

## ANNEX IX - POWER

### A. INTRODUCTION

1. **Overview of power sector in the tsunami-affected area.** In the coastal area of Sri Lanka affected by the tsunami, Ceylon Electricity Board (CEB) and Lanka Electricity Company Ltd. (LECO) provide their services in energy sector. CEB is a vertically integrated public governmental institution operating all over Sri Lanka in generation, transmission and distribution, while LECO provides services only in distribution sub-sector in two separate areas to the south and north of the capital city of Colombo (Moratuwa, Kalutara, and Galle in the south and Negombo in the north)<sup>1</sup>. In the tsunami-affected area, there were no major transmission lines, grid sub-stations, and power plants, and only the distribution lines and sub-stations were located to provide electricity to customers in the coastal area.

2. Immediately after the tsunami struck on December 26, 2004, CEB completed a report 'Rebuilding of Power Supply to the Tsunami-Affected Area' and submitted it to TAFREN on 10th January 2005. This comprehensive report covers a preliminary estimate of damages in power sector, short-term plan to rehabilitate damaged infrastructure, and a medium to long term reconstruction plan for the affected coastal region.

3. Based on the CEB's report and information gathered from Ministry of Power and Energy, CEB and LECO, the ADB-JBIC-WB assessment team conducted the needs assessment in the energy sector. The team visited and interacted with district secretariats in Amparai and Hambantota on January 12, and conducted site survey in Galle and Matara on January 14 to hold discussions with CEB's regional offices. The team also held discussions with other potential donor agencies such as KfW.

### B. DAMAGE OVERVIEW

4. It appears that despite the unprecedented scale of loss of human life, the impact of the disaster on power sector is rather limited and marginal. The total cost of damage to the assets owned by CEB and LECO, according to the preliminary estimate, is approximately LKR 1.04 billion. The damage is largely confined to the medium and low voltage distribution lines and related transformers located in the coastal areas, while other infrastructure such as grid-substations, major transmission lines, and power plants are not directly damaged by the tsunami.

5. **Categories of damage.** The number of households to which electricity supply was interrupted is approximately 62,500<sup>2</sup> in CEB's operating area (about 2% of the total number household customers of CEB) and above 7,800 in LECO's operating area (above 2% of the total household customers of LECO), respectively.

6. The major items destroyed are summarized below (Table 1). About 48 km of medium voltage distribution lines (11kV and 33kV) and 405 km of low voltage distribution lines (400V

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<sup>1</sup> LECO provides services to 391,000 customers, while CEB to about 3,567,000.

<sup>2</sup> According to CEB, the number of households which need to replace meters and service wires is 62,542 out of 3,175,000, the total number of CEB service recipients as of October 2004.

and below) are destroyed and needed to be replaced. About 70,000 sets of meters and service wires connected to households are also damaged, as the tidal wave washed away houses, distribution poles and wires. 88 sub-stations located in the distribution networks were also damaged as well.

**Table 1: Major Damage Caused by the Tsunami**

Item	Quantity	Unit	Cost of Damage (LKR million)
Medium Voltage Line (33kV, 11kV)	48	km	46.4
Low Voltage Line	405	km	299.6
Service Wire and Meter	70,342	house	461.0
Stock, Tool and Building	1	set	65.8

Source: Mission estimate, based on preliminary information from CEB and LECO

7. Other assets such as CEB area office building and housing complex in Hambantota, telecommunication systems in local offices of CEB, and vehicles were damaged. The customers database for Matara district was also lost. In addition, eight CEB employees from Galle, Matara, Colombo, Batticaloa, and Amparai were killed and some employees were injured by the disaster.

8. **Damage by district.** In CEB operating areas, distribution lines of almost all the districts were damaged. Out of six districts where LECO provides services, distribution lines and service connectors in four districts (Galle, Kalutara, Moratuwa, and Negombo) were damaged. The regional pattern of damage shows that the assets in the Southern and Eastern Provinces (Batticaloa, Amparai, Galle, and Trincomalee) suffered most, while the Northern Province (Jaffna and Mullaitivu) suffered less. This geographical difference in degree of damage is due to the electrification rate in the Southern and Eastern Provinces being higher than that of the Northern part<sup>3</sup>. However, more information regarding damages in Northern Province is necessary to evaluate the impacts accurately.

10. Loss of asset is highest in Galle district with an estimated cost of LKR 318 million, followed by Amparai district which suffered LKR 236.2 million and Hambantota district with LKR 177.8 million. The number of affected customers is largest in Galle district with nearly 20,000, followed by Amparai district with 14,000.

11. **Immediate actions taken by CEB and LECO.** Immediately after the tsunami disaster, CEB started damage assessment and commenced temporary repair works while shifting its labor force and inventories from the unaffected areas to the affected areas. During the temporary repair works, CEB gave priority to recovery of service to water supply facilities, street lights, hospitals, and shelters to meet immediate humanitarian needs. In continuing the temporary repair of the distribution lines, CEB's immediate problem is shortage of working capital to purchase necessary materials.

<sup>3</sup> The average electrification rate in each district as of October 2004 is 46% in Trincomalee, 44% in Batticaloa, 57% in Amparai, 57% in Hambantota, 74% in Matara, and 85% in Galle. The rate in the coastal area is regarded to be higher than that of the district average due to the high density of households in the coastal area. The electrification rate in northern area is envisioned to be around 30-40%.

12. LECO, being operated in a relatively small area compared to CEB, completed temporary repairing and resumed its operation in the affected areas.

**Table 2: Summary of Damage to Power Sector by District<sup>4</sup>**

District	Number of Consumers Affected <sup>5</sup>	CEB (LKR millions)	LECO (LKR millions)	Total Loss (LKR millions)
Colombo	1,238	1.4	7.5	8.9
Kalutara	1,491		15.0	15.0
Galle	19,582	268.0	50.0	318.0
Matara	11,900	91.1		91.1
Hambantota	8,650	177.8		177.8
Amparai	13,500	236.2		236.2
Batticalloa	6,590	121.7		121.7
Trincomalee	6,000	55.8		55.8
Jaffna	1,300	17.5		17.5
Gampaha	91		0.5	0.5
<b>Total</b>	<b>70,342</b>	<b>969.5</b>	<b>73.0</b>	<b>1,042.5</b>

Source: Mission estimate, based on preliminary information from CEB and LECO

### C. RECONSTRUCTION AND RECOVERY NEEDS

13. Based on the information gathered from CEB and LECO, and the findings from the site survey, recovery and reconstruction needs for the next three years include:

- Emergency procurement of tools, materials, vehicles, equipment, and office furniture to reestablish the operational capability at regional CEB offices, including replacement of material already used from other projects;
- Rehabilitation and emergency repairs of the damaged power infrastructure in particular the distribution system; and
- Upgrading and expansion of power infrastructure to improve access of the poor to electricity and to promote economic development in the Tsunami-affected area.

14. **Short Term Priority (3 to 12 months).** The most urgent need is to resume power supply to the affected customers as soon as possible. Short-term priority should be, therefore, placed on repair and rehabilitation of the existing damaged distribution lines and service connections particularly in CEB operating areas. Thereafter, expansion of the distribution network will need to supply power to new houses which will be provided to the Tsunami-affected people by the Government. This investment should be made in a timely manner to correspond to the progress of the housing plan. The short term financing needs by district is shown in the below table (Table 3).

<sup>4</sup> Unit costs are estimated based on the latest procurement by CEB.

<sup>5</sup> Consumers affected are those who need replacement of integrating watt meters.

**Table 3: Short Term Needs of Power Sector (3 to 12 months)**  
(\$ millions)

Province	District	Short term needs
Northern	Jaffna	2.3
	Killinochchi	1.2
	Mullaitivu	0.8
Eastern	Trincomalee	0.8
	Batticaloa	4.0
	Amparai	5.3
Southern	Hambantota	3.1
	Matara	2.9
	Galle	3.5
Western	Kalutara	1.7
	Colombo	1.1
	Gampaha	0.2
North Western	Puttalam	0.1
<b>Total</b>		<b>27.1</b>

Source: Mission estimate, based on preliminary information from CEB and LECO

15. **Medium to Long Term Priorities (1 to 3 years).** To address energy demand growth in the affected areas, the medium voltage distribution network and transmission network will need to be strengthened and expanded. For expansion of the transmission network, CEB has identified new transmission lines between Rantembe - Amparai and Habarana - Valachchena (Batticalloa) as priority projects. However, it should be noted that necessity of these projects within the next three years is to be further scrutinized through a review of a medium to long-term demand forecast of the affected areas as well as generation capacity.

16. The table below (Table 4) shows cost estimate for short term and medium to long term needs. The cost estimate of medium to long term needs will vary depending on the necessity of expansion of transmission networks.

**Table 4: Estimate of Total Needs of the Power Sector**  
(\$ millions)

	Total Needs
Short term needs (3- 12 months)	27
Medium to long term needs (1-3 years)	40-50
<b>Total Needs</b>	<b>67-77</b>

Source: Mission estimate, based on preliminary information from CEB and LECO

17. CEB estimates that \$158.8 million would be required for the next 10 to 15 years, including \$81.9 million beyond the next three years. This additional investment beyond 3 years cannot be justified by foreseeable demand growth in the tsunami-affected areas only. It will also depend on overall demand growth of the Northern, Eastern, and Southern Provinces including the affected area. Necessity of these longer-term investments should be carefully examined in the master plan of transmission and generation that will be prepared under JICA funding starting from February 2005.

#### **D. OTHER OBSERVED IMPACTS**

18. According to the estimate by CEB, loss of energy supply to consumers is roughly estimated at 120 million kWh in 2005, 75 million kWh in 2006, and 27 million kWh in 2007<sup>6</sup> respectively. Consequently, it is forecast that CEB will suffer revenue loss of about LKR 910 million in 2005, LKR 580 million in 2006, and LKR 209 million in 2007 respectively<sup>7</sup>.

19. It is difficult to measure and quantify the economic impact caused by the energy failure due to the tsunami. The opportunity cost of the power failure is calculated using 'the cost of power not served', which is the average loss to the economy due to electricity not supplied. In Sri Lanka, 'the cost of power not served' is estimated to be LKR. 72 per kWh<sup>8</sup>. Based on the CEB's forecast, opportunity cost of energy failure is roughly estimated to be LKR 8.6 billion for 2005, LKR 5.4 billion for 2006, and LKR 1.9 million for 2007, respectively.

#### **E. ENVIRONMENTAL AND SOCIAL ASPECTS**

20. Immediate restoration of the power supply in the affected areas requires rehabilitation of the existing distribution network, and therefore, no significant adverse environment and social impact is anticipated. However, in implementing medium to long term reconstruction of the power sector, an appropriate environmental and social assessment will be required.

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<sup>6</sup> CEB estimated the loss of energy with following assumption; loss of energy demand will recover 10% in the 1<sup>st</sup> month after the Tsunami, 30% in next 3 months, 60% in next 8 months, 70% in the 2<sup>nd</sup> year, 90% in the 3<sup>rd</sup> year, and fully recovered from the 4<sup>th</sup> year.

<sup>7</sup> CEB adopted the average tariff rate (LKR 7.70/ kWh) for the estimation. The actual revenue impact on CEB might be less than the CEB's estimation as the customers affected are highly subsidized.

<sup>8</sup> 'Cost of Energy Not Served' is estimated by CEB, based on the study "Assessment of Economic Impact of Poor Power Quality (USAID-SARI/E Programme, October 2002)".