	12,760	12.9	7,598	7.4
Arable crops	12,000	12.2	11,183	10.9
Fruit crops	2,200	2.2	1,819	1.7
Coconut	4,400	4.4	2,918	2.8
Palmyra	13,000	13.2	12,775	12.4
Economic trees	1,000	1.0	870	0.8
Rocky lands	3,000	3.0	3000	2.9
Sandy and scrublands	12,000	12.2	12,000	11.7
Saline, alkaline, and barren lands	16,000	16.2	16,000	15.6
Built-up areas	22,000	21.3	22,000	21.5

Inland waters	4,180	4.1	4,160	4.0
Land deprived of cultivation due to security reasons			2,000	1.9
Damaged permanent crop lands			6,000	5.8
<b>Total</b>	<b>102,530</b>	<b>100</b>	<b>102,323</b>	<b>100</b>

Source: Jaffna district Secretariat

## Agriculture

88. Other than in urban areas and excluding beach sands, the land was covered with plantations or agricultural crops or paddy fields. Fringe belts of land on the perimeter of lagoons are grasslands (pasture) or wasteland. The Red Yellow Latosol soils (RYL) are the agricultural soils highly suitable for crop agriculture. They are found extensively in Valikamam area (where Chunnakam aquifer is located) and in Vadamaradchi area. These soils are deep and well drained. Regosols and sandy soil sustain palm trees such as coconut and palmyrah. There are pockets of loam earth (mixture of sand clay silt and humus) suitable for some crops scattered throughout the peninsula. Cultivation of Other Food Crops (OFC i.e., crops other than paddy) under lift irrigation is the dependable agricultural pursuit in Jaffna. This includes crops such as onions, chillies, yams, tobacco and vegetables. Paddy is cultivated as a rain fed crop during the rainy season and is not dependable, subject to vagaries of rainfall and weather conditions.

89. Jaffna has been an area with high potential in the agriculture field. Nearly 65,400 farm families and 30,000 laborers are involved in agriculture and livestock in the district. In addition, a large share of the population is involved in home gardens. Paddy is cultivated in 7,566 ha and is produced during the Maha season (March-April and September-October) under rain-fed conditions. Vegetables are grown throughout the year with the help of lift irrigation from the wells. Low country vegetables such as brinjal, tomato, long bean, okra, snake gourd, bitter gourd, and other leafy vegetables are being cultivated and are available throughout the year. Exotic vegetables like cabbage, leeks, beet, beans, and carrots are also cultivated in large extent.

90. Among the other field crops, onion, potato, tobacco, chilli, and banana are cultivated as cash crops. At present field crops and vegetables are cultivated in 4,000 ha approximately with the help of lift irrigation from the dug wells. About 19,261 agro wells and 2,433 ditches are being used for agriculture purposes. Farmers generate considerable income from perennial crops such as orchard crops like mango, jackfruit, grapes; and citrus and other crops like palmyrah and coconut. In 2002 the extent of which coconut was cultivated was 12,480 ha and due to war almost 50% was damaged and during the year 2008 only 6,355 ha was used for cultivation of coconut. Other perennial crops are grown in subsistence level. Further nearly 3.5 million palmarah palms are available in Jaffna.

91. Valukai Aru basin is one of the main agricultural areas in the peninsula. This wet stream (seasonal river) in the western sector is 15 km in length and it is connected with 45 ponds and several channels. Around 1,300 ha of paddy land and 150 ha of high lands in Tellipalai, Uduvil, Sandilipay, and Chankanai areas are benefited by this seasonal river. Total population in this area is around 60,000 persons comprising of 15,000 families in which 4,950 are farm families. Around 5,000 farm laborers are involved in agriculture and the major crops cultivated in this area are onion, chilly, and vegetables.

## Tourism

92. Jaffna peninsula which points towards the west to the tip of India is a flat dry land with shallow lagoons and a number of offshore islands. It is rich with attractive sandy beaches, heritage places, cultural activities, traditional food, beverages, and religious festivals.

93. Having many natural resources including forests, agricultural land, wetlands, lagoons, bays; and places of tourist attraction would provide a solid base for economic development in the Northern Province. Among the notable attractions, Jaffna may be mentioned for the Keerimalai hot water ponds, Chundikulam and Paraitivu sanctuaries. Jaffna peninsula is also a stronghold of migratory bird species especially in lagoons and island sides where this can be promoted for bird watching. Jaffna also has spectacular beaches which among them, Casuarina Beach and Chatty Beach are the most popular.

94. Jaffna has several important locations that are of religious, cultural and architectural significance. The Nallur Kandaswamy Kovil or Nallur Murugan Kovil built in 1749, Nagadeepa island also known as Nainativu is a small but notable island 30 km off the coast of Jaffna peninsula. The Jaffna Fort, built by the Dutch in 1680, is one of the best architecturally designed Dutch forts in all Asia. Jaffna is becoming a tourist destination in Sri Lanka after remaining unseen for years.

## Social and Cultural Resources

### Population, Communities, and Demographics

95. Conflict-affected areas in the north east of the country, which constitutes about 24% of Sri Lanka's land area, contain about 10% of its population. The census in 2001, which is the 13th in the series, was conducted after a hiatus of 20 years. However, in Jaffna district no enumeration was done. Since 1981, the only population records available in the project area are from the District Secretariat offices in Jaffna. The figures given in the Census 2001 for the project area are estimates as shown below in Table 11.

**Table 11: Population, Annual Growth Rate and Population Density by district**

District	Population		Average Annual Rate of Growth (%)	Population Density (Per Sq. Km)	
Year	1981	2001	1981-2001	1981	2001
Jaffna	738,788	490,621	-2.0	795	528
Sri Lanka	14,846,750	18,732,255	1.1	230	299

96. In Jaffna district, the estimated present population (2009) is 627,664 based on figures available with the District Secretariat. The population density in 2009 was 3,263 persons per square kilometre in Jaffna division; 1500-2000 in Vadamaradchi north, Valikamam south and Nallur; 1000-1500 in Valikamam west and southwest; 500-1000 in Vadamaradchi southwest, Valikamam east and Islands north; and less than 500 in other divisions.

97. Regarding the ethnic composition, available data for the year 2008 shows that in the Jaffna district 99.91% of the population was Tamil, 0.005% Sinhalese, 0.08% Muslim, and 0.005% other. Religion-wise, 86.5% of the population was Hindu, 13.5% Christian, 0.1% Islam, 0.005% Buddhist, and 0.009% other. The present resident population is predominantly Tamils and the Muslims accounts for some thousands. Sinhalese are only those employed in the area and attached to government services such as the armed forces.

98. Due to lack of any census in the Northern Province in the recent past, availability of any reliable socio-economic data is scarce. Consumer Finances and Socio-economic Survey (CFS) have been conducted by the Central Bank of Sri Lanka in 2003/2004 which is scheduled once in 5 years. According to the CFS 2003/2004, in the Northern Province, the average monthly income per household, per spending unit and per income receiver were Rs15,204, Rs14,251 and Rs 9,228, respectively. However, 50% of households income was less than Rs10,430 per month while 50% of income receivers income were less than Rs6,500 per month. The poorest 20% of the income receivers in Northern Province received 1.9% of the total income and the richest 20% of the income receivers received 54.8% of the total income.

99. Labor force participation as a percentage of population for Jaffna and Vavuniya Districts are 31.7% and 37.7%, respectively. About 56.4% of Northern Province workforce is employed in the service sector, 25.9% in agriculture, forestry and fishery and 17.7% in the industrial sector. Unemployment rate in Jaffna district is 6.2%, while in Vavuniya Districts it is 4.7%. Survey results reveal that the average monthly household expenditure was Rs15,425 for the Northern Province. Expenditure on food was Rs 6,617 per household per month and it was 42.9% of the total household expenditure. Per capita consumption expenditure shares on liquor and tobacco, and education were 2.1% and 4.5%, respectively.

100. Except in the Jaffna municipal area where only 1% of land is under agriculture, cash crops in red soils with lift irrigation from dug wells is the major income source for the majority. Paddy is grown seasonally on sandy soils under rainfed conditions in the Maha season. Coconut plantations and fruit crops also bring substantial income. Fisheries were the livelihood for a large number of people and expanding rapidly with the conclusion of the conflict which eased the fishing activities with comparatively less restrictions. The households in the project areas get income from main sources such as income from employment, their own economic activities, and other sources such as assistance from government and NGOs mainly in the form of in-kind relief. Some get monetary assistance from relatives or friends especially from those living abroad.

### Public Health and Health Facilities

101. Jaffna Teaching Hospital is the main public health care and medical institution for the people of Northern Province and for teaching of medical students from the University of Jaffna, and nursing and

midwife students. Most of the very sick patients are referred to Jaffna Teaching Hospital from other areas in Jaffna peninsula, Palai, and Poonakary. This hospital handles about 308,438 in-patients and 239,302 out-patients during 2008 through 23 specialists, 172 doctors and 9 dental surgeons with the help of 310 nurses and 14 pharmacists.

102. Four base hospitals, 22 divisional hospitals, 16 primary medical care units and 34 public health clinic centers (PHC) are functioning under the Deputy Provincial Director of Health Services (DPDHS) while 41 ayurvedic dispensaries are under the control of local bodies. One ayurvedic teaching hospital is also available at Kaithady. The district is divided into seven Medical Officer of Health Divisions (MOH) for preventive care services under public clinics centers which are functioning in the Jaffna district. In addition 8 private hospitals and 78 pharmacies are functioning in the Jaffna district.

#### Education and Education Facilities

103. In 2008 there were 700 registered pre-schools with a student population of 18,016. There were 126,688 students in grade 1-13 with 3,141 graduate teachers and 3,682 trained teachers, with a pupil-teacher ratio of 18.2. A total of 413 schools are functioning in Jaffna district consisting of 45 Type 1AB, 49 Type 1C, 139 Type 2, 36 Type 3-I, and 145 Type 3-II.

104. Major constraints in implementing the rehabilitation and development programme are lack of adequate financial resources, presence of land mines, inadequate infrastructure, and acute shortage of skilled manpower resources, teaching aids and equipment.

#### Socio-economics

105. In Northern and Eastern Provinces during the conflict period many lives were lost and many persons were forced to flee their homes. Displaced people do not have stable shelter. There is a need for adequate housing and other amenities through a comprehensive social development program.

106. Poverty is major area of concern with respect to the project area. The official poverty line is defined as the minimum expenditure per person per month to fulfil basic needs, and the Department of Census and Statistics of Sri Lanka publishes the figure for each month (district-wise). However, the Census and Statistics Department of Sri Lanka has not provided the figures for Jaffna Districts. Therefore, the national figure is used for the district. Table 12 below illustrates the living status of the total population in Jaffna district and it is important to note that 79.5% of population is below the national poverty line (announced figure for month of October is LKR 2,980 per person).

**Table 12: Member-wise Population Summary as of 31 October 2009, Jaffna district**

Category	No of members in family						Total family	Total population
	1	2	3	4	5	6 ≤		
MR & DRS Relief								
Displaced before 11.08.2006	2,812	2,842	3,579	2,474	3,509	1,577	15,793	54,824
WFR Relief								
Displaced after 11.08.2006	265	310	236	241	265	113	1,430	4,595
Economically affected	10,062	10,549	7,600	5,686	4,252	1,318	39,467	106,418
IDP newly cleared areas	319	307	322	191	168	95	1,402	4,201
Resettled families	4,288	4,112	4,225	3,808	3,131	2,506	22,070	67,503
Total WFR relief	14,934	15,278	12,383	9,926	7,816	4,032	64,369	182,717
Samurdhi relief	8,239	5,577	7,562	8,843	11,863	11,014	53,098	205,293
Total Relief	25,985	23,697	22,524	21,243	23,188	16,623	133,260	442,834
Not provided Relief from Jan 2008								
Economically affected	3,888	3,630	2,964	2,500	2,612	2,040	17,634	53,072
Total Below Poverty Line	29,873	27,327	25,488	23,743	25,800	18,663	150,894	495,906
Above Poverty Line								
Government employees	4,790	5,232	4,589	4,251	3,975	1,232	24,069	75,189
Non-government employees	3,396	3,078	3,114	2,330	2,614	2,097	16,629	52,656
Total above poverty line	8,186	8,310	7,703	6,581	6,589	3,329	40,698	127,845
Total	38,059	35,637	33,191	30,324	32,389	21,992	21,992	623,751

Source: District Secretariat, Jaffna, 2009

#### History and Archaeological Sites

107. The city of Jaffna has a written history of 2,000 years. After the rule of Chola Empire in the Jaffna peninsula, the Arya Chakravathi dynasty reigned from 1240 to 1450. Jaffna was occupied by the Portuguese (1617 to 1658) and the Dutch (1658 to 1795) until the British conquest. In the project area, most of the high

priority archaeological, historical, and cultural sites are located within the coastal zone. They are listed in Table 13.

**Table 13: Important Archaeological, Historic and Cultural Sites in Coastal Parts of the Project Area**

	Place	Gramasevaka Division	Importance
1	Pas Pyl Fort	Mulliyar (149)	A/H
2	Vallipuram Burial	Thunilai north (131)	A
3	Kankasanturai Fort	Kankasanturai (67)	A/H
4	Sambiturai Port	Keerimalai (64A)	A
5	Keerimalai –freshwater spring below sea level	Keerimalai (64A)	C/H
6	Naguleswaran Sivan Kovil	Keerimalai (6A)	H/C
7	Vishnu Kovil	Keerimalai (64A)	C/H
8	Monastic Site – Keerimalai	Keerimalai (64A)	A/H
9	Megalithic Site-Anaikottai	Anaikottai (40)	A
10	Jaffna Fort **	Columbuturai (8)	A/H
11	Hammenhiel Fort	Karainagar north (10A)	A/H
12	Portuguese Fort	Allapiddai (19)	A/H
13	Portuguese Fort (Eyrie)	Allapiddai (19)	A/H
14	Allapiddai	Allapiddai (19)	A
15	Portuguese Fort – Urindikottai	Allapiddai (19)	A
16	Nagar Pooshary Amman Kovil	Nainativu (04)	H/C
17	Portuguese Fort	Delft west (01)	A/H
18	Dutch Fort **	Delft Central (02)	A/H
19	Monastic site-vadieresankottai	Delft Central (02)	H
20	Nolans Bungalow	Delft Central (02)	H
21	Elephant Pass Fort	Nukavil 9153)	A/H

Source: Coast Conservation Department

\*\* Protected Monument; A – Archaeological Value; H – Historical Value; C – Cultural Value

108. There are some other important sites in the interior of the peninsula. A palace of the last king (Sangillion) of Jaffna is present in Nallur area. There are the historically and culturally important Temples: Nallur Hindu Temple (both historical and present), Vallipuram Hindu Temple and Nagadeepa Buddhist Temple. The Puttur bottomless well is also a legendary place. In the Kandarodai area, an archaeological site is present where a large number of tombs of Buddhist monks are found.

109. Artifactual distribution at Anaikotti—a complex archaeological sites ranging over several hundred years—covers an area of 2 km<sup>2</sup>. A megalithic burial mound is found in this site. A large urn, several bones and number of early carinated black and red ware shreds are indications of the megalithic potential of this site.

110. Sites that carry an archaeological value in the Jaffna region were abandoned due to the conflict. Maintenance was not done due to the access constraints which arose with the security concerns. Some of the sites were damaged, and the Archaeological Department of Sri Lanka has taken initiatives in restoration of the sites through its regional office in Jaffna.

## 4 SCREENING OF POTENTIAL ENVIRONMENTAL IMPACT AND MITIGATION MEASURES

### 4.1 SLSEA'S Approach for Solar Rooftop Location Selection

111. The pilot project will include options for installing the rooftop systems on public buildings/universities on a PPP basis (i.e., installation, operation and maintenance handled by the private sector). In addition, the project will also help facilitate a sustainable private sector participation in solar rooftop project development by involving private entities (hotels, private factories, commercial entities, etc.). The project will also have a component to provide project implementation and monitoring consultancy support to the SLSEA in its role as the implementation agency for the duration of the project implementation.

112. The projects on the public buildings/universities will be developed on a PPP mode through allocation of an investment grant portion by the government for installing solar rooftop power generation on selected university buildings. The financing of private sector solar rooftop projects will be undertaken by providing credit to eligible private developers from a credit line as part of the project loan. The proposed pilot solar systems are expected to be bided out to the private sector for designing, developing, installation

and commissioning that may help to bring down capital costs to a reasonable level. The scope can include a maintenance contract for period of 10 years. National Competitive Bidding (NCB) procedures would be adopted for the selection of service providers.

## 4.2 Technical Information required for Solar Rooftop location selection

### Building Roof Structural Assessment

113. An ideal roof for PV installation is one with large flat space, contiguous space preferably with rectangular or square shape. Structural drawing of the building shall need to be reviewed by a structural engineer to approve the roof for the solar array. Having engineering drawings will allow for an assessment more efficiently and the drawings will be also necessary to design the solar system, module layout and fastening system.

#### a Roof Type

114. The key issue is to determine the life of the roof as any need to replace the roof in the next 30 - 40 years would be a problem. Also, different types of roofs have different lifespans:

- Metal roof – The oldest metal roof that is likely viable to look at is 10 - 15 years old because structurally the building will need to be able to carry the solar system (total 4 to 5 lb per sq. ft.)
- Non Metal roof (flat with stone / pebble) – The oldest to look at is 6 – 8 years because this roof only lasts 10 - 15 years and will need to be replaced.

#### b Roof Form

115. The size of roof is very important to determine the total generation that could be supported by the roof. Typically, a 10kW system needs roughly 1,000 sq ft, and a 100kW needs 12,000 sq ft. To estimate size of potential installation and performance of a system, it is necessary to fix the roof area:

- Roof pitch, covering materials and penetrations all impact suitability of PV. Pitched roofs may have some gravity problems, and also may raise aesthetic concerns from neighbors. Pitched roofs makes optimal panel orientation difficult if the pitch is more than 50%.
- Skylights, HVAC equipment, plumbing vents and roof covering Material – these would interrupt the coverage of the roof with modules and create shading issues and subtract its area from the total.
- Proposed roof traffic management plan to facilitate system maintenance and worker safety.

#### c Module Orientation

116. The way which the roof faces is very important for solar intensity – ideally, south facing is optimal, if not facing directly due south, a solar system will lose production capability. Depending on the pitch of the roof and other factors, facing SE / SW can often be financially viable for a solar project.

#### d Panel Tilt

117. The angle or pitch of the roof enables to capture more solar radiation. The best roof pitch is 30 degrees, but most roofs are not typically built this steep. The panel will have to be tilted accordingly.

#### e Shading Obstacles

118. Any shading on the solar panels will reduce the electricity production the system. A solar system may not include panels near any vents or fans that emerge from the roof or areas of the roof that are shaded by silos, buildings or trees. Fire Safety Installations, mostly installed on roofs of commercial buildings may cast shadow onto the panels.

#### f Other Electrical and Mechanical Systems

119. There are other fittings as well that are situated on the roof along with solar panels:

- Locations of inverter and electric fittings and interconnection with net meter:
- Fire safety and other installations.
- Water proofing of cables etc.

#### g Wind Velocity etc.

120. To avoid the panel getting detached from the roof in case of high velocity winds and avoid hitting other buildings or falling below:

- Use of optimal engineering designs.
- On a standing seam roof panels can be clamped directly onto the seam.
- On corrugated metal roofs, metal rails are fastened to (and therefore penetrating) the roof and panels are clamped to the rails.
- Flat roofs require racking; the angle/ pitch of the racking will not be ideal, as uplift and wind rating will not allow for 30 degrees, and you can usually not add weight to offset uplift due to structural / weight constraints.



## h Locational Issues

121. It is important to determine if the building is complying with current municipal bye laws and if there will be any additional formalities that will be required for additional compliance for solar rooftop application. The location selected will have to have reasonable distance from any nearby bird sanctuary etc.

## i Workers Health and Safety Issues

122. Workers health and safety issues being taken care include:

- Transportation and hoisting of panels to rooftop
- Installation of panels and electrical installations on rooftops
- Role of Electrical Safety Inspector.

## Feasibility Study

123. The PPP shall need to submit a detailed analysis of the project:

- Facility structural engineering analysis and approval / stamp.
- Complete PV system design: roof analysis, panel layout, component requirement, mounting solution, obstructions.
- Field study: shading analysis, measurements.
- Single line electrical drawing, grid connection assessment including settlement.
- Energy output and economic modeling.
- Development, logistics, installation, contract requirements, system maintenance.
- Reporting & project management: number and type of modules and inverters, system cost analysis.

124. These and other eligibility criteria will be established in more detail by the National Consultant who will prepare the project approval mechanism and operating guidelines.

## 4.3 Environmental Impacts and Mitigation Measures

### Environmental Impacts and Mitigation Measures due to Project Location, Design and Pre-construction

125. All items mentioned above in 4.2.1 shall be analysed to assess any environment impact during design and pre-construction.

### Environmental Impact of Construction Activities

126. This will involve construction – engagement of construction labour for repair/replacement of roofing tiles, erection of structures and equipment, laying of electrical installations, drain/pipelines and power line in the initial phase. Air, noise and soil/land may be affected by these activities. This solar panel installation on rooftop will have anticipated negligible impacts on aesthetics in the area and nil land use. Environmental impact of construction activities on physical resources, ecological and human environment is very limited.

127. The environmental impacts associated with the solar panel Installation are being assessed on a case-by case basis by SLSEA. The rooftop solar panel sites are not located in ecological sensitive areas such as reserve forests and wild life sanctuaries. Standard construction impacts that mainly relate to specific building erection activities and site disturbance will occur on a temporary basis. These types of construction impacts, common to most rooftops solar panel are described below, together with the associated mitigation measures. Table 14 lists the impacts during construction phase of rooftop PV system.

**Table 14: Impacts during construction phase of rooftop PV system**

Aspect	Impacts
<b>Biodiversity protection issues</b>	
Nearby bird sanctuary	None
<b>Worker health and safety issues</b>	
Transportation, hoisting and erection of PV system	<ul style="list-style-type: none"> <li>• Manual labor used for hoisting panels to roofs – proper tools, safety belts, boots and protective gear used.</li> <li>• Hoisting tools to conform to load safety requirements.</li> </ul>
<b>Waste Generation from un-packaging and installation</b>	
Soil and/or groundwater contamination due to improper disposal of packaging waste	<ul style="list-style-type: none"> <li>• Compliance with any existing local regulations for recycling of wastes.</li> <li>• In the absence of local regulations, disposal plans proposed or carried out for the environmentally safe disposal and recycling schemes.</li> </ul>
Construction waste – rubble etc.	<ul style="list-style-type: none"> <li>• Compliance with any existing local regulations for recycling of wastes.</li> <li>• In the absence of local regulations, disposal plans proposed or carried out for the environmentally safe disposal and recycling schemes.</li> </ul>
<b>Alternative uses of resources</b>	

Rooftop usage	<ul style="list-style-type: none"> <li>For roof-top mounted and building integrated schemes, as well as for small stand-alone systems for remote applications, land use is not a significant aspect.</li> <li>Rooftop use replaced by PV system: rooftop signage/advertisement/other installations etc.</li> </ul>
<b>Environmental issues sensitive to public opinion</b>	
Visual impact	<ul style="list-style-type: none"> <li>Type of scheme: Small visual impact for roof-top mounted schemes as compared to large grid-connected power stations cover more land area.</li> <li>Site location: placing building integrated systems in facades of historic buildings or building with cultural value can have significant aesthetic impact.</li> <li>Protests concerning project's visual impact.</li> </ul>

### Physical Resources

128. **Impact on Air Quality.** During construction, the rooftop erection activity will not generate significant dust and will not impact ambient quality of the area

129. **Impact on Noise Levels.** During construction, the major sources of noise pollution will be hoisting the panels on to the roof, hammering and grouting, and fixing of panels accompanied by one time movement of vehicles for transporting panel material and equipment to the site. The expected noise level of construction equipment is presented in Table 15.

**Table 15: Expected Noise Emissions**

S. N <sup>o</sup>	Machine	Noise level dB(a)
1.	DG set	80-110
2.	Grouting Machine	100-120
3.	Motor Scraper	85-95

130. **Impact on Surface Water Quality.** Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site temporarily. This can be avoided by careful selection and work styles so that surface runoff does not enter the stream.

131. **Impact on Soil and Geology:** None, as the installations are on rooftops.

132. **Spoil Disposal:** A small quantity of muck is expected to be generated as a result of repair work on the roof which will be disposed-off in accordance to the Municipality ordinances.

### Ecological Resources

133. **Impact on Terrestrial Ecology.** None, as the installations are on rooftops.

134. **Terrestrial Fauna.** None, as the installations are on rooftops.

### Human Environment

135. **Traffic and transport.** There is no high traffic density in the study area.

136. **Health and Safety.** The project proponent shall take care of all health and safety requirements of the workers engaged.

137. **Human Interference.** None, as the installations are on rooftops.

138. **Water Supply.** No impacts as the installations are on the rooftops of buildings.

### Socio-Economics

139. The implementation of the solar rooftop erection will make available excess power to the project proponent and therefore give an indirect potential for employment by meeting the electricity demands of the surrounding area due to more power availability in the neighbourhood. At present there is no industry in Jaffna region, the proposed system will give relief to the grid system and there can be potential for the development of agro, horticulture and forest based industries.

140. **Resettlement.** There are no resettlement issues as this a rooftop solar array erection activity.

141. **Agriculture.** No impact on any land.

142. **Cultural sites.** No archaeological, historical, or culturally important sites are located near the project site, hence no impact.

### Environmental Impact of Operation Activities

This phase will contribute its activity after the rooftop solar unit starts operation. During the operation phase, most of the construction phase impacts will get stabilised and the impacts will be very limited during operation and maintenance of the project. Table 16 gives illustrative impacts during operation of a rooftop



solar PV system.

**Table 15: Impacts during operation phase of rooftop PV system**

Aspect	Impacts
<b>Biodiversity protection issues</b>	
Nearby bird sanctuary	None
<b>Worker health and safety issues</b>	
Occupational health hazards during operation of PV system	<ul style="list-style-type: none"> <li>• Compliance with international, local, and national health and safety regulations.</li> <li>• Training of personnel.</li> <li>• Emergency plans in place.</li> <li>• Outstanding worker compensation claims.</li> </ul>
<b>Effluent emissions, on-site contamination, hazardous materials issues</b>	
Soil and/or groundwater contamination due to improper disposal of batteries	<ul style="list-style-type: none"> <li>• Type of solar PV system in review: this issue is not relevant for systems that do not have energy storage capacity (e.g. grid connected systems or stand-alone systems with no energy storage).</li> <li>• Compliance with any existing local regulations for recycling or special disposal of batteries.</li> <li>• In the absence of local regulations, disposal plans proposed or carried out for the environmentally safe disposal of batteries, including battery collection, storage and recycling schemes.</li> </ul>
Soil and/or groundwater contamination due to decommissioning of PV systems	<ul style="list-style-type: none"> <li>• Chemical content of PV cells used in project: Silicon modules pose fewer decommissioning problems than cadmium containing modules.</li> <li>• Decommissioning plans for the project: disposal methods proposed, recycling opportunities considered for end of life stage, PV cells collection schemes available for decommissioning purposes.</li> </ul>
Atmospheric emissions of toxic substances due to incineration during decommissioning of PV systems	<ul style="list-style-type: none"> <li>• Chemical content of PV cells used in project: Silicon modules pose fewer decommissioning problems than cadmium containing modules.</li> <li>• Decommissioning plans for the project: disposal methods proposed, recycling opportunities considered for end of life stage, PV cells collection schemes available for decommissioning purposes.</li> </ul>

### Physical Resources

143. **Impact on Topography.** No topographical changes are envisaged during the operation phase during the operation and maintenance.

144. **Impact on Climate.** No impact on climate of the area.

145. **Impact on Hydrology.** None.

**Impact on Air Quality.** The project does not generate any air emissions during operation.

146. **Impact on Noise Levels.** None.

147. **Impact on Surface Water Quality.** None.

**Decline in Water Quality.** None.

148. **Impact on Ground Water Quality.** None.

149. **Impact on Soil and Geology.** None.

### Ecological Resources

150. **Impact on Terrestrial Ecology.** None.

151. **Impact on Aquatic Ecology.** None.

### Human Environment

152. **Health and Safety.** Health and safety impacts, such as accidents due to electro-cutting, fires and explosions, and exposure to electromagnetic fields may occur. Personal protective equipment like safety gloves, helmet, and noise protection will be provided during construction and during maintenance work. Priority will be given to maintaining hygienic conditions and good aesthetics on the rooftop and proper traffic management on the roof. Necessary training regarding safety aspects to the personnel working at the project site will be provided.

153. **Socio-economics.** Beneficial impacts are envisaged on socio-economic conditions.

#### 4.4 Environmental Management Plan

154. The objective of EMP is to minimise stress on the natural resources within the carrying capacity. Solar rooftop installation implementation consists of several infrastructure components that are listed in Table 17.

**Table 17: Summary of Infrastructure Components of the Solar Rooftop Installations**

S.No.	Main Components	Infrastructure
1	Solar Panels	Prefabricated SPV panels
1	Electrical and Mechanical Equipment	Net meter, Inverter, Batteries (if required).
2	Civil Works	Foundations of panels, roof tiling, repair work Disposal inorganic waste generated
3	Power Evacuation	Power connection point/New Metering point, cables to CEB supply

155. A draft Environmental Management Plan (EMP) has been prepared for the project (attached in Annexure 2). The EMP summarises anticipated impacts, monitoring requirements, and the proposed mitigation measures with respect to the following stages: (i) Design, pre-construction, (ii) construction, and (iii) operation and maintenance. Detailed, site-specific mitigation measures and monitoring plans will be developed by the National Consultant hired under ADB Loan in accordance with the management by SEA for project implementation.

156. A summary environmental impact matrix and the mitigation measures are given in Table 18:

**Table 18: Environmental Impact Matrix**

SI N <sup>o</sup>	Environmental Attribute	Potential Impacts	Nature of Impact	Magnitude of Impacts			Mitigation Measures	Implementation & Monitoring	
				Low	Medium	High			
A. Physical Resources									
1.	Topography	Protests concerning project's visual impact.	Direct/local/reversible		X		Type of scheme: Small visual impact for roof-top mounted schemes as compared to large grid-connected power stations cover more land area. Site location: placing building integrated systems in facades of historic buildings or building with cultural value can have significant aesthetic impact.	Before construction phase	
2.	Climate	No impacts on the climatic conditions.	Indirect/local/irreversible	X			No known impact on the climatic conditions, hence no mitigation is required.	Before the construction phase.	
B. Environmental Resources									
1.	Air Quality	Project will have negligible impact on air quality during the construction period.	Direct/local/reversible	X			Covering the loose muck from the installation of the rooftop panel.	During construction phase.	
2.	Noise	Noise due to general construction activities.	Direct/local/reversible	X			No installation of the panels in the night and use of personal protective equipment like ear plugs etc.	During construction phase.	
3.	Surface and Ground Water quality	Run off construction waste – rubble etc. in drain from the roof.	Direct/local/reversible	X			Careful collection of loose rubble/muck and proper disposal.	During construction phase.	
		Soil and/or groundwater contamination due to improper disposal of packaging waste.	Direct/local/reversible	X			Compliance with any existing local regulations for recycling of wastes.	During constructionphase.	
C. Ecological Resources									
1.	Terrestrial Avifauna	Disturbance to local birds etc.	Direct/local/reversible	X			Bird Sanctuary and their habitats have been avoided.	Construction and operational phase	
D. Human Environment									
1.	Fire and Safety	Fires, explosion and other accidents during erection and operation.	Direct/local	X			Use of personal protective equipment during construction and operation. Regular inspection of connection and check for fault prone areas.	During construction and operation phase	
2.	Health and Safety	Transportation, hoisting and erection of PV system.	Direct/local	X			Manual labor used for hoisting panels to roofs – proper tools, safety belts, boots and protective gear used. Hoisting tools to conform to load safety requirements.	During construction phase.	
		Occupational health hazards during operation of PV system.	Direct/local/rev ersible	X			Compliance with international, local, and national health and safety regulations.	During construction and operational phase	

SI N°	Environmental Attribute	Potential Impacts	Nature of Impact	Magnitude of Impacts			Mitigation Measures	Implementation & Monitoring
				Low	Medium	High		
							Training of personnel. Emergency plans in place. Outstanding worker compensation claims.	
3.	Socio-economics	Beneficial impacts from excess power to the grid. Job opportunities during construction/operation phase.	Indirect/regional		X		Unskilled labor and indirect benefits. Overall economic growth of the region.	During operational phase
4.	Resettlement	Resettlement of persons living in buildings	Direct/Local/reversible	X			No mitigation required.	Before the construction phase.
5.	Cultural sites	No archaeological, historical or cultural important sites are affected by the construction of the lines.	Direct/local/reversible	X			No archaeological, historical or cultural important sites are affected, hence no mitigation required.	Before the construction phase.
6.	Solid Waste/hazardous wastes Generation	Probability of surface and ground water pollution.	Direct/local/reversible	X			Separated wooden and scrap will be collected and disposed of in compliance with applicable regulations and rules.	During construction phase
		Atmospheric emissions of toxic substances due to incineration during decommissioning of PV systems.	Direct/local/irreversible		X		Chemical content of PV cells used in project- Silicon modules pose fewer decommissioning problems than cadmium containing modules. Decommissioning plans for the project: disposal methods proposed, recycling opportunities considered for end of life stage. PV cells collection schemes available for decommissioning purposes.	During operation/de-commissioning phase
		Soil and/or groundwater contamination due to improper disposal of batteries.	Direct/local/irreversible		X		Type of solar PV system used- no energy storage capacity, but if batteries are used, compliance with any existing local/international regulations for recycling or special disposal of batteries.	

## 5 INSTITUTIONAL REQUIREMENT AND ENVIRONMENTAL MONITORING PROGRAMME

### 5.1 Institutional Arrangements

157. According to the National Environmental Act (NEA), there is no mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for any kind of solar power plants and power evacuation line at 33 kV. MoPE will be the Executing Agency (EA). SLSEA will implement the energy efficiency and renewable energy sub-components:

#### **Sri Lanka Sustainable Energy Authority (SLSEA)**

158. Sri Lanka Sustainable Energy Authority Act, No. 35 of 2007 which became operational from 21st September 2007. The objectives of SLSEA are:

- To develop renewable energy resources.
- To declare energy development areas.
- To implement energy efficiency measures and conservation programmes.
- To promote energy security, reliability and cost effectiveness in energy delivery and information management.
- To repeal the energy conservation Act No.2 of 1985.

159. SLSEA staff and senior officers will be assisted by a national consultant for two years to guide SEA undertake day-to-day project implementation activities. Full-time project managers with qualified staff will be appointed to supervise sub-projects. The PPP operators will be responsible for overall project implementation, including procurement, accounting, quality assurance, social and environmental issues, and coordination with concerned agencies.

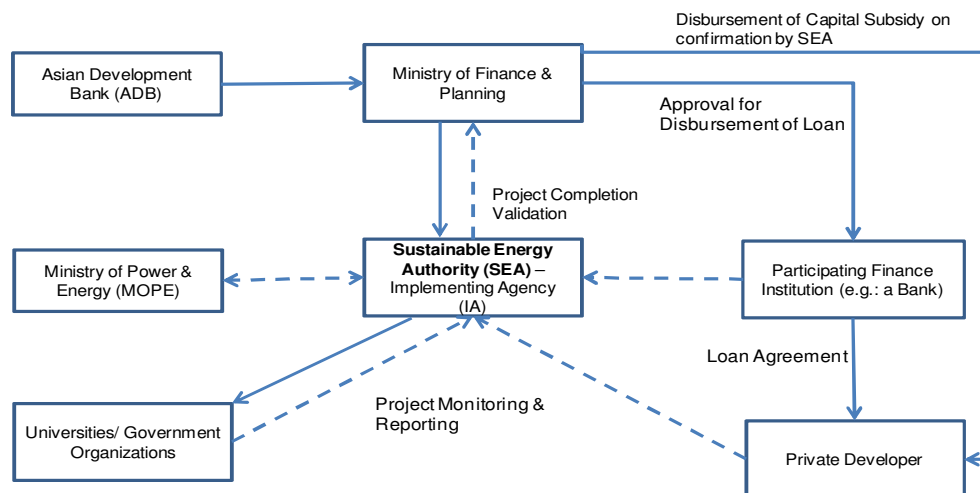
### 5.2 Establishment of the PIU

160. A Project Implementation Unit (PIU) was established for the ADB's Sustainable Power Sector Support Project that funded micro hydro repowering and energy efficiency project in 2010. This PIU could be used to assist the implementation of this project and will report directly to the Board of Management of SEA, in accordance with the GoSL's established rules for such PIUs. The PIU will only perform functions related to the project, and would ensure (i) information and support provided by project consultants are focused towards the needs of the project (ii) adequate promotion of the project, and (iii) serving a focal point in all issues related to the project. The PIU is expected to operate for two years on a full-time basis, by which time, project disbursements would be completed.

### 5.3 Technical Eligibility Criteria for subprojects

161. Once the PIU is established, a national consultant will be appointed by ADB, to serve the requirements of the PIU to establish eligibility criteria for projects and the details of the fund flow mechanism. The consultant will assist PIU to develop the guidelines for technical appraisal of subprojects, and the forms and formats to be used by the PIU. Criteria for environmental and social impacts assessment will also be developed in the same process.

162. The credit facility will be channelled from a dedicated account of the Ministry of Finance and Planning (MOFP) established in the Central Bank to an account in a participating financial institution(s) that will check repayment capacity of the developer according to its internal procedures and provide a loan to the developer. The same one or two participating financial institutions to be involved in a similar credit line implementation under the micro-hydro rehabilitation and repowering pilot of the ADB's Sustainable Power Sector Support Project may be selected for administration of the proposed credit line. The following Figure 3 indicates implementation arrangements for the solar rooftop power generation pilot.



**Figure 3- Project Implementation Mechanism**

163. The Table 19 below shows the proposed assignment of key responsibilities in the project development, approval, financing and monitoring process.

**Table 19 Proposed Key Responsibilities**

Activity	Key Responsibility	Technical Assistance	Facilitation
<b>Pre-project activities</b>			
Establishment of technical eligibility criteria for subprojects	SEA/PIU	Consultant	-
Project promotion (stakeholder meetings, project guidebook, brochure, media releases, project website)	SEA/PIU	Consultant	-
Establishment of eligibility criteria for borrowers	PFI	SEA/Consultant	-
<b>Project implementation activities</b>			
Subproject identification, feasibility study, finance application	PPP Company	SEA/Consultant	SEA/PIU
Sub-project financial appraisal	PFI	SEA/Consultant	-
Approvals required before project construction (Local authority, Environmental Agencies)	SEA/Consultant	SEA/Consultant	SEA/PIU
Project construction	PPP Company, with their contractor or ESCO	SEA/Consultant	-
Loan disbursements and re-financing	PFI and the MOF (Treasury)	SEA/PIU	-
Net metering agreement	PPP Company and Distribution Licensee	SEA/PIU	PUCSL
Grid interconnection and commissioning	PPP Company	SEA	SEA/PIU
<b>Project monitoring activities</b>			
Loan repayment	PPP Company	-	-
Maintenance	PPP Company and ESCO	-	-
Performance monitoring	SEA/PIU		

PPP: Public Private Partnership, PIU: Project Management Unit established in SEA, MoPE: Ministry of Power and Energy, MOF: Ministry of Finance, PFI: Participating Financial Institution, PUCSL: Public Utilities Commission of Sri Lanka

## 5.4 Environmental Monitoring Plan

164. During the construction and operation phase of this project, the monitoring of the environmental

aspects shall be done at the solar rooftop project by the SEA as per GoSL requirements. During the construction phase, the project proponent should ensure that all construction activities are done properly to have minimum impact. This in turn should be monitored by the SEA at individual rooftop solar project level through consultant hired under the loan/technical assistance from ADB.

165. Monitoring report should be prepared once in six months with the corrective action plan for the problem areas. Overall the environmental good practices should be followed as per environmental policy guidelines. The monitoring activities of the project include site supervision and verification of permits. The environmental monitoring report will be submitted by the project proponent to the PIU, which will include the result of environmental monitoring (if any) into its environmental report.

166. As per ADB's safeguards Policy 2009, ADB requires the borrower to retain external qualified experts or qualified NGOs to verify monitoring reports with significant impacts and risks. This external monitoring report will be on a semi-annual basis directly to ADB to verify whether sound environmental management practices are applied, and the set environments targets are achieved. In case the implementation of EMP measures is not satisfactory, this external monitoring experts/NGO will recommend actions to enhance environmental compliance.

## 5.5 Critical Environmental Review Criteria

### (i) Loss of Irreplaceable Resources

167. The rooftop solar power projects do not involve any land impact. The GoSL requires compensation for the loss by minimising the impact of loss of vegetation as per existing norms under the Forest (Conservation) Act, 2002. There will be no Net Biodiversity loss in these rooftop solar projects as no tree shall be cut.

### (ii) Accelerated use of Resources for Short-Term Gains

168. The project will not make use of any natural resources occurring in the area during construction as well as its operation cum maintenance phases. The construction material shall be very small in quantities. Thus the project shall not cause any accelerated use of resources for short term gains.

### (iii) Endangering of Species

169. Endemic species of flora and fauna exist in the project area and adjoining forest areas, but the project activities will not be threatened or cause their extinction.

### (iv) Promoting Undesirable Rural-to Urban Migration

170. The project will not cause any acquisition of land holdings that normally trigger migration. It also does not involve acquisition of any private land holdings. Hence, there is no possibility of any migration.

### (v) Increase in Affluent/Poor Income Gap

171. The project will increase availability and reliability of power for local area to the extent of 50 kW. It is well known that power is a key input to the economic development of any area. Past experience indicates that economic development leads to generation of more jobs which in turn should raise the living standards of poor. Thus the project is expected to contribute in reduction of affluent/poor income gap by providing indirect opportunities for employment and rural based economic activities.

## 5.6 Environmental Management Plan Budget Costs

### Cost estimate and financing plan

172. The cost estimates for the pilot solar rooftop project are based on market analysis and information available from service providers in Sri Lanka and international price benchmarks for the equipment in south Asian market and presented in Table 20 below.

**Table 20: Cost Estimates for 1 MW solar rooftop (Refer to Table 3 of the Main document)**

173. The total financing available for the pilot project is USD 3 million, comprising of USD 1.5 million as a grant and additional USD 1.5 million as counterpart funding by the government to be provided from the Asian Development Fund (ADF) loan proceeds. Based on the cost estimates, a total capacity of 1 MW can be developed under the pilot, provided a competitive bidding process is followed which will bring down the capital cost. Out of the total amount of the proposed financing, USD 100,000 from the grant proceeds would be allocated for the project implementation and monitoring support to SEA. The financing plan is provided in Table 21 below.

**Table 21: Financing Plan**

Description	Total	Government Institutes	Private Subprojects	Sector	In USD Thousand	
					Project support	Implementation
CEF Grant	1,500	580	820			100
ADF Loan	1,500		1,500			
<b>Total</b>	<b>3,000</b>	<b>580</b>	<b>2,320</b>			<b>100</b>

174. The main benefits of the environmental mitigation plan are (i) ensuring that environmental standards are met during design, construction, and operation of the project; (ii) providing offsets to negate project impacts especially ecological impacts. The compliance with the EMP has been prepared based upon optimum and reasonable costs that are derived upon minimisation of mitigation measures on a “least-cost” basis. Cost estimate for EMP is estimated at 2% (approximately LKR 0.8 million) of the project cost for implementation of environmental mitigation measures, and monitoring costs, independent audit costs for the project.

### 5.7 Associated Facilities

175. There are no associated facilities for these solar rooftop projects.

## 6 FINDINGS AND RECOMMENDATIONS

176. Impacts are manageable and can be managed cost effectively –negligible environmental impacts are likely to result from the proposed rooftop solar PV powergeneration with net metering concept. There is no storage of power using batteries involved. The detailed design to be done by project proponent would ensure inclusion of any environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts, if any, can be reduced through the use of mitigation measures such as correction in work practices at the construction sites.

177. The anticipated impact of the pilot will be increase in clean energy investments, deployment of solar power technologies with strong demonstration effects in a greater scale, and lowering barriers to solar power applications in Sri Lanka. The anticipated outcome of the pilot project will be sustainable and cleaner power supply, reduction in greenhouse gas (GHG) emissions, economic benefits from utilization of renewable energy sources, and developing private sector market for solar rooftop power generation.

178. It is estimated that when implemented, the 1 MW solar rooftop pilot may result in approximately 1,286 ton CO<sub>2</sub> emissions equivalent avoided per year during the useful life of the solar rooftop power generation sub-projects due to replacement of the fossil fuel based generation. There may be additional benefits such as reduction of transmission and distribution losses due to decentralized nature of solar power generation.

179. Benefits far outweigh negative impacts - installation of rooftop solar power generation will improve operational efficiency and quality of power, reliability of the system in the building. This pilot shall introduce net metering concept, supply excess power to the local area thereby reducing the load on the local grid and boosting economic development of the area. Overall, the major social and environmental impacts associated with such projects are negligible and limited to the construction period and can be mitigated through best engineering and environmental practices. The project will not have any negative environmental impacts and the project would help in improving the socio-economic conditions in the area. As the project falls in “Category C” as per the ADB’s guidelines, no detailed IEE or an EIA study is required.

## 7 CONCLUSIONS

180. In accordance with the ADB’s safeguard policy statements, 2009, the proposed rooftop solar power generation projects will fall under “Category C”. Thus an Initial Environmental Examination (IEE) or a full Environmental Impact Assessments (EIA) for the project is not required. No land is required, no tree shall be cut, and no relocation of persons living in private or public properties will be involved.

181. The proposed construction/erection activities will cause very negligible environment impacts which are mostly temporary in nature and restricted to construction periods. The Environment Management Plan (EMP) has been prepared for the project and responsibilities for implementation assigned. The anticipated environmental impacts can be easily mitigated through implementation of EMP.



## Annexure 1: Applicable Environmental Policy and Procedures

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
Ceylon Electricity Board Act, 1969	To provide for the establishment of an electricity board for the development and co-ordination of generation	Enters with the joint schemes by such board with any government department or approved body for the generation of electrical energy, the irrigation lands, control of floods or other like objects, and to make provision for all matters connected there with or incidental thereto.	Ceylon Electricity Board
Electricity Act 2009	To provide reliable and cheap electrical energy	Regulates the generation, transmission, transformation, distribution, supply and use of electrical energy	Ceylon Electricity Board
Fauna and Flora Protection (Amendment) Act 1993 (Nº 49 of 1993).	To provide greatest protection to fauna and flora	Makes provision for the establishment of protected areas, regulates human involvements to such areas and their fauna and flora.	Department of Wild Life and Department of Forest
Felling of Trees (Amendment Act Nº 01 of 2000 and Act to Amend felling of trees control)	The control removal of trees.	Regulates the removal of trees relevant to type and the compensation	Department of Forest
Fisheries and Aquatic Resources Act 1996	To provide for the management, regulation, conservation and development of fisheries and aquatic resources	Restricts detrimental or risk activities for aquatic fauna and flora	National Aquatic Resources Research and Development Agency (NARA) and CEA
Forest Ordinance Act Nº 13 of 1966 Forest (Amendment) Act Nº 65 of 2009	Conservation, protection and management of forest and forest resources for control of felling and transport of timber	Definition of Conservation Forest, Reserve Forest, Village forests	Forest Department
Irrigation Clauses Act 1973	To provide regulations for the construction of structures across the irrigation canals and water recourses.	Regulates the construction of structures across the irrigation canals and water recourses.	Department of Irrigation
Monuments and Archaeological Sites and remains Act, 1958. Act Nº 24 of 1958 Antiques Ordinance, 1960	An Act to provide for the preservation of ancient and historical monuments and archaeological sites and remains of national importance,	For the regulation of archaeological excavations and for the protection of sculptures, carvings and other like objects etc.	Department of Archaeology
Motor Traffic Act Nº 60 of 1979	To provide sustainable approach for vehicle traffic	Regulates vehicle traffic during transportation of construction materials and the construction activities	
National Environmental Act Nº 47 of 1980, amendment Nº 56 of 1988, and other amendments	Provide protection, management, enhancement of the environment with prevention and control of pollution	Regulates sustainable utilisation of almost all natural resources such as water, soil and air	Central Environmental Authority (CEA)
National Environmental (Protection & Quality) Regulations, Nº 01 1990.	To provide for the prevention and control of water pollution and enhancing the quality of water	Controls sewage and effluents into inland surface water	CEA
National Environmental (Ambient Air Quality) Regulations, 1994.	To provide for the prevention and control of air pollution	Controls emissions of air pollutants	CEA
National Environmental (Noise Control) Regulations Nº 1 1996	To provide maximum allowable noise levels	Regulates noise pollution	CEA
National Involuntary Land Acquisition Act does not		To land replacement, income	Government of Sri

Name	Scope and Objectives	Key Areas	Operational Agencies / Key Players
Resettlement Policy	deal with the boarder social and economic impacts of the project. Thus this Policy established to overcome these impacts.	restoration, relocation assistance and allowances, consultation and grievance redress, assistance to vulnerable groups and provision of resettlement sites and services.	Lanka / Land Acquisition and Resettlement Committee (LARC)
Public Utilities Commission of Sri Lanka Act , N° 35 of 2002	Create an environment for all inhabitants of Sri Lanka and the contributors to its development, to have access to essential infrastructure and utility services in the most economical manner within the boundaries of the sustainable development agenda	Regulate all the utilities within the purview of the Public Utilities Commission of Sri Lanka, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner.	The Public Utilities Commission of Sri Lanka
Soil Conservation (Amendment) Act N° 24 of 1996	Act for Conservation of Soil resources and productive capacity of land	Degraded Land, prevent damage against salinity, water logging, drought, floods	Soil Conservation Board
Sri Lanka sustainable energy Authority Act, N° 35 of 2007	To develop renewable energy resources; to declare energy development areas; To implement energy efficiency measures and conservation programmes; to promote energy security	Reliability and cost effectiveness in energy delivery and information management, function as a National Technical Service Agency of Clean Development Mechanism (CDM) in Sri Lanka that provides technical assistance to the Designated National Agency for Clean Development Mechanism and project developers, on energy sector clean development project activities	Sri Lanka Sustainable Energy Authority

## Annexure 2: Environmental Management Plan

Project Activity /Stage	Potential Impact	Proposed Mitigation Measure	Parameter to be Monitored	Measurement and Frequency	Institutional Responsibility	Implementation Schedule
<b>Design and Pre-Construction</b>						
Equipment specifications and design parameters	Release of chemicals and gases in receptors (air, water, land)	Processes, equipment and systems design to contain leakage of SF6 from switching cubicles and other equipment (if any)	Process, equipment and system design	Ensure 0.01% SF6 leakage stated in tender specification – once	SEA, PPP	Part of tender specifications for the equipment
Location of Rooftop Panels	Impact on nearby bird sanctuary etc.	Consideration of site location at where they could be located to avoid bird sanctuary etc.	Site location (distance to bird sanctuary)	Consultation with local authorities- once	SEA, PPP	Part of detailed survey and design
	Social inequities	Careful site selection to avoid nuisance to existing settlements	Site location (distance to nearest dwellings or social institutions)	Consultation with local authorities and other building owners - once	SEA, PPP	Part of detailed project design
Visual Impact/Glare/Tilt related	Nuisance to neighbouring properties	Rooftop design to ensure Tilt angle designed to ensure glare will not be a nuisance.	Lumens levels (Lux)	Glare levels if any nearest to properties and consultation with affected parties if any – once	SEA, PPP	Operations
Noise related	Nuisance to neighbouring properties during transportation and erection	Erection schedule to ensure noise will not be a nuisance.	Noise levels	Noise levels to be specified in tender documents - once	SEA, PPP	Part of detailed equipment design
Equipment affected by inclement weather	Panels, electrical connections	Suitable weather resistant material.	Design for weather proofing.	Electrical design - once	SEA, PPP	Part of detailed layout and design /drawings
Explosions/Fire	Hazards to life	Design of rooftop array to include modern fire control systems.	Design compliance with fire prevention and control codes	Tender document to mention detailed specifications - once	SEA, PPP	Part of detailed layout and design /drawings
<b>Construction</b>						
Panel transportation and hoisting to rooftop	Safety on Road, health and safety of workers	Road transportation route to be marked for any obstacles prior to transportation	Visual Check	Once	SEA, PPP, Contractor through contract provisions	Construction period
Equipment layout and installation	Noise and vibrations	Construction techniques and machinery selection seeking to minimise ground disturbance.	Construction techniques and machinery	Construction techniques and machinery creating minimal ground disturbance - once	SEA, PPP, Contractor through contract provisions	Construction period

Project Activity /Stage	Potential Impact	Proposed Mitigation Measure	Parameter to be Monitored	Measurement and Frequency	Institutional Responsibility	Implementation Schedule
				at the start of each construction phase		
Packing Material Waste	Contamination of receptors (land, water, air)	Disposal of recyclable material through recyclers, non-recyclable waste to be sent for waste site	Quantity of recyclable waste generated/Quantity of non-recyclable material generated (in Kgs)	Every week	SEA, PPP , Contractor through contract provisions	Construction period
Surplus muck/waste from repair/erection on roof	Runoff to cause water pollution, solid waste disposal	Muck disposed of properly	Disposal locations and volume (m <sup>3</sup> )	Acceptable disposal sites - every 2 weeks	SEA, PPP , Contractor through contract provisions	Construction period Construction period
Storage of batteries/chemicals and materials (if any)	Contamination of receptors (land, water, air)	Batteries/acid and other hazardous materials securely stored	Location of all material storage; spill reports (type of material spilled, amount (kg or m <sup>3</sup> ) and action taken to control and clean up spill)	Storage in appropriate locations and receptacles - every 2 weeks	SEA, PPP , Contractor through contract provisions	Construction period
Nuisance to nearby properties	Losses to neighbouring land uses/ values	Contract clauses specifying careful construction practices.	Contract clauses	Incorporating good construction management practices – once for each site	SEA (Contractor through contract provisions)	Construction period
Health and safety	Injury and sickness of workers and members of the public	Contractor to prepare and implement a health and safety plan.	Contract clauses (number of incidents and total lost-work days caused by injuries and sickness)	Contract clauses compliance – once	SEA (Contractor through contract provisions)	Construction period
Inadequate construction stage monitoring	Likely to maximise damages	Implementation of effective environmental monitoring and reporting system using checklist of all contractual environmental requirements	Respective contract checklists and remedial actions taken thereof.	Submission of duly completed checklists of all contracts for each site - once	SEA, PPP	Routinely throughout construction period
		Appropriate contract clauses to ensure satisfactory implementation of contractual environmental mitigation measures.	Compliance report related to environmental aspects for the contract	Submission of duly completed compliance report for each contract - once		
Operation and Maintenance						
Battery Water spillage	Contamination of land/nearby water bodies	Batteries located within secure and impervious bunded areas with a storage capacity of at least 100% of the capacity of acid in batteries as well as	Bunding (“as-built” diagrams)	Bunding capacity and permeability - once	SEA, PPP	During operations

Project Activity /Stage	Potential Impact	Proposed Mitigation Measure	Parameter to be Monitored	Measurement and Frequency	Institutional Responsibility	Implementation Schedule
		storage.				
Inadequate provision of staff/workers health and safety during operations	Injury and sickness of staff /workers	Careful design using appropriate technologies to minimise hazards	Usage of appropriate technologies (lost work days due to illness and injuries)	Preparedness level for using these technologies in crisis – once each year	SEA, PPP	Design and operation
		Preparation of fire emergency action plan and training given to staff on implementing emergency action plan	Training/awareness programmes and mock drills	Number of programmes and percent of staff /workers covered – once each year		
Electric Shock Hazards	Injury/mortality to staff and public	Electricity safety awareness raising in project areas	Training /awareness programmes and mock drills for all concerned personnel	Number of programmes and percent of total persons covered – once each year	SEA, PPP	Design and Operation
Inadequate periodic environmental monitoring.	Diminished ecological and social values.	SEA staff to receive training in environmental monitoring of project operations and maintenance activities.	Training/awareness programmes and mock drills for all relevant staff	Number of programmes and percent of staff covered – once each year	SEA, PPP	Operation
Equipment specifications and design parameters	Release of any chemicals and gases in receptors (air, water, land)	Switching cubicles, equipment and systems using SF6 (Sulphur Hexa flouride) if any.	Process, equipment and system design	Proper Handling mechanism in place – once in a quarter	SEA, PPP	Operations
Rooftop Panel maintenance	Exposure to electromagnetic interference	Rooftop design to comply with the limits of electromagnetic interference within floor area	Required vibrations level, instrumentation	Instrumentation - Regular	SEA, PPP	Operations
Visual Impact/Glare/Tilt related	Nuisance to neighbouring properties	Rooftop design to ensure Tilt angle designed to ensure glare will not be a nuisance.	Lumens levels (Lux)	Glare levels if any nearest to properties and consultation with affected parties if any - once	SEA, PPP	Operations
Soil and/or groundwater contamination due decommissioning of PV systems	Chemical content of PV cells used in project	Silicon modules pose fewer decommissioning problems than cadmium containing modules.	Decommissioning plans for the project: disposal methods proposed, recycling opportunities considered for end of life stage,	List of PV cells collection schemes available for decommissioning, Once	SEA, PPP	During decommissioning operations

## **A 18. Annex 18: Environmental Assessment & summary of Initial Environmental Examination**

### **1.0 The Project**

1. ADB is proposing to extend USD 130 million loan to Sri Lanka's power sector for clean energy and network efficiency improvement with a focus to identify the transmission and distribution projects for evacuation of renewable energy (wind and solar) parks/ projects and overall improvement of network efficiency.

2. The project consists of following components:

#### **A. Transmission Projects**

- I. Transmission System Strengthening in Mannar region,
- II. New Polpitiya 220/132 kV grid substation (GSS) and associated transmission line,
- III. Padukka 220/132/33kV GSS and associated transmission line,
- IV. Construction of 132/33 kV GSS at Kegalle, and
- V. Installation of reactive power compensation devices.

#### **B. Distribution Projects**

- VI. Vavyunia-Kebithigollewa 33 kV,
- VII. Anuradhapura-Kahatagasdigiliya 33 kV,
- VIII. Kiribathkumbura-Galaha gantry 33kv, and
- IX. Galmadu Junction-Pothuvil 33 kV.

#### **C. Roof Top Solar Project**

### **1.1 Transmission Projects**

3. The selected lands for New Politipitiya, Padukka and Kegalle GSS are located in private rubber plantation and paddy fields respectively. These lands will be purchased at market rates and acquisition of land will not be required from the surrounding communities. The proposed Mannar and Kegalle GSS lands are paddy fields, there is no need for removal of trees involved; however, for New Politipitiya and Padukka GSS, the rubber plantation at the site will need to be cut. The Mannar GSS land which is a paddy field that belongs to the Irrigation department. Larger extent of proposed transmission line from Politipitiya-New Politipitiya (10 km), New Politipitiya to Pannipitiya line (58.5 km), Athurugiriya-Padukka (12.5 km) as well as the Kegalle to Thulhiriya GSS (14 km) runs through paddy fields, rubber cultivated lands, uncultivated lands and a lesser extent runs through human settlements. Athurugiriya to Kolonnawa (15 km) will be rebuilt on the same existing route and runs through populated areas. Larger extent of proposed transmission line from Mannar to Vavuniya (70 km), Vavuniya to New Anuradhapura (55 km) runs through paddy fields, forest areas, cultivated/uncultivated lands and with very small section through human settlements. Some section of Vavuniya-Mannar line passes outside the boundary of the Giant Tank Sanctuary, skirts through the boundary (2 km long) of the Madhu Road Sanctuary and forest reserves parallel to the existing road network. All the forest reserve areas traversed by the line are degraded forests, which were cleared during the conflict period.

### **1.2 Distribution Projects**

4. The selected 250 sq. m. plot of land required for gantry based switching stations for Kahatagasdigiliya, Galaha, Akkaraipattu and Pothuvil will be based on government lands. Whereas, the Kebithigollewa land is private which will be purchased at market rates and acquisition of land will not be

required from the surrounding communities. The Vavyunia-Kebithigollewa 33 kV line (23 km) passes two forest reserves (Kapundkalipulam and Padaviya), home gardens, paddy fields and crosses the Sinnapuluk Kulam and Dutuwewa dry zone tanks. The Kiribathkumbura-Galaha 33 kV line (15 km) is based in hilly region through home gardens, tea gardens, paddy, pinus and rubber plantations; New Anuradhapura to Kahatagasdigiliya (31 km) 33 kV passes through paddy fields, home gardens, chena lands, scrub jungle and secondary forests; the Galmadu Junction-Akkaraipaththu 33 kV line (18 km) passes through densely populated area, home gardens, paddy fields, and degraded lands; whereas the Akkaraipaththu-Pothuvil 33 kV line (42 km) passes through paddy fields, home gardens, edge of tanks (Komari and Paladi), scrublands and degraded lands. All the forest reserve areas traversed by the lines are degraded forests which were cleared during the conflict period.

### **1.3 Rooftop Solar Projects**

5. The government buildings identified for the purpose of developing solar rooftop power generation pilot subprojects include some key universities, including those with engineering departments, namely University of Moratuwa (Colombo, Western province), University of Peradeniya (Kandy, Central province), and University of Ruhuna (Galle, Southern province). Besides the above, three subproject sites are proposed at Jaffna include Central Hospital, Jaffna Hospital Building and one Hostel for Medical Students; and the other two on private buildings - Damro Showroom and Sri Nathiya Commercial Building in Jaffna (Jaffna, Northern province). The expected solar power generation capacity to be developed at each of these locations would be around 50 kW. The subprojects would be developed based on the net metering concept. The subprojects in universities of Moratuwa and Peradeniya may be extended for solar power research.

### **2.0 Assessment of Legal Framework and Policy**

6. A large number of recurrent and non-recurrent activities under establishment of power transmission/distribution lines, sub-stations and solar rooftop PV generation units are presently not covered by the National Environmental Act (NEA). Applicable laws and regulations, which are necessary for the proposed project activities, are listed in the project's IEEs.

7. Based on the CEA (Central Environmental Authority) guidelines of GoSL, the proposed transmission projects are categorised as "prescribed", whereas the distribution projects are categorised as "unprescribed". The IEE reports are prepared for the transmission projects for which CEB will seek Terms of Reference (ToR) for preparing the EIA in prescribed format from CEA for seeking approval and the environmental clearances for the transmission projects from relevant PAA. Distribution projects do not require such permissions from the CEA. The rooftop solar project involves only installation of solar panels on existing buildings, there is no impact associated with this component. In accordance with the ADB's Safeguard Policy Statement 2009 (SPS 2009), the proposed project is categorised as category B. Thus, a full Environmental Impact Assessment (EIA) for the project is not required.

### **3.0 Anticipated Environmental Impacts**

8. Impacts are manageable and can be managed cost effectively - environmental impacts are likely to result from the proposed project development. Careful mitigation and monitoring, specific selection criteria and review/assessment procedures for candidate subprojects have been specified to ensure that minimal impacts take place. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this stage are taken into account and mitigated where necessary. Those impacts can be reduced through the use of mitigation measures such as correction in work practices at the construction sites, or through the careful selection of sites and access routes.

9. The proposed project will have number of positive impacts and negative impacts to the existing environment as follows:

- Significant improvement of the quality and reliability of the electricity supply to the project affected area according to current demand is the main positive impact.
- Removal of trees for maintaining the safety clearance from the transmission/distribution lines is the main negative impact to the proposed project area.
- Environment pollution due to cut and fill operations, transportation of construction materials, disposal of debris, disturbance to the farming activities, nuisance from dust, noise, vehicle fumes, black smoke, vibration etc. due to construction activities are the short term negative impacts due to proposed project.
- There may be loss of agricultural productivity due to obstruction and reduction of the land of paddy fields, coconut trees, rubber plantations, and tea gardens.

10. Benefits far outweigh negative impacts - The proposed project will improve operational efficiency and quality of power, reliability of the system and at the same time will reduce losses. Supply of power to both the local areas and regions will boost economic development of the area by strengthening the power transmission infrastructure. Overall, the major social and environmental impacts associated with transmission projects are limited to the construction period and can be mitigated to an acceptable level by implementation of recommended measures and by best engineering and environmental practices.

11. Potential adverse environment impacts associated with transmission/distribution lines have been avoided or minimised through careful route selection. The alignment is sited away from major settlements, whenever possible, to account for future urban expansion. Forests areas and thick vegetation areas are avoided wherever possible; however, route alignments passes through scrublands, cultivated paddy fields, rubber cultivations, rubber plantations, tea cultivations etc. The lines will also pass through degraded forest areas but avoid any national park or sanctuary. For transmission, minor alignment passed through outskirts of the proposed Madhu Road Sanctuary extension. For distribution, land will only be purchased/acquired for one gantry based switching station but no land will be required for placing distribution towers on private land. The alignments in this project have also avoided marshy lands and geologically unstable areas, which can also pose foundation related problems. No land acquisition is required for placing transmission/distribution towers on private land. However, any damage to the crops during the construction phase of the project will be compensated. Associated impacts on agricultural land will be restricted to the construction phase and will be temporary in nature. Agricultural land will not be lost permanently at the base of the tower. After construction, agricultural land within the transmission/distribution corridors can be used again for farming purpose except for growing trees, which are above 3m in height.

12. Various mitigation measures to be taken prior to the project activities are listed in the project's IEEs. This SIEE (Summary Initial Environmental Examination) summarises the following two IEEs and one Environmental due diligence report prepared for the three components of the project:

- IEE Report for power transmission development component, 07 June 2012,
- IEE Report for distribution system improvement component, 03 June 2012, and
- Environmental due diligence report for roof top solar component, June 09, 2012.

### **3.1 Environmental Issues associated with design and pre-construction stage**

#### **Impacts on Temporary Use of Land**

13. The mobilisation of construction equipment and construction materials will require space for storage and parking of construction vehicles and equipment, construction material storage yards, disposal sites, and labour camps for human resource to avoid environmental impact and public inconvenience. These locations must comply with the local laws and regulations and need approval from authorities to utilise these facilities (access roads, telecommunication, and pipe borne water supply etc.). It is important that selection of temporary lands is at least 500 m away from highly populated



areas, water bodies, natural flow paths, agricultural lands, important ecological habitats, and residential areas. Removal of trees and green cover vegetation should be minimised during preparation of access road and other facilities.

### **3.2 Environmental Issues Associated with Construction and Operation Stage**

14. The project activities during construction phase will involve clearing of trees along the route alignment wherever required, excavation for installation of towers, erection of towers, civil works related to line erection. For substation, it will involve excavation for building and equipment foundations, civil works and erection of equipment. During the operation phase, most of the construction phase impacts will get stabilised and the impacts will be restricted only to the operation and maintenance of the project.

#### **3.2.1 Impact on Topography**

15. The most prominent impact on the surface topography will be due to the removing of the trees at the tower erection site and all along the Right of Way (RoW) for construction facilitation. This will lead to change in the surface features only. The impact will be irreversible, as the present features along the RoW will be changed due to presence of the transmission line.

16. No topographical changes are envisaged during the operation phase of the transmission/distribution line, GSS, distribution gantry, and solar rooftop. The existing access routes will be utilised during the operation and maintenance of the transmission/distribution lines.

#### **3.2.2 Impact on Climate**

17. The study area along the RoW is predominantly tea/coconut/rubber/paddy plantation and home gardens in the project area. However, impact on the climate conditions from the proposed projects both during the construction and operation phases will not be significant.

#### **3.2.3 Impact on Air Quality**

18. During the construction phase, the activity would involve excavation for the tower erection, movement of transporting vehicles carrying the construction materials etc. along the haul road (through un-built roads, but not maintained). At majority of locations, movement of heavy vehicle is not possible; from approach road to construction site material will be taken in smaller vehicles. All these activities would give rise to emission of dust particles thereby affecting air quality marginally at the site which although will be transitory in nature. Sprinkling of water during excavation will reduce the dust emission to a great extent.

19. The construction of lines, GSS, distribution gantry, and solar rooftop panels will have a temporary negligible impact on the air quality of the region during the operation phase.

#### **3.2.4 Impact on Noise Levels**

20. During the construction phase, the major sources of noise pollution are movement of vehicles transporting the construction material and equipment to the site. Most of the access roads along the alignment are motor able. The major work of the construction is expected to be carried out during the daytime. The noise produced during the construction will have negligible impact on the residents, as the predominant land use along most part of the alignment is plantations area. There will be very limited presence of population being exposed to noise generated during the construction phase.

21. Various mitigation measures to keep noise and vibration to an acceptable level during construction phase are listed in the project's IEEs.

22. During the operation phase of the project, there may be corona noise from the conductors which will be felt only up to 15 to 30 m area, hence the ambient noise level meets the CEA standard for residential areas during daytime and night time.

### 3.2.5 Impact on Surface Water Quality

23. The construction and operation of the power lines will not have any major impact on the surface and ground water quality in the area. Contamination of water bodies may result due to spilling of construction materials and surface runoff from the construction site joining the water body. There may be increase in the turbidity levels temporarily where the proposed alignment is crossing and if the surface runoff during construction meets the river. This can be avoided by careful selection of the tower site and the access roads so that the surface runoff does not meet the river.

24. Proposed activities will create temporary impacts to the existing drainage system in the area including irrigation canals, natural flow paths, and line drains. Thus, it will create temporary inundation closer to the above locations during rainy season. Stagnation of water will create temporary breeding sites to mosquitoes, which will have direct impact on public health. Various mitigation measures to minimise anticipated impact due to obstruction of natural flow paths and existing drainage are listed in the project's IEEs.

25. Care shall be taken to locate the temporary construction worker sheds away from the water bodies. Adequate drinking water facilities, sanitary facilities and drainage in the temporary sheds of the construction workers should be provided to avoid the surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

### 3.2.6 Impact on Ground Water Quality

26. Ground water pollution can take place, if chemical substances and oily waste get leached by precipitation of water and percolate to the ground water table. For transmission line construction activity, no chemical substance or oil is used hence there is no impact on ground water quality. The silt discharge from the earthwork around water bodies, oil, grease, and fuel release from the construction vehicles/equipment and spoil from construction, and other construction related activities such as raw sewerage from worker accommodation sites will mix with runoff water. This situation will increase during the rainy season and have a critical impact on surface and ground water. Various mitigation measures to prevent deterioration of water from the construction and construction related activities are listed in the project's IEEs.

### 3.2.7 Impact on Soil and Geology

27. Project activities including excavation, cut and fill operations, removal of trees and green cover vegetation etc., will enhance the soil erosion during the rainy season. Removal of trees and green cover vegetation will reduce infiltration rate of rainwater. The impact on soils will be due to the soil erosion at the tower construction sites along the access routes. The excavation activity and land clearance the erosion prone areas have been minimised while conducting the site selection for towers. Levelling and stabilisation of tower construction sites will be done after completion of construction activity. It will also increase acceleration of surface runoff and damage to the topsoil. Various mitigation measures to minimise the impact associated with landslides due to excessive erosion and other civil works are listed in the project's IEEs.

### 3.2.8 Impact on Ecological Resources

28. Although Mannar-Vavuniya transmission line avoids the Giant Tank Sanctuary, the line traverses the outskirts of the proposed extension of Madhu Road Sanctuary, and few forest reserves. However, for other lines, GSSs, distribution gantry and solar rooftop, none of the declared environmentally sensitive areas is located within the project-affected area. The ecological impacts are briefly described in the following sections.

#### Effect on Flora and Fauna

29. The study area for route alignment has forest and plantations areas. Considerable amount of

trees will be removed from the project area for right of way (RoW) - 35 m for 220/132 kV transmission line and 20 m for 33 kV distribution line. It is not expected that any flora and fauna that are rare, endangered, endemic or threatened will be affected. Migratory paths of small mammals and reptiles may be affected due to construction activities. However, noise, vibration and emission from construction vehicles, equipment will occur during construction and pre-construction stages in temporary manner. Except the removal of trees for ROW, the impacts related to above activities are temporary and various mitigation measures are listed in the project's IEEs.

#### **Impact on Terrestrial Ecology**

30. There is no sensitive ecological area crossing the proposed route alignment. The removal of herbaceous vegetation from the soil and loosening of the top soil generally causes soil erosion. However, such impacts would be primarily confined to the project site during initial periods of the construction phase and would be minimised through adoption of mitigation measures like paving and surface treatment and water sprinkling.

#### **Removal of Trees**

31. Approximately 4,100 forest and 26,600 fruit/non-fruit/plantation trees will be removed during the construction of transmission/ distribution lines. The initial construction works along the alignment involving land clearance, cutting, filling and levelling may cause loss of vegetation. This will be an irreversible impact. Care has been taken to avoid the thick plantations/vegetation as far as possible and tower locations are selected at plain paddy fields where the vegetation is thin. This will minimise the tree loss. Compensation will be paid to the tree owners in the private areas as per GoSL norms. Clearing of plantations and forest area is involved along the route alignment; hence, the compensatory afforestation is required for forest areas for which clearance will be obtained from the forest department.

32. During operation phase, corridor along the alignment will be chopped of vegetation and lopping of trees will be done for maintenance purpose. This will also reduce the chances of fires due to electric sparks.

#### **Effect on Local Road Network**

33. Transformers, tower material, substation equipment, iron bars, concrete materials, solar panels, other equipment will be transported through the provincial and local road network to the project site. Transporting of large quantities of materials using heavy vehicles could exceed the carrying capacity of the road. This would lead to physical damages to local road network. Thus, it will be necessary to obtain consent from Road Development Authority (RDA) or Provincial Road Development Authority (PRDA) to use local roads prior to transportation. In addition, the contractor should properly maintain all road sections, which will be utilised for the construction related activities.

#### **Disposal of Debris**

34. Because of construction related activities, spoil and debris will be generated during the construction stage. Improper disposal of the debris will have an impact on the surrounding ecology, public health and scenic beauty. Various mitigation measures to minimise the impacts associated with disposal of debris are listed in the project's IEEs.

#### **Wild Life**

35. For selecting the route alignment, wild life travel routes have been avoided as far as possible, although the elephant corridors exist in Mannar, Vavuniya areas along the route alignment of transmission/distribution lines.

#### **Impact on Aquatic Ecology**

36. No significant impacts on aquatic ecology of the river are envisaged, as there will be careful

selection of the tower sites near the river, to avoid the river pollution and disturbance to the aquatic fauna of the area.

### **3.2.9 Health and Safety**

37. Health and safety impacts will be in terms of risk of accidents. Necessary training regarding safety aspects to the personnel working at the line will be provided by the contractor. Personal protective equipment like safety gloves, helmet, mufflers etc. will be provided during construction period and during the maintenance work. First aid facilities will be made available with the labour gangs and doctors called in from nearby towns when necessary. Workers are also covered by the statutory workmen compensation as per GoSL laws by the contractor.

38. Project activities may create accidental damage to public and the construction workers. Therefore, contractors should take necessary action to enhance personal safety during the construction. Various mitigation measures are listed in the project's IEEs.

### **Agriculture**

39. Permanent and temporary loss of agricultural land occurs due to tower location in the agricultural field and loss of crop for access route etc. There will not be any land acquisition for the tower erection. As far as possible, the prime agricultural land will be avoided and the construction will be done after crop harvesting. For GSS and distribution gantry, private and government lands will be used, thereby reducing some area for cultivation. Mannar and Kegalle GSS and some distribution gantries will be situated on paddy lands whereas the others will be on plantation area.

### **3.2.9 Socio-Economics**

40. Construction of power infrastructure will generate local employment, as number of unskilled labour (men/women) will be required at the time of construction activities. Local employment during this period will increase socio-economic standards.

### **Temporary Outage of the Electricity**

41. Temporary disconnection of power supply will occur during the construction activities. Thus public and the industrial places, which are located in project-affected area, will face inconvenience for short periods of time. Various mitigation measures are listed in the project's IEEs.

### **Resettlement and Rehabilitation**

42. For the construction of transmission line, the lands required to be used for the GSS do not displace any resident and will be purchased on market prices. Since the land shall be purchased at market price, no land acquisition procedure would be required, hence there is no resettlement and rehabilitation involved in the project.

### **Cultural Sites**

43. The New Anuradhapura-Vavuniya line passes 900 meter from the Mihintale Preservation Area in Anuradhapura. There are no archaeological, historical or cultural important sites along the route alignment of all other lines, GSS, distribution gantries, Solar rooftop, hence the impacts on these sites are not envisaged.

### **Traffic and Transport**

44. During the construction phase, traffic disturbance needs to be minimised by avoiding high-density areas, using proper traffic signs, ensuring proper access roads and avoiding road blockage.

### **Interference with Other Utilities and Traffic**

45. As per regulations enacted by GoSL, it is mandatory for CEB to seek clearance prior to construction from railways, telecommunications and wherever necessary from aviation authorities that are likely to be affected by the construction of lines. The transmission lines affect nearby

telecommunication circuits by causing electrical interference and induced voltage that may occur to nearby telecom circuit and suggested necessary protection measures will need to be adopted.

### **Solid Waste Disposal**

46. The solid waste generation will be at the location of the tower erection site which will include metal scraps, wooden packing material etc. Wooden waste and metal scrap will be collected and disposed of in compliance with applicable regulations and rules.

### **Sanitary Waste Disposal at Construction Sites and Labour Camps**

47. The labour camps at the site of tower erection will be temporary in nature and the human excreta will not be significant to cause contamination of ground water. Those places where most labour will be staying will be near hamlets which shall use the community services for solid waste, water and sanitation. Adequate drinking water facilities, sanitary facilities, and drainage in the temporary sheds of the construction workers should be provided to avoid surface water pollution. Provision of adequate washing and toilet facilities should be made obligatory. This should form an integral component in the planning stage before commencement of construction activity.

48. Unacceptable solid waste disposal practices such as open dumping of solid waste and poor sanitation facilities will lead to pollution of surrounding environment, contamination of water bodies and increase adverse impact to the aquatic; terrestrial lives and general public inhabited in the area. Surrounding of labour camps, garbage disposal sites and material storage yards provide favourable habitats for vectors of diseases such as mosquitoes, rats and flies. There should be proper solid waste disposal procedure to enhance sanitation of workers who stay in camps, thereby reducing possibilities of infecting water borne diseases or vector borne diseases (Parasitic infections). Various mitigation measures are listed in the project's IEEs.

### **Liquid Waste Disposal**

49. There will be no oil or chemical waste generated during the construction of line, GSS, distribution gantry and solar rooftop panels, hence no mitigation is required.

### **Electric Shock**

50. This may lead to death or injury to the workers and public in the area. This can be minimised or avoided by security fences around GSS, distribution gantry, and solar panels, establishment of warning signs; and careful design using appropriate technologies to minimise hazards.

### **Noise Generation**

51. Nuisance to the community around the site can occur during the project implementation stage. Provision of appropriate noise barriers will be essential in this regard.

### **Maintenance**

52. Possible exposure to electromagnetic interference could occur during these activities. Design of transmission/distribution line, GSS and gantry should comply with the limits of electromagnetic interference.

### **Oil Spillage**

53. Contamination of water on land/nearby water bodies by the transformer oil can occur during operation due to leakage or accident. Substation transformers are normally located within secure and impervious areas with a storage capacity of 100% spare oil. Also proper drainage facilities will be constructed during the construction stage to avoid overflow or contamination with natural flow paths especially during the rainy season.

## **4.0 Environmental Impact Management for Project Activities**

54. The summary environmental impact matrix and the mitigation measures are given in the

following table:

Project Stage/Anticipated Impact	Mitigation Measures
<b>A. Physical Resources</b>	
Topography Change in the surface features and present aesthetics due to the construction of the project.	The compensatory afforestation to be paid to Forest Department by CEB to minimise the impact of loss of vegetation as per existing norms under the Felling of Trees (Amendment Act Nº 01 of 2000 and Act to Amend felling of trees control)
<u>Climate</u> No impacts on the climatic conditions	No impact on the climatic conditions, hence no mitigation is required
<b>B. Environmental Resources</b>	
<u>Air Quality</u> Project will have marginal impact on air quality during the construction period due to increase in the dust emission.	Watering at construction site, limited bare soils, maintenance of vehicles etc.
<u>Noise</u> Noise due to general construction activities. Noise from erection of rooftop solar panels.	Restriction of noise generating activities at night and use of personal protective equipment like ear plugs, mufflers etc.
Noise arising from corona noise from conductors	Monitoring of possible corona noise to identify and correct problems
<u>Surface and Ground Water quality</u> Runoff from the construction site Domestic wastewater from construction sites	Careful siting of towers and access roads Domestic waste treatment by providing septic tank/soak pits
<u>Soils and Geology</u> Soil erosion due to tower erecting and clearing of vegetation in the RoW and access roads.	Avoiding sites, which are prone to the soil erosion. Levelling of tower construction sites. Use of few access roads. Rehabilitation and stabilisation of disturbed land. Site selection and proper tower foundation design considering the geological conditions and seismicity of the area
Damage due to seismic activity	
<b>C. Ecological Resources</b>	
Terrestrial Ecology Loss of vegetation	Transmission: Location of towers at the forest and plantation area. Selection of few access roads. Compensation to the tree owners. The tree planting of equivalent amount of the trees cleared along the route alignment would be undertaken as per the directives/requirements of the Forest Department, and financed by CEB. Distribution: Compensation to the tree owners. Afforestation equivalent amount of the trees cut along the route alignment would be undertaken as per the directives/requirements of the Forest Department, and financed by CEB.
<u>Terrestrial Fauna</u> Disturbance to the local fauna during construction  Disturbance to the local fauna during operation	Wildlife routes and their habitats have been avoided as far as possible during the route selection. Monitoring of line especially for bird strikes during the operation and use of deflectors if required.
<u>Aquatic Ecology</u> No significant impacts envisaged	No mitigation required.
<b>D. Human Environment</b>	
Fires, explosion and other accidents at the route alignment of transmission line	Use of personal protective equipment during construction. By lopping and chopping of trees, fire hazards due to sparking will be avoided during maintenance period. Regular inspection of lines for faults prone to accidents.

Project Stage/Anticipated Impact	Mitigation Measures
<u>Health and Safety</u> Exposure to electromagnetic fields	Transmission: Alignment route away from the settlement. No mitigation required Distribution: MV lines do not cause too much EM fields.
<u>Agriculture</u> Permanent and temporary loss of agriculture land due to tower erection and due to access routes	Avoid prime agriculture land. Assessment of land required and compensation. Construction activity after crop harvesting and selection of few access routes
<u>Socio-economics</u> Beneficial impacts from rural and urban electrification. Job opportunities during construction phase Resettlement of the house falling along the RoW	Unskilled labour and indirect benefits. Overall economic growth of the region Route alignment is selected in such a way that there is no resettlement issue
<u>Cultural sites</u> No archaeological, historical or cultural important sites are affected by the construction of the lines	No archaeological, historical or cultural important sites are affected, hence no mitigation required
<u>Traffic and Transportation</u> Traffic congestion due to movement of construction vehicles	Avoid high density traffic areas, proper traffic signs at the construction site, ensuring proper access roads
<u>Solid Waste Generation</u> Probability of surface and ground water pollution	Separated wooden and scrap will be collected and disposed of in compliance with applicable regulations and rules

## 5.0 Environmental Management Plan Costs

55. The indicative estimated costs for EMP implementation of these components has been taken as 2-4% (which are project specific) of the total base project cost which has been included by CEB in their proposals to ADB.

### 5.1 Associated Power Generation Facilities

56. The transmission lines evacuate power from the Laxapana and Mahaweli Hydro electric power (HEP) complexes which have been the main backbone for electric power generation in Sri Lanka since the early 1960's and late 1980's consecutively. The Laxapana HEP complex consists of following power plants - Canyon (2 x 30 MW), Wimalasurendra PS (2 x 25 MW), Old Laxapana (3 X 8.33 MW+ 2 x 12.5 MW), New Laxapana (2 x 50 MW), and Polpitiya (2 x 37.5 MW). From Laxapana HEP complex, following main existing transmission lines evacuate power – i). Polpitiya–Kollonnawa 132 kV Line 1 and 2, 3, and 4, ii). Laxapana–Balangoda–Galle line 132 kV line 1 and 2, Balangoda–Embilipitiya–Hambantota 132 kV line 1 and 2, and Laxapana–Badulla 132 kV line 1 and 2 and Badulla Ampara 132 kV line 1. The Mahaweli HEP complex consists of following power plants, Victoria PS (3 x 70 MW), Kotmale PS (3 x 67 MW), Randeenigala (2 x 61 MW), Rantambe (2 x 24.5 MW), Ukuwela (2 x 19 MW) and Bowathanna (1 x 40 MW). From Mahaweli HEP complex following main existing transmission lines evacuates the power- i). Kotmale–Anuradhapura 220 kV line, ii). Kotmale–Biyagama 220 kV line, iii). Randenigala Badulla 132 kV line, whereas Randenigala–Mahiyangana 132 kV line, and Mahiyangana– Vaunativu–Ampara 132k V line are committed projects.

57. Mul Oya (5 MW) mini hydro power (MHP) project is currently under construction as per the GoSL policies for MHPs in Sri Lanka being administered by Sri Lanka Sustainable Energy Authority (SEA).

### 6.0 Institutional Arrangements and Responsibilities

58. According to the National Environmental Act (NEA), there exists a mandatory requirement to obtain the environmental clearance from the Central Environmental Authority or a Project Approving Agency (PAA) which is authorised under the NEA for any kind of power plants of prescribed capacity and transmission lines over 50 kV in capacity, and above 10 km in length. In most cases, Central Environmental Authority (CEA) designates the Ministry of Power and Energy as the PAA for the



environmental approval process for transmission line. Therefore, the Ministry of Power and Energy has established an environment cell in the Planning Division to implement the requirements of NEA. CEB has set up a Design & Environment Division (D&ED) for dealing with environmental issues at the corporate level to monitor and implement environmental good practices.

59. The D&ED will be responsible for implementing safeguard issues associated with the Project through the Project Implementation unit (PIU). During the construction and operation phase of this project, the monitoring of the environmental aspects shall be done by D&ED. During the construction phase, the contractor should ensure that activities like handling of earth works clearing work, access road construction, putting traffic signals is done properly to have minimum impact. This in turn should be monitored by the Engineer-in-Charge of the individual transmission line/substation project.

60. For the solar rooftop component, the projects on the public buildings/universities will be developed on a (public private partnership) PPP mode through allocation of an investment grant portion by the government for installing solar rooftop power generation on selected university buildings. The financing of by private sector solar rooftop projects will be undertaken by providing credit to eligible private developers from a credit line as part of the project loan. SEA will be supported by project management consulting services to ensure effective implementation and monitoring of the pilot project and contribute to capacity building in SEA. It is proposed to finance these consulting services (one national consultant for 24 person-months) from the grant proceeds.

## **7.0 Environmental Monitoring Plan (EMoP)**

61. In addition to the EMP, to ensure that project would not be generating a negative impact to the overall environment quality, an EMoP will be prepared. The monitoring activities of the project include site supervision, verification of permits, monitoring of water quality, soil, noise and air. Monitoring of the quality of water, soil, air and noise during the construction stage is a responsibility of the contractor by the approved government agency. PIU and Environmental and Social staff will supervise the contractor. The environmental monitoring report will be submitted by the PIU to the PMU, which will include the result of environmental monitoring into its environmental report.

62. As per ADB's safeguards Policy 2009, ADB requires the borrower to retain external qualified experts or qualified NGOs to verify monitoring reports of the projects with significant impacts and risks. This external monitoring report will be on a semi-annual basis directly to ADB to verify whether sound environmental management practices are applied, and the set environment targets are achieved. In case the implementation of EMP measures is not satisfactory, this external monitoring experts/NGO will recommend actions to enhance environmental compliance.

## **8.0 Public Consultation and Information Disclosure**

63. In line with National Environmental Act (2002) in Sri Lanka, public consultation and information disclosure will be undertaken through public notice prior to the approval by CEA for the relevant projects. According to ADB SPS 2009, public consultation and information disclosure is to be during the initial stages by the client itself. This activity supports the view to understand the public's perception of the project and respond to their concerns and suggestions during the early stages of the project design. Incorporation on the environmental concerns to the decision making process through the public consultation will avoid or minimise conflict situation during the implementation process.

64. Public consultations were conducted in project-affected area between 15 March to 10 May 2012. The community aired their opinions freely on the project, its impact, and suggestions for mitigating adverse impacts. People participated in voluntary public consultation sessions to express their views about the proposed project.

## **9.0 Grievance Redress Mechanism**

65. The community should be informed about the Grievance Redress Mechanism (GRM), procedure for making complaints, including the place and the responsible person to contact which is already



established by the Public Utilities Commission of Sri Lanka (PUCSL). Almost all the stakeholders related to the GRM will also be aware of the established grievance process, the requirement of grievance mechanism, goals, benefits, relevant laws regulations etc. PUCSL Act lays down procedures for Grievance Redressal for activities of an industry overseen by PUCSL. This mechanism will remain active throughout the life cycle of the project. PUCSL's mission is to regulate all the utilities within the purview of the PAAs, to ensure safe, reliable and reasonably priced infrastructure services for existing as well as future consumers in the most equitable and sustainable manner.

66. Grievances not settled as per the above PUCSL's standard mechanism will be brought to the Grievance Redress Committee (GRC). The GRC will have representatives from APs, CEB, MoPE, Divisional Secretary, Land Officer under each divisional secretary, field level staff, and local community – where necessary. The main responsibilities of the GRC will be to: (i) provide support to APs on problems arising from land/property acquisition, if any; (ii) record AP grievances, categorize, and prioritise grievances and resolve them; (iii) immediately inform the EA/IA of serious cases; and (iv) report to APs on developments regarding their grievances and the decisions of the GRC and the PIU. The GRCs will continue to function during the life of the Project loan including the defects liability period.

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