Technical Assistance Consultant’s Report
Final Report: Part 3 (Analysis of RE Regulatory Framework and Potential PPP Options)

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SRI LANKA: Clean Energy and Network Efficiency Improvement Project

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Asian Development Bank

PREPARING CLEAN ENERGY NETWORK IMPROVEMENT PROJECT IN SRI LANKA

Analysis of renewable energy regulatory framework and potential PPP options for developing wind and solar power generation

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ADB Asian Development Bank

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ADB: Asian Development Bank

BLT: Build-Lease-Transfer

BOI: Board Of Investment

BOT: Build-Operate-Transfer

BOO: Build-Own-Operate

BOOT: Build-Own-Operate-Transfer

CDM: Clean Development Mechanism

CEB: Ceylon Electricity Board

DBFO: Design-Build-Finance-Operate

DCMF: Design-Construct-Manage-Finance

D/L: Distribution Licensees

ECF: Energy Conservation Fund

ESD: Energy Services Delivery Project

FIT: Feed in tariff

GEF: Global Environmental Facility

LECO: Lanka Electricity Company (Pvt) Ltd.

MFIs: Micro-Finance Institutions

MOPE: Ministry of Power and Energy

NCRE: Non-Conventional Renewable Energy

PCIs: Participating Credit Institutions

PPP: Public-Private-Partnership

PUCSL: Public Utility Commission Sri Lanka

REC: Renewable Energy Certificates

RES-E: Renewable Energy Sources- Electricity

RERED: Renewable Energy for Rural Economic Development

ROT: Refurbish-Operate-Transfer

RPS: Renewable Portfolio Standard

SHS: Solar Home Systems

SL: Sri Lanka

SLR: Sri Lankan Rupees

SLSEA: Sustainable Energy Authority

SPP: Solar Power Plants

SPPA: Standard Power Purchase Agreement

T/L: Transmission Licensees

USD: US Dollars

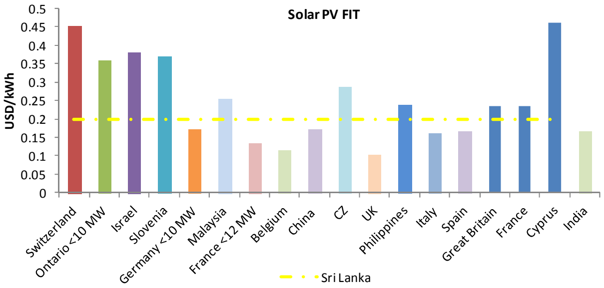
WPP: Wind Power Plants

I EXECUTIVE SUMMARY

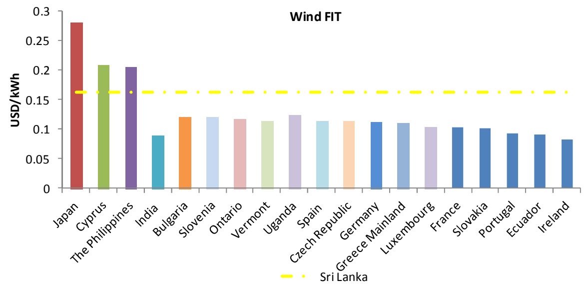
The objective of this report is to analyze the renewable energy regulatory framework in Sri Lanka and determine the country's Public-Private Partnership (PPP) options for developing wind and solar power generation parks, as well as rooftop solar power generation development.

This reports includes (1) a review of the best international practices for wind and solar power development in different countries, specifically focusing on the wind and solar park development concept as well as on a solar rooftop power generation approach on a PPP basis; (2) an analysis of the current renewable energy development legal and regulatory framework in Sri Lanka; (3) an analysis of prospects, viability and suitability of potential PPP options in Sri Lanka and (4) recommendations on further improvement of the legal and regulatory framework for renewable energy development and appropriate PPP options for the use in developing wind and solar power in Sri Lanka.

The total Installed capacity of the Sri Lanka power system is about 3,200 MW with a peak demand of about 2100 MW and an annual energy demand of about 11.8 GWh (29% RES-E in 2012). The total RES-E generation with SPPA is about 730 GWh (6% of total in 2012). Currently, the wind and solar penetration with SPPA (March 2013), as published by the CEB is 74 MW (additional 21 MW expected to be commissioned soon) of WPP and 1.4 MW of SPP in 4 facilities.



The FIT level is the most important element for developing RES-E. However, the FIT values in Sri Lanka appear to be higher than in other parts of the world, specially for wind, and it is complicated by the financial burden that is placed on CEB and, ultimately, to the electricity consumer, which has resulted in the scheme coming to a stop recently, as well as the CEB refusing to sign any SPPA at present.



FIT for SPPA is the special mechanism to promote NCRE plants below 10 MW. Therefore this scheme is currently restricted to 10MW and therefore it has resulted in the wind farm capacities being limited to legally separate entities of 10MW with loss of economies of scale. Above 10 MW requires PUCSL's authorization for acquisition of generation and should be based on a tendering process.

On top of this, a generation licence for a power plant over 25 MW can be issued only to the CEB, a Local Authority or a company in which a government entity holds a share of the ownership that it is decided on a case by case basis by the GoSL, meaning that for that size and higher, the only type of PPP possible is a joint venture.

Despite the fact that the existing framework has attracted about 600 MW of RES-E generation and the there exists a pipeline of around 40 Million USD of foreign and local investment (already with BOI concessions), several issues are still hindering wider development of RES-E in the country. The most critical issues that were identified during the assignment related to this are listed below.

- Institutional issues:
  - A lack of clearly allocated institutional responsibility and roles (e.g. many different actors involved in the implementation of policies or project realization): one controversial issue is the right of PUCSL to approve FITs.
  - Lack of agreement among stakeholders concerning objectives and procedures; dissent between institutional bodies can impede or slow down a fast promotion of renewable energy.
- Regulatory issues:
  - The threshold of 10 MW seems to be related to technical issues as the lack of clear-cut grid code, where technical conditions requirements that are set for RES-E have transformed into constraints for the absorption of renewable power to 10 MW per facility as a rule.

  - The inter-license agreements between the Government owned Generation Licensee/Transmission Licensee and other Transmission Licensee/Distribution Licensees, which are required to make power sector regulations work, are still not in place. It is important to increase the transparency of the power sector for attracting private investment at reasonable prices. The agreements between T/L and generation licensees is of utmost importance; in the future, both CEB and private developers may be competing to supply RES-E to the CEB T/L.
  - The current law requires public sector participation in the development of RES-E facilities with an installed capacity above 25 MW.
  - Probably, the main regulatory gap is the uncertainty in relation to the promotion mechanism for facilities larger than 10 MW. From 25 MW and above, it is clear that the price should be the result of a competitive procurement but, currently, no plan for tenders does exist. From a 10 to 25 MW size, the issue remains even more unclear.

- Financial issues:
  - The power sector has a very large deficit, which is supposed to be funded by the Treasury. The present retail tariffs are not fully cost reflective; this implies that generation is not only paid by the consumers but also by the Treasury.
  - There has been a lot of controversy about the level of FITs, mostly in the case of WPPs. Unfortunately; the only way to test if the current figures are not generating large infra-marginal rents is to develop a more sophisticated mechanism for price discovery, such as tenders.
  - Technology has still not reduced RES-E costs to grid parity. The SLSEA is mandated by law to have a sustainable energy fund which is not in operation. Hence customers are paying the full cost of RES-E, leading to an extra burden on the consumer electricity tariffs. Not only is this a financial issue but a legal one, as it is not clear whether the full pass-through of RES-E is aligned with the spirit of the current legislation or not, potentially raising legal claims for consumers in the future.

- Grid integration issues:
  - The size of the Power System itself is a barrier to absorbing renewable (mostly intermittent; mini-hydro, solar PV and Wind).
  - Balancing possibilities and cost, as well as system stability, will place a limit on renewable power absorption.
  - The main issue is that no provisions are stated, either for wind or solar spilling, in the current SPPAs; it is "guaranteed" that curtailment will not happen provided that the total installed capacity of intermittent generation is lower than 90 MW. This issue will be perceived as a potential risk by the coming developers because installed capacity is reaching that threshold and because non-curtailment cannot be guaranteed; a compensation mechanism is required.
  - Any costs of improvements to overcome transmission/distribution constraints have to be met by project proponent.
  - Safety practices may slow net-metering penetration.

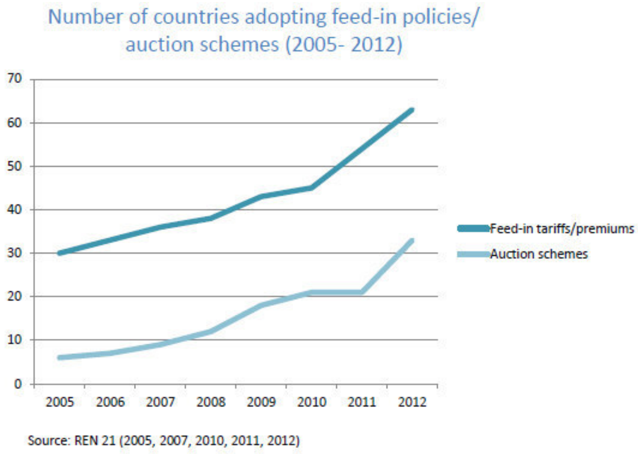
In order to provide a comparative analysis on the support scheme for RES-E, even if Sri Lanka RES-E's policy is focused in the development of a traditional FIT and relevant authorities pave the way towards the implementation of this mechanism, the consultant outlines alternative mechanisms that may complement a traditional FIT scheme.

Historically, feed-in tariffs have been the main instrument used for promoting renewable energy. As they are administratively set and usually constant over a pre-established period of time, they provide a high degree of certainty for developers on their expected stream of revenues. In some cases, feed-in tariffs have been set at such levels that investors were able to recover the investment costs over a period of only a few years, raising the concern of authorities and civil society. In many cases, the conclusion was that FITs should be set by a tendering procedure so the market (competition for the market) reveals the actual cost of providing certain type of RES-E. At a glance, it seems to be a small change, but in a deeper analysis, it means changing the type of promotion mechanism.

FIT has been the selected scheme in most European countries which have successfully achieved significant RES-E penetration on their energy mix. Sri Lanka has followed this approach as well. The consultant provides an overall review of the main aspects that should be defined to set this regulatory framework to highlight issues which may be fine tuned in the current framework.

Since 2007, auctions have been increasing at a higher rate than FIT and premium schemes as a promotion mechanism for RES-E; this approach entails two weaknesses that are critical to trigger the market, especially in its first stages. These issues are:

- Competition must be ensured; if this is not the case, prices resulting from the auction may be higher than cost-based FIT (or could result in failure if a price cap is set in the tender).
- Need to set up the mechanism for the tender; this included, among others, (1) institutional set up, (2) tender rules (technology-wise?, participants eligibility, pricing, etc), (3) what to tender (amount of MW, bunch of projects, individual projects, etc) and (4) enforcement measures (ensure that awarded investors actually develop the projects).



The usage of technology specific auction mechanisms, in which potential investors compete for long-term energy contracts for demand to be served for a number of years after the auction occurs, arose as an alternative in Latin America, led by Brazil in 2004. Chile, Peru, Colombia and Panama also implemented auction-based schemes during 2005–2009. In Europe, France and Italy, the existing FIT laws were modified to include tenders for large-scale installations. Other countries such as Denmark have launched tenders for certain technologies, mainly those that were less mature. Brazil and Peru have been further outlined in this report to explore the potential implementation of this scheme for RES-E promotion in Sri Lanka.

Traditionally, in developed countries renewable energy projects are mainly developed in a fully private manner, while other schemes such as BOT, BOOT, JV, etc. are commonly used for transport infrastructures, public services etc. Though some developed countries have triggered the development of the renewable energy industry through PPPs (with significant subsidies to RES-E development), this scheme has been transformed into the existing FIT scheme, where project developers are entitled to perceive a regulated tariff for the energy fed into the national grid over a period of time. Under this scheme, most of the installations were developed under a BOO agreement or directly by the power utilities, which are mostly private. Internationally, - as described by the World Bank database on Participation of Private Sector in Infrastructure, RES-E projects (including large hydropower) are mainly based on BOT and BOO; about 70 % of the projects have been developed under BOO agreements, this figure standing for 65 % when analysing South East Asia.

Regarding the development of PPP, Sri Lanka has been significantly active in their implementation in different activities of the economy. Particularly, the following examples show the involvement of public and private entities within the power sector.

- Conventional large power stations; for example, the Lakvijaya coal power station (DBT), West Coast CCP (BOO) and Colombo Barge Power (BOO)
- Power stations operating with SPPA with CEB are private (BOO)
- Upper Kotmale power station is a case of DBT
- Trincomalee coal power plant is a JV-BOOT

The consultant provided an overall review of the main PPP approaches taken by other countries worldwide and particularly south Asia. Based on these experiences, few cases have been selected to provide a more detailed vision on how these operations were structured, as well as potential lessons that may be applied or replicated in Sri Lanka. The cases analysed are[1]:

- India (125 MW PV in Maharashtra): the project is structured under performance linked revenue sharing models which it is considered of interest in the case that CEB or another state-owned entity develops this type of projects.
- India (Solar PV in public building rooftops): this alternative may be exploited in Sri Lanka, whose features are relatively equivalent to India's ones.
- Cape Verde (25 MW WPP under JV): it is one of the most interesting cases of JV in which public (treasury and utility), private and multilateral funds are participating.
- Morocco (Solar PV rural electrification): opposite to previous experiences, in this case the private contractor directly provides service to the end users and is entitled to collect fees for

[1] The selected cases are biased to solar PV as there is a consultant currently working in designing potential business models for WPPs.

the provision of this service. The ownership of the installed devices is directly transferred to the national utility once it is installed.

According to the current development of wind and solar PV facilities, certain aspects should be highlighted. The existing framework for promoting wind technology should be considered effective, with over 70 MW installed and more than 20 MW expected to be in place soon. Conversely, solar PV facilities have not attracted private investors so far, due to the insufficient incentives for their installation as well as other signals from the policy, which may discourage investors from developing such technologies. However, efficiency of the mechanism is to the least controversial, as there is evidence that may suggest it is not maximized (potential high FIT, loss of economic of scale, wind turbines of about 1 MW average been installed, etc).

In order to overcome the previously mentioned barriers to the development of certain renewables and following international experience, the main findings on the existing framework regarding the suitability of existing schemes to foster RES-E in Sri Lanka are summarized below.

Although a traditional FIT seems to be a faster and simpler way to kick-off the market, tenders are also an interesting alternative to fine-tune the level of tariff for future developments, and thus reduce costs. For this, the Consultant recommends for certain facilities to call for tenders to assess investors' appetite and accuracy of FITs.

The main advantages of tendering procedures in relation to FIT are:

- it allows GoSL to control the amount MW installed;
- it minimizes cost to achieve the penetration targets, if competition is enough;
- it reduces the potential for large infra-marginal rents due to miscalculation of the cost-based FIT. There could be several reasons for appearance of the windfall profit, among which we find underestimation of the plant factor and/or overestimation of the technology-specific costs.

The preferred alternative is described in the following points:

- Competitive procurement for large developments to figure out investor expectation.
- Regarding smaller facilities – those smaller than 3 to 5 MW -, a FIT scheme as today but providing some minor adjustments that can be implemented as described below, provided that the GoSL wants to specifically promote this size of installations[2]. If this is not the case, FIT can be removed for WPPs and SPPs. This report assumes that the GoSL intends to foster small scale developments. Unfortunately, while FIT are kept, it is very difficult to prevent larger wind parks being divided into 5MW blocks if prevailing FIT is higher than the results of the auctions; however, given the smaller threshold, transaction costs are an important dis-incentive to do so.
- Fine tune the net-metering scheme.

The following table summarizes the preferred approach for fine tuning the regulatory framework surrounding the development of RES-E.

	Net-metering	FIT	Tendering
Size	Up to 2 MW	3 / 5 MW	Above 3 / 5 MW
Eligible technologies	All RES-E	All RES-E	All RES-E
Review	No review	4 years or target achieved	Tender program set in the RES-E Plan. Price cap is the prevailing FIT (w/wo. A discount) at the moment of the auction

[2] There are many be many reasons for this policy – despite that small installations may need a high tariff – i.e. development of local manufacturing, development of local communities or small scale local developers, etc.

Responsible agency	-	MOPE sets FIT	SLSEA develops the planning MOPE approves tendering rules and price caps CEB/SLSEA prepares the sites to tender CEB calls for tenders

Specific provisions which should be reviewed by relevant authorities in order to enhance current support scheme, including net-metering, FIT and the potential inclusion of tendering procedures are as follows.

a) RES-E up to 5MW

a.1) Net-metering

In Sri Lanka, the selected approach for buildings and householders which decide to implement RES-E facilities will remain traditional net-metering. This means that the energy produced shall be used for self-consumption, and the exceeding –if any- will be "sold" to the grid and used to offset future consumption, the energy banking period, currently set at 10 years. Even though there are number of net-metering customers already operating in the system, certain amendments are proposed to this scheme:

- The banking period could be reduced down to 1 year for wind and solar installations (though it is not the scope of this report, in case of small scale hydropower facilities, the reduction of the banking period should be limited to 5 years to consider inter-annual hydrological variations). In case there is an excess of credits at the end of the year, two options may be available: (1) CEB buys the credit at a discount over the relevant retail tariff or (2) the credit are carried forward for the next year provided that the credits were generated in the 3 immediate previous years.
- The consultant proposes to amend current net-metering scheme by reducing the threshold down to 2 MW. This will facilitate technical and connection requirements and will ensure a streamlined operation of the electricity grid.
- Define the maximum penetration target in the system (or per subsystem) of these installations for safety reasons (generally this target is set between 1 to 5 % of the peak load of the distribution area). However, specific cases might be evaluated separately by PUCSL.
- Back-up charges may be needed to cover the fixed cost of the networks that the consumers may need in case of self-generation failure.

a.2) Feed in Tariff

The following table summarizes the features for the proposed amendment to the FIT scheme.

Feature	Approach
Capacity limit	3 to 5 MW (this limit has been applied in other countries where quota promotion mechanism are set for larger facilities)
Installation targets	Technology-wise defined based on the results of the RES-E master plan, economic efficiency and total burden for consumers the GoSL is willing to accept.
Determination of FITs	Reference cost-based by MOPE
Duration	SPPA (20 years) or cumulative generation. Duration of the FIT may be further explored with alternative options as there is always an important uncertainty regarding the expected plant factor. The alternative based on cumulative generation seems to better allocate the risk between producers and off-takers.

Currency nomination and indexation	One part flat tariff nominated in local currency FITs adjusted by mix of external cost drivers.
Review of FITs	FIT should be set for an indefinite period of time. Tariff review provisions will define the events to change these tariffs, based on a volumetric degression scheme. Jointly with the FIT, a installation target will be defined for that technology. The approved FIT will remain valid until the target is achieved. Once the target is achieved, the FIT is recalculated. The speed to fulfil the target is an indication of over/under estimation of the FIT. When the installation target is by far not achieved within the period targeted (4 years is recommended), FIT is reviewed as well. A criteria to decide when the target is fulfilled needs to be defined; initial recommendation could be to link the target to the amount of MW of each technology with final permit[3] by SLSEA.
Allocation of network costs	For the case of SPPA, the consultant supports that the best approach for this issue is the shallow method of connection charging. Under this framework the RES-E producers just pay for the connection cost to the grid and it's the grid operator the one who takes up the cost derived from grid reinforcement –if any- or other additional charges.

b) RES-E above 5 MW

The following table summarizes the features for the proposed tendering scheme.

Issues	Initial recommendations
Institutional set up	SLSEA should develop a RES-E master Plan for 10 years in which it: • Provides the most accurate appraisal plant factors • Defines the maximum penetration in coordination with T/L • Defines the technology-wise installation targets MOPE calculates the technology-wise price cap based on the best available information. If FIT for that technology is available, the cap should be based on the value of the FIT, potentially with a discount to consider economies of scale. SLSEA define the tender timeline plan for a 5-year period. MOPE will approve the tendering rules based on recommendations by a technical Working group. The tenders will be launched and managed by the CEB according to the Plan defined by SLSEA.
Tenders' organisation and management	The preferred product under tendering is a project of certain amount of installed MW rather than an amount of MW without identification of the precise site. SLSEA would be responsible of preparing and selecting the best sites. Tariff will be one-part expressed local currency. The tendering process will consist of two phases: prequalification and auction. At the prequalification stage, the selection will be based on minimum technical and financial qualifications that a developer has to meet in order to be eligible for submitting the bid. Ultimate success of each tender (actual installation of RES-E facilities in due time) should be supported by a dual system of guarantees / penalties properly sized for each project. The tendering mechanism should be built on a "First-price sealed-bid" (FPSB)

[3] Permit for engaging in and carrying on of an on-grid renewable energy project

	type of auction, pay-as-bid payment. A PPA will be granted to the winners for 20 years based on the amounts offered and selected. The PPA template is made public before the auction. The Grid Code including the technical connection and operational requirements for intermittent generation must be known before the first auction takes place.
Allocation of network costs	For these facilities, the current deep connection charging policy can be kept as today though flexibility to address specific case should be allowed.

c) *Other issues*

Besides the previously mentioned amendments of the existing framework, other regulatory amendments may be implemented to enhance RES-E development in the future.

- Fine tune technical connection conditions in the distribution code. The maximum size of an installation should be based by a maximum unit size feeding a single electrical circuit at each “declarable” voltage (33kV, 11kV, LV).
- As mentioned before, a Grid connection including requirements for wind and solar power plants connected to high voltage should be issued, defining main protection and power quality requirements. These requirements should include, but no be limited to:
    - Frequency Requirement
    - Voltage Requirement
    - Power Factor and Reactive Power Support
    - Voltage Ride Through Capability
    - Harmonics
    - Flicker
- Build & operate the Sustainable Energy Fund to ensure the sustainable development of RES-E without hampering customers’ ability to pay electricity bills.
- SLSEA should include in the RES-E Master Plan the development of Solar PV rooftop and more specifically, tender the available space in all public buildings for developers to install and operate, as described below.
- The legal umbrella for PUCSL passing-through the full cost of RES-E to the final customers should be clarified.
- Another action could be to evaluate the possibility and opportunity of extending the scope of the Renewable Energy Guarantee Fund to help small RES-E installations to get debt financing.
- PPA should include clauses allowing the compensation for curtailment as the threshold for the “guaranteed” non-curtailment is exhausted.

d) *PPP schemes*

PPP schemes have been already explored in the country; there are however market segments in which more sophisticated business models may be explored even in small size facilities.

- One specific case is needed to develop the RES-E potential (mostly hydropower) in hands of the state; there is a lot of RES-E small potentials in facilities/lands owned by the Irrigation department or the Mahaweli Authority.
    - To tap this hydro potential in Sri Lanka, bundling of irrigation projects is proposed. Under this scheme relevant irrigation authority would select a number of projects (with a total capacity around 10 MW) which will be grouped and tendered together.
    - Foster Performance-linked Revenue Sharing agreements. Under this scheme, the project developer (to be chosen in a transparent way, i.e. tendering procedure) will design and build the facility but, differently to other traditional approaches, the project developer will receive a portion of his EPC cost on achieving successful commercial operation; the rest of his payment, as a share of revenue over the life of the project jointly with O&M. Both payments, O&M expenses and deferred EPC cost payment will be linked to performance criteria (i.e. availability for hydropower plants). The ownership of the plant will be in the hands of the corresponding public organization, but the operation may be separate or private.

- On the other hand, where these projects do not reach 5 relevant volume, they will be developed under traditional FIT and conventional PPP schemes such as BT/BOT.

- Another case is required to foster net-metering in public facilities (buildings, sanitation facilities, schools, etc). Net-metering in public facilities (basically solar PV) will not be developed naturally (even if economically convenient) as in private facilities unless a specific business model is designed and implemented by the competent authorities. One potential alternative is conceptually similar to the scheme described above in which the project developer will design and build the facility but it will receive a portion of his EPC cost on achieving successful commercial operation and the rest of his payment as a share of revenue over the life of the project jointly with O&M linked to performance criteria (i.e. average annual generation per square metre of rooftop/land used). Main difference is that the criteria for selecting the developer should be based on tendering procedure in which the winner is the one who has bid the highest rental per square metre of rooftop/land.

The private sector can participate directly up to 25 MW, CEB or other state-owned companies can participate keeping full ownership (through traditional PPP arrangements such DBT, BOT, etc) or entering into JV with private participants (with/out a controlling share). There is nothing that impedes this type of approach to be implemented in Sri Lanka, and further economies of scale for RES-E facilities with capacity over 25 MW are envisaged.

As we are dealing with WPPs and SPPs, this consultant agrees with the initial recommendation provided by the consultant analysing business models for Mannar WPPs – in the sense that for economic and commercial reason, to limit the project up to 25 MW each may have a lot of advantages; these are:

- More competition among developers; this is extremely critical for the success of a promotion policy based a tendering mechanism;
- Manageable size to encourage local developers;
- More diversified financing sources;
- Insulation from risk of failure of a large project;
- Ability to build capabilities in a wider development community and supply chain, and
- Limited dis-economies of scale

As we are suggesting to tender projects out (instead of MWs), it would be recommendable that the parks are mostly developed by the GoSL agencies (either CEB or SLSEA) and then transferred to the selected bidder(s) through a bidding process. Developing costs may be paid back up-front or through shares in the project.

In any case, this approach requires some political and policy commitments, such as:

- That the private sector can develop RES-E facilities without intervention.
- That CEB – given the still limited level of unbundling – will behave competitively (i.e. it will not unnecessary block the connection to the grid of a private developers or other JV in which CEB is not participating).
- That the tendering will be developed in a fully transparent way.
- That not all the sites have been previously locked by state-owned or private corporations (i.e. all SLSEA permits are in hands of a few players).

II BACKGROUND AND SCOPE

Till about 1995, Sri Lanka's power generation was dominated by renewable hydro power generation. From then onwards, the power generation system gradually transformed to the present mainly fossil fuel fired thermal generation. An even more significant change in the fossil fuel mix occurred with the introduction of coal fired power plants in 2011.

In 1996 the CEB introduced a scheme for embedded RES-E, known as Non-Conventional Renewable Energy (NCRE) projects. This scheme was regularized with the introduction of a Standard Power Purchase Agreement (SPPA), which was targeted at private investors. With the introduction of NCRES-E projects with SPPA and a cost-based FITs, the quantum of wind electricity has gradually increased since 2007.

Existing studies show that the renewable energy potential is adequate to meet Sri Lanka's power needs. Currently, fuel wood is the primary energy source in Sri Lanka, traded as an unregulated market and the conversion efficiencies are very low. Hydropower potential in Sri Lanka is considered to be substantially exploited, however, small scale hydropower plants are important (less than 10MW) and the development is ongoing. The remaining potential for wind power generation and solar power generation parks, as well as rooftop solar power generation, is substantial and untapped on a large scale.

Sri Lanka is estimated to have an in-shore wind energy potential in an excess of 20,000 MW. The wind map by the National Renewable Energy Laboratory of USA (NREL) in 2003 identified three regions as having good to excellent wind resources. The regions are the North-Western coastal region, central highlands and parts of Sabaragamuwa and Uva province. It is estimated that there is nearly 5000 square km of good wind potential areas. This potential will be much larger with off-shore wind.

Preparing Clean Energy Network Improvement Project in Sri Lanka is a Technical Assistance funded by the Asian Development Bank (ADB). The Executing Agency is the Ministry of Power and Energy (MOPE). One part of the project will be for system stability and network planning studies, power system analysis and power system operational aspects with wind and solar integration, transmission and generation planning and operation. The analysis prepares a comprehensive report including the Wind Power Development Plan for Sri Lanka over the period 2013-2028, taking into consideration the maximum prudent absorption limits of the other embedded generation, mainly wind, solar and mini hydro. The second part is the Preparation of Renewables Development and Wind Park Master Plans and Business Model for Wind Park in Mannar. (The Mannar Wind Park is expected to be about 100 MW to 200 MW in size.) The third part is to analyze the renewable energy regulatory framework in Sri Lanka and determine the country's Public Private Partnership (PPP) options for developing wind and solar power generation parks, as well as rooftop solar power generation development. These are the objectives of this report.

This report is the final report of the assignment. In June 2013, a draft report was submitted to MOPE. In early July, a visit was developed to Colombo to meet all relevant stakeholders (MOPE, SLSEA, PUCSL and CEB among others). This report considers the feedback collected during the visit and through additional meetings with the local consultant. This report includes (1) a review of the international experience in promotion mechanism focused on in innovation in FIT setting and tendering procedures, (2) a review of the best international practices in different countries, specifically focusing on the wind and solar park development concept as well as on a solar rooftop power generation approach on a PPP basis; (3) an analysis of the current renewable energy development legal and regulatory framework in Sri Lanka; (4) an analysis of prospects, viability and suitability of potential PPP options in Sri Lanka and (5) recommendations on further improvement of the legal and regulatory framework for renewable energy development and appropriate PPP options for the use in developing wind and solar power in Sri Lanka.

It is worth mentioning that there is another parallel TA focused in analysing the business model for WPPs (specifically for the case of Mannar) including PPP options; therefore, this consultant (1) has focused this assignment in analysing the current RES-E promotion mechanism and in PPP options for SPPs and (2) has entered into contact with the other consultant to discuss options for WPPs.

III COLLECTED AND ANALYZED INFORMATION

The consultant carried out meetings with main stakeholders involved in the development and regulation of the energy sector. Between the 16th of July and the 19th several agents were interviewed in order to validate the main findings and potential amendments to the renewable energy regulatory framework to boost PPP options for developing wind and solar power generation. Main stakeholders interviewed during this visit and key issues discussed during these meetings are listed below.

- RMA: Coordination between ongoing projects dealing with the PPPs in Sri Lanka.
- SEA: Discussions on existing renewable energy regulations.
- Ministry of Power and Energy: Discussions on current situation of RES-E policy and forthcoming initiatives.
- PUCSL: Discussion on general regulatory and licensing issues affecting the development of renewables.
- CEB: CEB perspectives of the proposed wind park development and other potential projects.
- MOPE Working Group meetings dealing with RES-E

Besides aforementioned meetings local consultant (Gemunu Abayasekara) has interviewed different stakeholders as required by the assignment.

IV EXISTING CONDITIONS IN SRI LANKA

1. WIND AND SOLAR PV DEVELOPMENT

CURRENT PENETRATION OF WIND AND SOLAR PV GENERATION

The development of the NCRES-E sector is lagging the government policy quota. In 2010, in the development policy framework of the government, "Mahinda Chintana Vision for the Future", the government set targets for renewable energy development. The targets were 8.5% in 2012, 10% in 2016 and 20% in 2020 share of renewable energy on grid.

The total Installed capacity of the Sri Lanka power system is about 3,200 MW with a peak demand of about 2100 MW and an annual energy demand of about 11.8 GWh (29% RES-E in 2012). Total RES-E generation with SPPA is about 730 GWh (6% of total in 2012). Currently, the wind and solar penetration with SPPA (March 2013) as published by the CEB was 74 MW (additional 21 MW expected to be commissioned soon) of WPP and 1.4 MW of SPP in 4 facilities.

Regarding WPPs, all facilities (described below) are less than 10 MW. In relation to SPP the largest facility is a solar park in Hambantota under the Sri Lanka Sustainable Energy Authority (SLSEA), Gonnoruwa I of 500 kW and Gonnoruws II of 737 kW. The rooftop solar PV installations under the net-metering scheme are estimated to be less than 200 in number, the capacity of each being in the kW range. A 120 kW is connected on the roof of Dilmah Tea, Peliyagoda who is a net-metering consumer of Lanka Electricity Company (Pvt) Ltd. (LECO); it is one of the largest net-metering solar PV installations.

PAST & EXISTING PROJECTS

a) Renewable Energy for Rural Economic Development Project

(i) Main features

The Renewable Energy for Rural Economic Development (RERED) project followed the previous Energy Services Delivery (ESD) project, which was established in 1997 and ended in 2002.

The RERED project started in 2002. Then, access to electricity was very low in rural areas averaging around 35% of households. The RERED project provided support for off-grid solar PV and off-grid micro-hydro investments with the aim of expanding the market and achieving commercial viability. RERED was funded by World Bank and Global Environmental Facility (GEF).

The principal objective of the program was promoting the provision by the private sector, non-governmental organizations and cooperatives of grid-connected and off-grid energy services using environmentally sustainable renewable energy technologies (solar PV, hydro, wind and biomass).

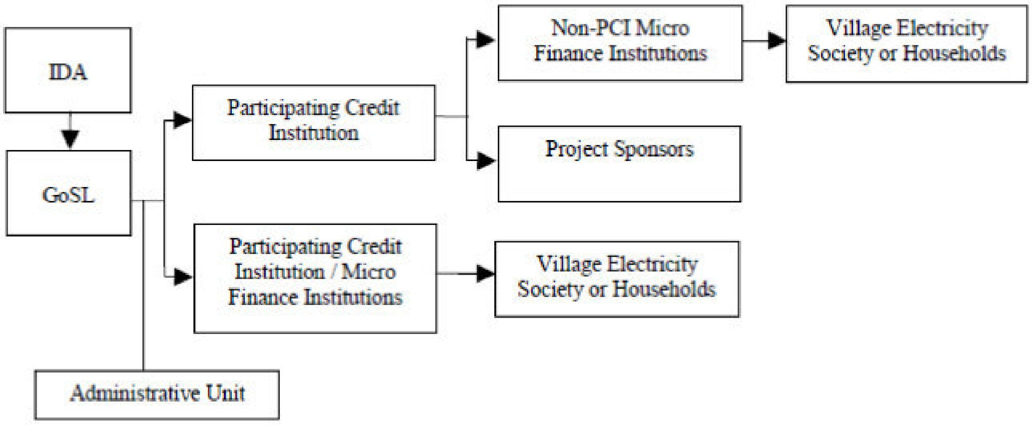
For the stand-alone Solar Home Systems (SHS), the program provided a consumer credit delivery mechanism, in which the program encourages Micro-Finance Institutions (MFIs) involvement. MFIs were allowed to apply to become Participating Credit Institutions (PCIs), and hence were able to provide consumer credit to SHS vendors or developers, or even end-users.

Private investors or developers were eligible to apply for funding under the program by submitting a private investment proposal. Proposals were evaluated for credit worthiness by PCIs which lend to qualifying projects on a medium- or long-term basis. The PCI was able to apply to RERED to refinance up to 80% of the sub-loan. Under the credit facility of the program, the government of Sri Lanka on-lent the proceeds to eligible PCIs, which in turn on-lent these proceeds, along with complementary financing from their own resources, to eligible sub-borrowers. These included commercial banks, project developers, equipment vendors, community electricity cooperatives and end-users.

Village micro-hydropower schemes of about 150 were completed under the RERED in capacities ranging from 3-50 kW. The management of the scheme was by an Electricity Consumer Societies on a co-operative society basis, which managed the technical aspects of the scheme and set the tariffs mostly a flat fee and paid back the loan.

The solar systems were marketed among the villages by private sector suppliers who maintained the systems under normal commercial terms.

Exhibit 1 – Flow of Funds under the Credit Facility of the Program



(ii) Outputs

The initial target for the 'off-grid renewable' component was downsized from 161,000 households, small and medium enterprises and public institutions being connected to 113,500 as recommended by the Ministry of Power and Energy (MOPE). The reduced target was appropriate in the light of faster than anticipated grid-based rural electrification, which reduces demand for off-grid renewable solutions. As a matter of fact, the potential for RES-E off-grid solution for rural electrification seems to be negligible as consequence of the government rural electrification program. It appears that with the access of the grid, the defaulting of the villagers of the loans has increased, the equipment recovered is lying with the lenders unused and the supplier numbers have declined.

b) Small Scale Wind under SPPA with CEB

(i) Main features

The CEB regularised the development of RES-E by introducing a Standard Power Purchase Agreement (SPPA) in 1997 with a Feed-In Tariff (FIT) based on avoided cost as described below. The initial scheme was attractive enough to develop non-conventional mini-hydropower facilities. With the introduction of technology specific Feed In Tariffs (FIT) in 2007 there was a boom in wind power generation with SPPAs.

(ii) Outputs

Under the SPPA with CEB, at present there are 9 wind power projects with a total installed capacity of about 74 MW already commissioned. There are also 4 projects with an installed capacity of about 21 MW waiting to be commissioned. The first wind power project was the Mampuri Wind Farm by the licensee Senok Wind Power (Pvt) Ltd of 10MW commissioned in March 2010, based on the technology specific tariff of about SLRs 20.00 for the first 8 years and a reduced tariff thereafter. The investment was about 26 Million USD with 55% from Senok and the balance from commercial banks, refinanced through the World Bank's RERED project credit line. This was closely followed by Seguwantivu Wind Farm of 10 MW by Seguwantivu Wind Power (Pvt) Ltd and Vidatatamunai Wind Farm of 10 MW by Vidatatamunai Wind Power (Pvt) Ltd. the investors being a consortium of local investors consisting of Akbar Brothers (Ltd) among others. These two were legally separated to meet the 10 MW limit placed on SPPA contracts. These were connected at 33 kV to the Puttalam Grid Substation.

These were followed by several more 10 MW and smaller wind farms in the same geographical area amounting to about 60 MW at present connected to the power system through a dedicated 75 MVA 220kV/33kV transformer. These power projects have been invested by local and foreign investors with Board of Investment (BOI)[4] concessions.

c) Small solar under SPPA with CEB

(i) Main features

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[4] It is a government agency to promote Foreign Direct Investment.

Small scale solar was also allowed under the SPPA. The flat tariff option for biomass is available for solar PV generators as well[5].

(ii) Outputs

In the very early stages, a solar power system joined the SPPA scheme but this facility is now not functioning properly due to the developer not maintaining the facility. The government with funds provided by the Government of Japan and the Government of Korea has established the Buruthakanda Solar Park consisting of Gonnoruwa 1 of 500kW and Gonnoruwa II of 737 kW. The solar park is owned and operated by the Sri Lanka Sustainable Energy Authority (SLSEA) and sells the generation to CEB on a SPPA.

It can be considered that the FIT of the SPPA scheme for solar power has been unsuccessful in attracting private investment in Sri Lanka as yet. There is only one 1.4 MW solar SPPA at present[6]. However, it is observed that the FIT is not very low when compared to international standards.

d) Solar PV rooftop under net-metering

(i) Main features

In 2011, the Distribution Licensees (D/L) introduced a net-metering scheme for their consumers. The D/L electricity consumer is able to generate electricity at his premises and synchronize the generator with the power system. The generation source has to be renewable. The technical parameters of protection and interconnection facilities are specified by the D/L. The net-metering RES-E capacity is limited to the consumer's service connection agreement demand not exceeding a maximum of 10 MW. The 2013 tariff for domestic category consumer is SLRs.42.00 per kWh with a 40% fuel adjustment charge (SLRs. 58.80 per kWh) for the block of above 180 kWh per month. This amount is very attractive when compared to the FIT for solar in 2013 which is SLRs. 25.09[7] per kWh for 20 years. This is likely to attract small private investments for rooftop solar PV, with estimated pay back periods of about 5 to 7 years.

(ii) Outputs

Currently, it is estimated that about 200 consumer installations have joined the net-metering scheme of the D/Ls, most of them being solar PV systems[8].

e) Others

(i) Main features

SPPA have also been signed for other RES-E. The other eligible sources for SPPA are mini hydropower, biomass-agricultural & industrial waste power, biomass-dendro power and biomass-municipal solid waste. Majority of them have been commissioned with some still in the pipeline with potential to increase in the future. At present the facilities are dominated by non-conventional mini-hydropower projects. The initial SPPA scheme with the FIT based on wet-season and dry-season was attractive to kick-off the non-conventional mini-hydropower sector and attract private sector investment. These received a boost with the technology specific FIT in 2007.

(ii) Outputs

The present level of development of other RES-E technologies is described in the following exhibit:

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[5] Even though solar PV FIT is not specified in current NCRES-E tariffs, according to the provisions stated in this rules, these facilities are guaranteed with the same FIT as biomass from dendro.

[6] A Letter of Intent was issued by CEB for a 6 MW solar in the so called Kankesanturai project, though it seems to be lapsed.

[7] Approved value by PUCSL, not yet implemented.

[8] Two micro hydros are also operational on net-metering. An ADB credit line is supporting the rehabilitation of 19 microhydros to be connected on net-metering basis.

Type	Facilities	Installed MW
Mini- hydro Power	111	239
Agricultural & Industrial Waste Power	2	11
Dendro Power	1	0.5

There are a more in the pipeline with SPPA signed.

Type	Facilities	Installed MW
Mini- hydro Power	72	167
Agricultural & Industrial Waste Power	2	4
Dendro Power	10	57
Biomass-Municipal Solid Waste	1	10

f) Lessons learnt

The FIT level has been the most important element in developing RES-E. It has attracted about 600 MW of RES-E generation and there is pipeline of around 40 Million USD of foreign and local investment (already with BOI concessions). These concessions for RES-E have been enhanced in the 2013 government budget with further tax concessions.

However, the FIT values in Sri Lanka appear to be higher than in other parts of the world (see heading V) and is complicated by the financial burden being placed on CEB and ultimately the electricity consumer, which has resulted to the scheme coming to a stop recently with the CEB refusing to sign any SPPA at present.

The SPPA scheme being restricted to 10MW has resulted in the wind farm capacities being limited to legally separate entities of 10MW with loss of economies of scale. Therefore, it is time to re-evaluate these regulatory barriers. There has been a lot of concern about the impact of intermittent RES-E generation in the power quality; however, there is no a clear assessment developed so far.

Where small investments are concerned as for solar rooftops, small investor friendly funding as per the RERED Project has good results. However, with the grid access to consumers reaching over 90 % the potential for off-grid RES-E is saturating. With consumers having such systems opting to connect to the grid immediately accessibility is within reach. This has led to abandonment of the invested equipment. However, with appropriate research and technology they can be converted into net-metering or captive generation, thus not wasting the investments to date.

2. CURRENT INSTITUTIONAL & REGULATORY FRAMEWORK FOR RES-E

CURRENT INSTITUTIONAL SET-UP DEALING WITH RES-E

The institutional set-up dealing with RES-E in Sri Lanka is complex. Besides the traditional players, regulatory agency (PUCSL), agency dealing with RES-E (SLSEA), the Ministry of Power and Energy and the off-taker (state-owned CEB), there exist other organizations that are involved in the process.

The Public Utilities Commission of Sri Lanka (PUCSL) is a multi-sector regulator, a regulator for water industry, petroleum industry and electricity industry that was established by Act in 2002. The Sri Lanka Sustainable Energy Authority (SLSEA) was established by SLSEA Act No.35 of 2007 for development of sustainable energy. The lack of an enabling industry Act for the electricity industry or the water industry, delayed the implementation of the regulatory function. The PUCSL was finally

enabled by Sri Lanka Electricity Act No 20 (SLEA 20) to regulate the electricity industry in 2009. The renewable energy sector will come under the purview of PUCSL only once it is converted to electricity. The PUCSL works reasonably closely with the SLSEA.

Today, the electricity industry is regulated by the PUCSL. Licenses are for generation, transmission, bulk supply business and system operation, distribution and supply. At present there are generators without licenses connected to the transmission system selling bulk power. Also, net–metering consumer installations can generate power up to their agreed contract demand not exceeding 10 MW. The regulator is empowered to set relevant tariffs and approve method of acquisition of generation etc.

The Ministry of Power and Energy (MOPE) is responsible for formulation of policies, programmes and projects under the subject of power and energy and all subjects that come under the purview of the institutes within the ministry; ultimately, it is responsible for the direction and implementation of such policies, programmes and projects.

Public Corporations are any corporation, board or other body which was or is established by or under any written law other than the Companies Ordinance, with funds or capital wholly or partly provided by the government by way of grant, loan or otherwise. The Ceylon Electricity Board (CEB) is a public corporation. However, its subsidiaries, such as the LECO are established under the Companies Act and operate as private entities.

The Sri Lanka Sustainable Energy Authority established by SLSEA Act 35 is facilitating non-conventional renewable electrical energy generation and energy efficiency. The SLSEA is empowered to carry out mapping of the resources, acquire immovable property, carry out promotional programs, forge joint ventures, maintain an energy fund, maintain a guarantee fund, issue permits, technically regulate and carry out research.

The regulation of renewable energy projects in declared development areas falls within the purview of the SLSEA 35. SLSEA can enter into joint schemes with any person approved by the Minister and acquire and lease immovable property for projects. It also can specify and enforce standards, norms, codes, measurement and verification protocols and building codes, for the efficient use of energy and for reduction of wastage of energy in buildings, enforce limits and codes of practices for existing and proposed buildings, industrial premises, land vehicles, ships and aircraft, in association with relevant agencies. The SLSEA is responsible for the adoption and implementation of measures to conserve energy and improve efficiency in harnessing energy, processing, conversion, transportation, storage, co-generation and heat recovery techniques, in the use of energy in all consumer sectors.

The SLSEA is responsible for the development of renewable energy in Sri Lanka. For this purpose they have established a resource allocation process, process applications for on-grid renewables. They maintain a list of accredited consultants; They arrange provisional approvals and energy permits and carry out awareness programs.

The bridge between renewable energy and electricity, that is the conversion to electricity, is legally within the scope of the SLSEA. In declared development areas, renewable energy projects and renewable power projects need a permit of the SLSEA. Once the energy is in the form of electricity it will also fall within the SLEA Act 20 (with PUCSL as the regulator).

The SLSEA is also empowered to function as a National Technical Service Agency of Clean Development Mechanism (CDM) in Sri Lanka, which provides technical assistance to the Designated National Agency for Clean Development Mechanism and project developers. SLSEA also has a mandate to initiate, promote, conduct and co-ordinate research, surveys and investigations concerning specific aspects of energy efficiency, conservation and demand management.

The thirteenth amendment to the constitution established Provincial Councils with authority to enact legislation and regulations pertaining to some subjects within the respective province and to establish an executive with Provincial Ministers. The Ninth Schedule list I (Provincial Council List) includes development, conservation and management of sites and facilities in the province for the generation and promotion of electrical energy (other than hydro-electric power and the power generated to feed the national grid). List III (Concurrent List) includes extension of electrification within the province and the promotion and regulation of the use of electricity within the province and protection of the environment. The concurrent list is the subject for which both the government and the provincial council have to agree. Although the provincial councils have these powers vested by the constitution with them, they have not chosen to exercise these powers significantly to date.

CURRENT REGULATION FOR PROMOTION OF RES-E

In terms of the SLSEA 35 Section 16 and Section 23, no person shall engage in or carry on an on-grid renewable energy project or an off grid renewable energy project for the generation and supply of power within a development area, except under the authority of a permit issued by the SLSEA. A person who is desirous of engaging in and carrying on an on-grid renewable energy project within a development area, is required to make an application to the Director-General of the SLSEA with the prescribed fee and the documents describing the location, a brief description, the total estimated cost and financial model, proof of availability of adequate finances, technical information etc. Once the SLSEA is satisfied and the project is approved, initially a provisional permit will be issued. Once the project is approved a permit will be issued to the applicant valid for a period of twenty years, provided that the developer commences the project and begins to generate electricity within two years of being issued with the permit. At the end of the period of twenty years at the request of the developer the SLSEA can extend the period, of validity of the permit by a further period, not exceeding twenty more years.

However, presently all electricity generation falls within the ambit of the SLEA 20 licensing regime prescribed in Section 7. SLEA 20 Section 43 prescribes the procedure for acquisition of a new generation plant. No person shall operate or provide any new generation plant or extend any existing generation plant, except as authorized by the PUCSL. Subject to the approval of the PUCSL, a transmission licensee shall, in accordance with the conditions of the transmission licence and such guidelines relating to procurement, call for tenders to procure new generation plant or to extend the existing generation plant. A transmission licensee shall select them based on least cost. However, in the case of generators with SPPA (under FIT) and a valid permit from the SLSEA, the PUCSL issues a generation license.

In accordance with SLEA 20 Section 9 a generation licence for a power plant over and above 25 MW can be issued only to the CEB, Local Authority or to a company in which a government entity holds a share of the ownership that it is decide case by case by the GoSL, meaning that for that size and higher, only type of PPP is a joint venture. This legal requirement has prevented the PUCSL issuing generation Licences for those wholly owned private owned IPPs which were feeding the Sri Lanka power system before the coming into force of the SLEA 20. Presently a series of amendments to the SLEA 20 are being considered by the parliament; one is to enable those IPPs to receive generation licenses.

CEB started a private sector owned embedded generation scheme based on feed-in tariffs for renewable power generation up to 10 MW in 1996. Presently, that has evolved to where the SLSEA issues permits for renewable energy power projects on a Standard Power Purchase Agreement (SPPA) with the CEB and the PUCSL issues the generation License under the SLEA 20.

Beyond 10 MW, the SLEA 20 in Section 43 requires PUCSL authorization for acquisition of generation. This generation follows the least cost rationale and should be as defined in the CEB-T/L Long Term Generation Expansion Plan (LTGEP).

Initially, the FIT was based on the avoided cost of generation. The avoided cost was reviewed annually and published to apply for the SPPAs of that year. These initial tariffs were attractive enough only to introduce mini-hydro power plants. Subsequently in 2007, a technology-specific, (for hydropower, wind-power, etc.) cost-based, three-tiered tariff structure was introduced. The intention was that the CEB would meet 90% of the avoided cost with its funds and the balance would be met by the Energy Conservation Fund (ECF). The inability of the ECF, now included in the SLSEA, to meet this difference resulted in regular disputes between the RES-E developers and the CEB as it had impacts on the CEB's financial position.

Last year, the PUCSL announced rates for electricity purchased by the Transmission Licensee (T/L); Ceylon Electricity Board (CEB) from Non-Conventional Renewable Energy (NCRE) sources for SPPAs signed on or after 1st January 2012 until December 2013.

As in previous periods, two different schemes are available for RES-E producers. Option 1, whose tariffs are split in three tiers (from year 1-8, 8-15, 16-20)[9] and Option 2, where these tariffs are flat during the PPA. The selection between options 1 and 2 would be at the discretion of the developer, at the time of signing the SPPA. Any other NCRES-E technology (electricity produced based on SPPA) that does not have a declared tariff would be offered a flat tariff of Rs. 25.09/ kWh, for 20 years, PUCSL announced in 2011.

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[9] There are conditions on the energy delivered under this scheme; for instance, average generation in the third tier has to be similar to first two tiers in order to ensure an adequate maintenance and performance of the facilities.

Exhibit 2[10]- Current FITs

Technology	All inclusive rate (LKR/kWh)for year 1-20	All inclusive rate (USD/MWh)for year 1-20
Mini-hydro	16.70	132.17
Wind	20.62	163.20
Biomass (Dendro)	25.09	198.58
Biomass (Agricultural& Industrial Waste)	17.71	140.17
Municipal Solid Waste	26.10	206.57
Waste Heat	9.19	72.73

With the enabling of the PUCSL, who was responsible for power sector regulation and considered independent, the approval of the annual FIT was passed on to the PUCSL. The PUCSL adopted the procedure of calling for tariff proposals from the Transmission Licensee the CEB, publishing a consultation paper, holding a public hearing and approving the FIT for the year's SPPAs. A messy intuitional conflict has arisen recently; PUCSL has been approving the feed-in tariffs of the CEB but CEB has this year objected to the approved tariffs and filed a case in the court of appeal[11]. Unfortunately, this has hindered the signing of SPPAs in 2013. The crux of the case is that the PUCSL has no mandate to determine generation tariffs; these are required to be determined by a competitive bidding process, while transmission tariffs and distribution tariffs are regulated by PUCSL.

The absorption capacity of the technology specific SPPA is decided based on local embedding constraints and the capacity of Sri Lanka's power system to absorb as determined by the CEB - Transmission license holder. The CEB issues a letter of intent (LOI) to the project developer to obtain the clearances required to obtain a permit from the SLSEA. RES-E projects are not centrally dispatched; the project developer is able to generate what he is capable of into the system. The guideline technical requirements for the interconnection of embedded generators are available with the CEB and are given in the distribution code of the distribution licensees approved by the PUCSL.

The government has encouraged foreign investment in the RES-E sector by providing for BOI concessions for the sector. They are tax exemptions, import duty exemptions on capital goods and potential exemptions from exchange control. The government also has obtained concessionary loans from financing institutions for disbursement through local banks.

Net-metering was allowed in 2010 with the potential of generation at any point in the network up to 10 MW at present as announced by the PUCSL. The consumers who request such net-metering facilities will be limited to the Service Connection Agreement's contract demand. The connections will need to meet technical requirements specified by the distribution licensees, the CEB or LECO. They will be connected by the Distribution Licensee, with metering to measure the demand (as an energy debit) and generation (as an energy credit) at the consumer installation supply terminal. The monthly bill will be computed on the net-energy consumption based on the applicable consumer tariff. If the energy generation exceeds the energy demand, that excess energy credit will be carried forward to the next billing period. Banking of electricity excess may be used to offset electricity consumption up to 10 years. The service connection costs will be met by the consumer making the net-metering request. At present, the additional metering costs are met by the consumer.

The SPPA was developed with the assistance of the World Bank and drafted with standardized terms and conditions. All energy produced by the facility will be purchased by the CEB and without a penalty for the non-delivery of energy from the facility.

This SPPA is intended to be used for generation based on renewable sources (including small scale hydro).

These characteristics requires (and it is a common international practise) that:

- The plants have a subsidy to make them feasible. This subsidy can be explicit and direct or under the form of a special tariff.

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[10] Solar PV facilities will receive same FIT as biomass from dendro.

[11] The SLEA20 has no provision for PUCSL to set Generator/Transmission Licensee Tariff. They are set during PPA negotiations in the acquisition procedure. SPPA are exempt from the procedure. The CEB considers the PUCSL-NCRES-E tariff too high and refuses to sign any SPPA on the 2013 NCRES-E Tariff.

- These plants need some kind of special consideration in the system from the operational point of view because of their technical characteristics (for example wind generation must be dispatched when there is wind, small run river hydro the same, etc) and also because they need to sell all the output they may produce.

The existing template for these agreements is mostly aligned with international best practices and softens several risks which may be faced by RES-E developers. In this sense, these facilities are bestowed with:

- Priority dispatch: *"the Seller is a must run facility"*
- Balancing responsibilities: *"...the Seller shall have no liability to CEB and shall be subject to no penalty in the event that the actual amount of electrical energy delivered to CEB differs from the forecasts.."*

However, there are some provisions which may hinder the development of renewable energy (RE) facilities that might be perceived as risky.

- Interruption: this is an issue worldwide which allows the TL to curtail RES-E facilities under prudent T/L practices and developers would not be compensated in this event.
- Default: SPPA provisions require guaranteeing average energy output during the contract duration.
- Some force majeure clauses seem to be defined *ad hoc*.
- Connection to the grid fully charged to the developer (already mentioned in the report)

Solar SPPA have been made by CEB only with the SLSEA for Gonnoruuwa I and II. The same SPPA with the changes to technology, tariff and Appendix is to be applicable for solar, though no specific template has been published so far in the CEB website. Section 46 of the SLSEA established a fund called the "Sri Lanka Sustainable Energy Fund", which was to be initiated with grant paid out of the Consolidated Fund. The fund is capable of being enlarged by the proceeds of a levy imposed on import of fossil fuel products, fees chargeable from developers for managing the carbon asset of Sri Lanka; amounts paid as royalty or charges by developers and permit holders, fees charged for rendering any professional services; money received as lease rentals from the lease of land or interest in land for carrying on of any on-grid and off-grid renewable energy project; fees charged for entertaining applications submitted for engaging in on-grid and off-grid renewable energy projects; and fees and shared savings earned from undertaking projects connected with the development of renewable energy resources and the improvement of energy efficiency, energy conservation and demand management, for and on behalf of state and private sector organizations. The Sustainable Energy Fund, can use such sums of money required for the payment of subsidies to selected renewable energy based energy conversion plants, subsidies for promoting the use of energy efficient appliances and technologies, capital subsidy for fuel switching, expenses incurred in conducting awareness programs through mass media and incentives or other similar financial assistance to any society or community based organization to encourage the adoption of energy conservation measures and for the development of rural energy services in all areas of the country. The effect of the Sustainable Energy Fund has been so far negligible.

Additionally, section 47 established a fund called the "Sustainable Energy Guarantee Fund" for the purpose of providing guarantees on behalf of investors who apply for loans to carry on any project relating to energy efficiency, RES-E generation is not in the scope of this fund.

V BARRIERS & CHALLENGES FOR WIND AND SOLAR PV PENERATION IN SRI LANKA

1. GRID INTEGRATION BARRIERS

The Sri Lanka Power System today has a maximum demand of about 2100 MW. Therefore, the size of the Power System itself is a barrier to absorbing renewable (mostly mini-hydro, solar PV and Wind) power potential of Sri Lanka. In any case, there are other successful cases of islands with a reasonable penetration of RES-E such as Hawaii, Canary Islands, Tasmania and Ireland. Additionally, the potential connection of the Sri Lanka power grid to the Indian power grid will probably increase the potential absorption of renewable energy.

Balancing possibilities and cost as well as system stability will place a limit on the renewable power absorption. The expertise for the determination of this limit and the capacity to determine this limit, as well as the trustworthiness of these experts, should be established by the MOPE. This limit is affected both for the total penetration of intermittent RES-E and by the unit/park size.

Most RES-E generation must be must-run in order not to spill the resource, only biomass based generation might be considered as dispatchable. Electricity cannot be stored as electricity. Therefore, electricity demand must be met by the supply instantaneously. Wind and solar generation is intermittent, and may be required to be curtailed to match the demand (or stored and released, nowadays, still not economic) under certain conditions. Moreover, wind and rain occur simultaneously during the monsoon season. The main issue is that no provisions are stated either for wind or solar spilling in current SPPAs; it is "guaranteed" that curtailment will not happen provided that the total installed capacity of intermittent generation is lower than 90 MW. This issue will be perceived as a potential risk by the coming developers because installed capacity is reaching that threshold and because non-curtailment cannot be guaranteed. A compensation mechanism is required.

Any costs of improvements to overcome transmission/distribution constraints at the time of project proposal to CEB have to be met by the project developer at CEB standard rates where available or at CEB work estimates (deep connection charging). Subsequently, because of delays in construction by CEB, the project developer was allowed to do the construction with CEB supervision at 10% of the work estimate. Though deep connection with regulated prices is not a bad approach, the delays in construction seem to be an issue. For small facilities, deep connection charging may be a barrier.

The technical requirements for SPPA have dated from 2000 (CEB Guide for Grid Connection of Embedded Generators). This aspect has been traditionally the most controversial issue when deploying RES-E. Power utilities are concerned of potential impacts from intermittent RES-E development, which may jeopardize the performance of the electricity grid related with the lack of wide spread requirements for RES-E such as Fault Ride-Through, capacity factor, etc. However, in 2008 these rules were complemented/amended with certain grid interconnection requirements for wind facilities, which include these aspects but are mostly limited to distribution systems. These rules need to be transposed to higher voltage levels (and potentially adjusted); this issue is related to the nonexistence of a state-of-art grid code described below.

2. INSTITUTIONAL BARRIERS

A lack of clearly allocated institutional responsibility (e.g. many different actors involved in the implementation of policies or realization of projects) makes the process more difficult. If there is no agreement among stakeholders about objectives and procedures, institutional disagreement can impede or slow down a fast promotion of renewable energy. An attempt has been made to address this by making the representatives of the many stakeholders as members of the Board of SLSEA. The main institutional barrier seems to be the dispute about whether PUCSL has the right to approve the FITs or not.

As mentioned before, by its very nature renewable energy sources come under the purview of many institutions, both the government and provincial councils interact. Similarly, the Local Authorities continue to have jurisdiction over the power sector which is also reflected in the SLEA 20. Local Authorities are eligible for generation licenses over 25 MW capacities. Mahaweli Authority by its Act is also empowered to issue directions and the CEB is obliged to follow its directions. The Water Management Secretariat of the Mahaweli Authority therefore controls the conventional hydropower generation.

Renewable energy use can benefit by research. It is even more relevant today with net-metering, where any electricity consumer premises can be converted to a power generation source using any

form of energy resource, be it renewable or non-renewable with the technology available. The National Engineering and Research & Development Centre is involved in appropriate technology designs for Sri Lanka since its establishment in 1974. The universities in Sri Lanka are capable of carrying out the research; the SLSEA, which has a mandate to foster research into RES-E, should do so in collaboration with these institutions.

3. FINANCIAL BARRIERS

The power sector has a very large deficit that is supposed to be funded by the Treasury. The present retail tariffs are not fully cost reflective; this implies that generation is not only paid by the consumers but also by the Treasury.

Full cost reflective tariffs or until this can be achieved, a transparent subsidy provision by the Treasury through the Bulk Supply Account as it was designed in the past, will increase the perception that the off taker (CEB – T/L) is financially sound, potentially decreasing the return required. Unfortunately, despite of been in approved tariff methodology by PUCSL, the bulk supply account is not yet in place and the mechanism for the government to finance the account is missing.

Technology has still not reduced RES-E costs to grid parity. The SLSEA is mandated by law to have a renewable energy fund. The SLSEA can determine the extent of subsidy and therefore, the FIT provided it has the finances to subsidize. However, since this fund is not in operation consumers are paying the full cost of RES-E as PUCSL is allowing full pass-through of RES-E generation cost, leading to an extra burden on the consumer electricity tariffs. Not only is this a financial issue but a legal one, as it is not clear that the full pass-through of RES-E is aligned with spirit of the current legislation, potentially raising legal claims for consumers in the future. This issue should be analyzed by the legal experts of PUCSL.

There has been a lot of controversy about the level of FITs, mostly in the case of WPPs. Unfortunately; the only way to test if the current figures are not generating large infra-marginal rents is to develop a more sophisticated mechanism for price discovery, such as tenders.

4. INFORMATIVE BARRIERS

Inexperienced stakeholders and the unawareness among decision makers of the economic, social, and environmental benefits of renewable energy is still an issue in Sri Lanka. Often governmental stakeholders consider renewable energy an expensive investment without acknowledging the short- and long term benefits of it. There is a lack of social and political knowledge of the benefit of entering into an energy swap (RES-E are more capital expenditure demanding but decreases the risk of fuel variation in the future) in small isolated fuel-dependent country.

Additionally, subsidised electricity prices to some consumers are making the support of renewable energy appear more costly than it actually is. Moreover, the cost of the renewable energy pool (average cost per kWh) has been previous published by PUCSL, which has since been limited to a statement, without clearly identifying the cost in the final Bulk Supply Tariff (BST) summary. Proposals to show the cost break-up (generation, transmission, distribution, levies for renewable energy, surcharges and subsidies, in the consumer bill, are yet to be implemented by PUCSL.

Another barrier is civil opposition against renewable energy, often caused by competing interests in land use. Land use management is a critical issue for the potential coming larger WPPs.

5. REGULATORY BARRIERS

The safety practices existing at present may hinder the connection of net-metering consumers. The classical design of the power system required the user to disconnect and isolate his consumer installation system when using his captive generation. The main reason for this practice is safety. However, in 2010, the SLSEA and PUCSL allowed net-metering. It is necessary to have compatible regulations enacted by the PUCSL.

At present, FIT is only allowed for facilities of less than 10 MW. This has restricted the advantage of economies of scale especially for wind power and has made interconnection of generation at 33kV a fact as developers do not want to pay for a deep connection.

The threshold of 10 MW seems to be related to technical issues as the lack of clear-cut grid code, where technical conditions requirements are set for RES-E have resulted in constraining the

absorption of renewable power to 10 MW per facility by rule. A few RES-E developers have adopted the practice of establishing separate legal entities of 10 MW each at virtual single site to by-pass this requirement. PUCSL should establish the required technical (and operational) regulations in the existing draft Grid Code. This Grid Code should be formally approved as soon as possible.

Probably, the main regulatory gap lies in the uncertainty in relation to the promotion mechanism for facilities larger than 10 MW. From 25 MW and beyond, it is clear that price should be the result of a competitive procurement, but no plan for tenders does exist. From 10 to 25 MW, it is even more puzzling.

The inter licensee agreements between CEB owned Generation Licensee/Transmission Licensee and Transmission Licensee/Distribution Licensees, required to make power sector regulations work are still not in place. It is important to increase the transparency of the power sector for attracting private investment at reasonable prices. The agreements between T/L and generation licensees is of utmost importance as it may be that in the future, both CEB and private developers may be competing to supply RES-E to the CEB T/L.

The current Law requires public sector participation for the development of RES-E facilities with an installed capacity beyond 25 MW. This boundary has required the assessment of alternative mechanisms to develop power generators from renewable energy sources enabling private participation while ensuring participation of the public sector[12]. PPP was selected as the main mechanism to comply with this condition[13]. The following headings deal with the current situation of PPPs in the power sector and the foreseeable future of RES-E under this scheme.

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[12] "No person other than any one of the following shall be eligible to apply for the issue of a generation licence, to generate electricity over and above the generation capacity of 25 MW:

(*a*) the Ceylon Electricity Board, established by the Ceylon Electricity Board Act, No. 17 of 1969;

(*b*) a local authority;

(*c*) a company incorporated under the Companies Act, No. 7 of 2007, in which the government, a public corporation, a company in which the government holds more than fifty *per centum* of the shares or a subsidiary of such a company, holds such number of shares as may be determined by the Secretary to the Treasury, with the concurrence of the Minister in charge of the subject of Finance."

[13] Even if public sector presence in these PPPs does not seem to be formally a constraint, they have to be interpreted in the light of Government policy when the share is set.

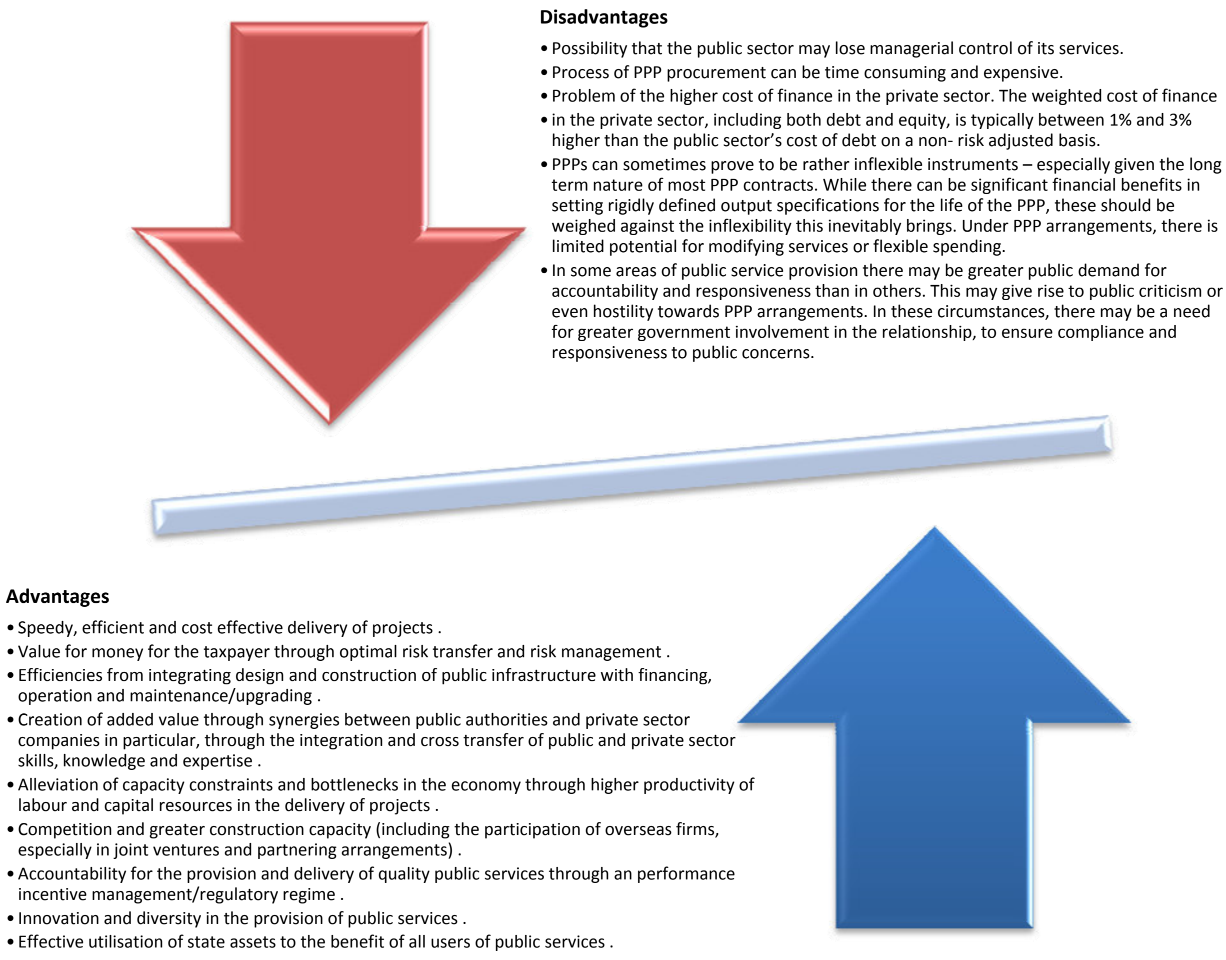
VI AVAILABLE PPP OPTIONS

1. WHAT ARE PUBLIC PRIVATE PARTNERSHIPS (PPP)?

The term has been used since the 1990s to describe a form of private sector participation in infrastructure financing. Although definitions vary, all are based on the common principle that PPP is a procurement process to provide services or deliver assets through public and private sector cooperation. Forms of PPP include inter alia, concessions, build-operate-transfer (BOT) and its variants, and leases. Best practice PPP aims for an optimum balance of private sector risk and rewards. PPP recognizes that private sector has a higher cost and the private sector needs a return on investment, but this is offset by private sector ability to reduce the overall costs of infrastructure services delivery through higher efficiency and better risk management, for example during construction.

The main benefit of PPP is to provide better value-for money to public authorities, which means cheaper/ better services over the long term. PPP can attract private sector financing given that investors can recover their investment from user charges. However, investors borrow to invest so they must repay debt and generate a reasonable profit for their equity participation. In this sense, PPP presents different advantages and disadvantages which are presented below.

Exhibit 3-Pros and Cons of PPPs



PPP's are so widespread now that many studies have been undertaken for different regions, countries and states within countries. The Asian Development Bank has published the "Public Private Partnership Handbook". It has identified the three main needs that motivate governments to enter into PPPs for infrastructures: to attract private capital investment, to increase efficiency and use available resources more effectively, and to reform sectors. PPP allow governments to focus on core public sector responsibilities such as regulation and supervision.

Globally, PPP are a feature of many economic sectors. power generation and distribution, water and sanitation, refuse disposal, pipelines, hospitals, school buildings and teaching facilities, stadiums, air traffic control systems, prisons, railways, roads, billing and other information technology systems, housing etc. They are in use for projects in hard and soft infrastructure such as agribusiness, education, forestry, health, hospitality, information technology, mining, municipal services, power/energy, telecommunication, transport, waste, water etc. Of about two hundred countries in the world PPP have been undertaken over a hundred.

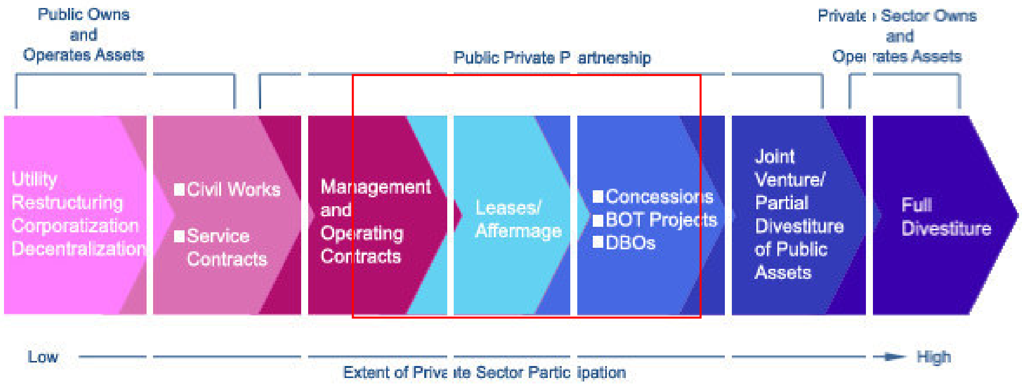
From the point of view of investors, successful PPP projects require a clear, broad, and flexible legal environment. Private partners and long-term investors seek the reassurance of a solid legal framework that provides judicial enforcement of contractual rights, clear laws and regulations that assign responsibilities and specify processes for preparing, bidding, and approving projects. Often, sector laws need updating and sometimes a regional framework can complement national legislation. Sustainable PPPs involve adequate risk allocation as well.

2. CLASSIFICATIONS OF PPP OPTIONS

The conventional PPP was Design Build and Transfer (DBT). The additional available PPP models are many, including divestiture, concession[14], lease[15], affermage[16], Build-Operate-Transfer (BOT), Build-Own-Operate (BOO), Build-Own-Operate-Transfer (BOOT), Design-Build-Finance-Operate (DBFO), Design-Construct-Manage-Finance (DCMF), refurbish-Operate-Transfer (ROT)[17] and like, Build-lease-transfer (BLT) and like, outsourcing, delegation of services, management contract, operation and maintenance contract[18], service contract[19], performance contract, among others.

Exhibit 4 shows the traditional classification of PPPs. Given that the scope of this assignment deals (mostly) with new business with construction obligations and service delivery, public/private financing and revenues from off-taker, we will mostly analyse the right end of the alternatives, as highlighted in the Exhibit.

Exhibit 4-Classification of I PPs[20]



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[14] In which a private entity finances and builds and operates a service usually delivered directly to consumers.

[15] In which existing assets and/or land is leased to a private entity for construction of assets to provide services to offtakers or directly to consumers

[16] In which a private entity builds and/or refurbishes and operates a service usually delivered directly to consumers, and the grantor finances any major capital expenditure. The private entity generally collects tariffs directly from consumers.

[17] This is a family of contracts in which private entity finances and builds/refurbishes a facility that provides services to a single or small group of large offtakers (often a public utility) or directly to consumers (e.g. toll roads)

[18] In which a private entity provides some operation and maintenance services for a fee, usually based on delivering satisfactory services

[19] Service contract has a limited objective and short duration, which may include design, study, supervision, upgrading, billing, meter reading. Payment to the private sector is based on input, output or bidding

[20] Source: World Bank

This section does not intend to present in detail all options but to describe main features of each and make a deeper analysis of those of special interest for this assignment. In Exhibit 5, an overall characterization of the different main models is provided.

Exhibit 5– Assessment of PPP Models

Option	Management	Maintenance	Investment	Ownership	Duration	Rationale for selection
Service Contract	Private	Private	Public	Public	1-3	Service contracts can be a competitive form of operational type PPPs, and require a well-developed service industry, though may not be suitable for initial investments.
Performance/ O&M contract	Private	Private	Private – Public	Public	3-5	Suitable for projects with a significant operating content. Ca be applied to most mechanisms outlined below.
Leasing/affermage	Private	Private	Private – Public	Public	10-20	This scheme will only fit in particular conditions where the concessionaire provides services directly to consumers and is entitled of collect payments directly from them (e.g. distribution companies).
BOT[21]/**ROT and like**	Private	Private	Private/SPV	SPV	20-30	Suited to projects that involve a significant investment/operating content, though it might not overcome shortage of State funding for infrastructure
BTL[22] and like	Private	Private	Private	Public	5-15	Suited to capital projects where the government can retain operating responsibility. Can be suitable for high risk and/or low financial return projects
BOOT	Private	Private	Private	Private	25-35	Suited to projects that involve a significant investment/operating content. Utilization of private sector's investment instead of public sector's, transferring all the risk to private sector
- Revenue Sharing Model 1[23]	Private	Private	Private	SPV		Effective Monitoring and evaluation from public sector is needed. Shares revenue from the project.
Revenue Sharing Model 2[24]	Private	Private	Public	SPV		Synergy of govt. ability for high investment and efficient running of business by private sector
Joint Venture (JV)[25]- Revenue Sharing Model 3[26]	Private/Public	Private/Public	Private/Public	SPV		Projects requiring large capital investments
Full Privatization / BOO and like	Private	Private	Private	Company	Perpetuity	Suitable if government wants to import private sector efficiencies. However, its implementation may be controversial. Suitable for small scale projects – new technologies

[21] After the completion of the period it transfers the operation to the government. It must be understood in the BOT format at all times title to the assets of the concession will remain vested in the public authority.

[22] This scheme is not widely developed. The Uruguayan government, through its public utility UTE, has decided to award the construction of 450 MW of wind power capacity. Even though this project has not been successfully launched so far, its structure presents an alternative viewpoint for PPPs.

[23] This model basically relies on the Private Partner's ability to fund the project and run it independently of the public sector's intervention

[24] Capital Investment by Government and business run by private partner

[25] Generally, this mechanism is used to implement BOT projects

[26] Risk and Return divided equally between PPP partners. Therefore, returns are shared as per the original capital investment ratio as well as the risk perception of the partners.

3. PPP & SRI LANKA

Sri Lanka has economic activity based on Public Sector Participation, PPP and Private business. PPP are common in the power generation sector including renewable power generation. They have been used for conventional large power stations; for example, the Lakvijaya coal power station (DBT), West Coast CCP (BOO) and Colombo Barge Power (BOO); additionally, all the power stations operating with SPPA with CEB are private (BOO), while Upper Kotmale power station is a case of (DBT). Sri Lanka has seen funds sourced from local private sources, foreign private sources, public institutions, foreign public institutions, bi-lateral government sources and multi-lateral government sources for projects. Part of these funds has been deployed under PPP contracts (e.g. RERED Project) or into special purpose entities (e.g. Trincomalee Coal Power Plant- Sampur – JV under a BOOT agreement)

Sri Lanka stopped privatizing state enterprises transferring full business risks to private owners under a new policy from 2005 (Mahinda Chintana) and instead, started PPPs where the state retains ownership.

The next exhibit provides a summary of some existing PPPs already developed in the country in the power sector.

Exhibit 6 Existing PPP In Sri Lanka power sector[27]

Project	Charact.	Construction	Operation	Funding	Ownership	Type
Maskeliya Oya	Hydropower	Private	CEB	Multi lateral/ Public	CEB	DBT
Victoria	Hydropower 3x70 MW	Private	CEB	Bilateral/ Public	Public (MASL)[28]	DBT
Broadlands Hydropower Plant	35 MW	Private	CEB	Bilateral/ Public	CEB	DBT
UPPER KOTMALE	Hydro 150 MW	Private	CEB	Bilateral/ Public	CEB	DBT
West Coast CCP	Combined Cycle Power Plant 300 MW	Private	State-owned SPV	Public	State-owned SPV	BOOT (transfer to CEB)
Colombo Power	Barge Mounted Diesel Power Plant 60 MW	Private	Private	Private	Private	BOO
Sapugaskande	Medium Speed Diesel Power Plant 4x 20MW 8x10 MW	private	Private	CEB	CEB	ROT
Mini Hydro With SPPA	Less than 10 MW	Private	Private	multilateral/local banks/ Private	Private	BOO
Wind With SPPA	Less than 10 MW	Private	Private	multilateral/local banks/ Private	Private	BOO

[27] A LOI was issued by CEB for Kankesanturai project (29wind+6 Solar). Now LOI process replaced by SLSEA permit and SLEA20 procurement. This project is on hold for the time being. If Solar FIT is increased maybe resurrected.

[28] Mahaweli Authority, Sri Lanka is a Government Agency

RERED	Micro sized off-grid systems	Private	Public	Multi lateral/ Public	Private/public	BOO
Lakvijaya	Coal Power Plant 300 MW	Private	CEB	Exim. Bank / Public	CEB	DBT
Solar With SPPA	Less than 10 MW	Private	SLSEA	Bilateral/ Public	SLSEA	DBT
Trincomalee	Coal Power Plant 2x250MW	Private	SPV (CEB/private)	Public/ Private	SPV (CEB/private)	JV under BOOT (transfer to CEB)

The next exhibit shows the increase of private sector participation in Sri Lanka's total generation. Meanwhile, the country's power-generation industry had been mainly reliant on hydro sources in the past. However, this dependency had rendered the sector vulnerable to rainfall fluctuations. In the interest of speedy capacity augmentation and as Sri Lanka's large reserves of hydro power have already been utilised, the CEB had diversified to thermal power.

Year	% Hydro Public	% Non-Conventional Renewable Private	% Thermal Oil Public	% Thermal Oil Private	%Thermal Coal Public	Total %	Total GWh
1970	94		6			100	786
1980	89		11			100	1668
1990	100		< 1			100	3150
1995	94		6			100	4783
2000	47	< 1	33	20		100	6686
2005	36	3	25	36		100	8769
2010	47	6	13	34		100	10714
2011	35	6	13	37	9	100	11528
2012	23	6	17	42	12	100	11801

The introduction of PPP for thermal power plants has been successful in improving the reliability of Sri Lanka's power system. However, the cost incurred has resulted in substantial controversy in the 2013 consumer tariff setting process.

4. REQUIREMENTS FOR PPP SUCCESS

Success conditions in PPP developments have been extensively analysed by academics and multilateral institutions. In this heading, only a list of the most important conditions is provided:

- Successful PPP require a peaceful, secure and stable political environment.
- An effective, independent and unbiased regulatory framework.
- Successful PPP projects require a clear, broad, and flexible legal environment. Private partners and long-term investors seek the reassurance of a solid legal framework that provides judicial enforcement of contractual rights, clear laws and regulations that assign responsibilities and specify processes for preparing, bidding, and approving projects.
- A public sector organization that champions the process is a must.
- Clearly defined revenue stream including a reasonable profit is one of the most important factors. Private investor – equity providers and lenders will always perceive this stream as risky; however, such risk is reduced if the government can demonstrate to the private sector that such policy decisions are made after careful assessment of their impacts on all players. A sound and credible revenue framework is a condition for success.

- Institutional capacity is critical for a successful PPP. Governmental institutions dealing with PPP should be trained and prepared to deal with the complexities of PPP arrangements.
- An adequate risk allocation between private and public sides is potentially.
- A PPP scheme should optimize risk between the public and private sector by allocating them to the party best able to manage them. Investor risks as a tactic to attract more private capital at lower cost. Some risks raise concerns among potential private sector investors; risk appreciation varies among PPP partners. In general, key PPP project risk categories are political, breach of contract by government entity, market risk, and default risk.
- Clarity and common understanding regarding the contractual obligations, division of risks and revenue streams for recovery of investment/expenditure.
- Focus on project fundamentals –good quality feasibility and request for proposals preparation is critical. Poor project preparation will unlikely get good market response.
- Timeliness and transparency in bidding and award process –track record and market confidence building is important.
- Smooth coordination among various govt ministries/ departments (for linkages, social, environment, other clearances etc.).
- Post contract monitoring of PPPs to ensure expected outcomes.
- Robust dispute resolution mechanism.
- Clear Public sector concessioning authority empowered and equipped to handle all the key aspects of the project.

5. COMPARISON OF AVAILABLE PPP OPTIONS WIND AND SOLAR PV

Most types of PPPs are practiced in Sri Lanka. For the time being, small scale RES-E projects, up to 10 MW, have been implemented under BOO (fully private basis), larger projects were developed using DBT, BOO, ROT and more recently JV. Internationally, the most common PPP are concessions, BOT, BOOT and BOO. Recently, JV with a revenue sharing models became more spread; they present certain advantages which make us envisage this alternative as an interesting field to be further analysed**.** The main pros and cons of JV (under revenue sharing models outlined in Exhibit 5) and DBT schemes are shown below.

Exhibit 7- PPPs with "Revenue Sharing Agreements"

Scheme	Pros	Cons
Revenue Sharing Model 1[29]	Private Partner has ability to fund the project and run it independently of the public sector's intervention. Government is relieved from financial risk of the venture. Utilizes the Efficiency of the private sector.	Effective Monitoring and evaluation from public sector is needed.
Revenue Sharing Model 2[30]	Utilizes the Efficiency of the private sector. Potentially cheaper cost of capital.	Capital Investment by Government. Hence the financial risk is borne by the government. Requires a strong service agreement to ensure an efficient performance of the business.
JV - Revenue Sharing Model 3[31]	Returns are shared as per the	Potential intervention of the

[29] This model basically relies on the Private Partner's ability to fund the project and run it independently of the public sector's intervention

[30] Capital Investment by Government and business run by private partner

	original capital investment ratio, as well as the risk perception of the partners.	government in the operation of the plant.
JV scheme controlled by public ownership	Government holds control and decisions over the running of the plant. Easy to manage bureaucratic issues as company boards are appointed by the Minister; (informally) political commitment is better.	Does not fully utilize the efficiency of the private sector. Potential issues securing financial support (i.e. step in rights).
DBT[32]	Use private efficiency in design and construction Potentially cheaper cost of capital?	Financial burden on public funds Does not take advantage of private operation

[31] Risk and Return divided equally between PPP partners. Therefore, returns are shared as per the original capital investment ratio as well as the risk perception of the partners.

[32] An example of this scheme is Mexico. The system so called "Pidiregas" entails the participation of the private sector in the development (construction) of certain facility in the power sector which once commissioned will be transferred to CFE (publicly owned electricity company) who will operate the facilities. CFE will secure funds from national banks and will pay private developers. CFE will re pay this loan, though not guarantees will be required as cash flows from the project will be the only guarantee.

VII INTERNATIONAL EXPERIENCE

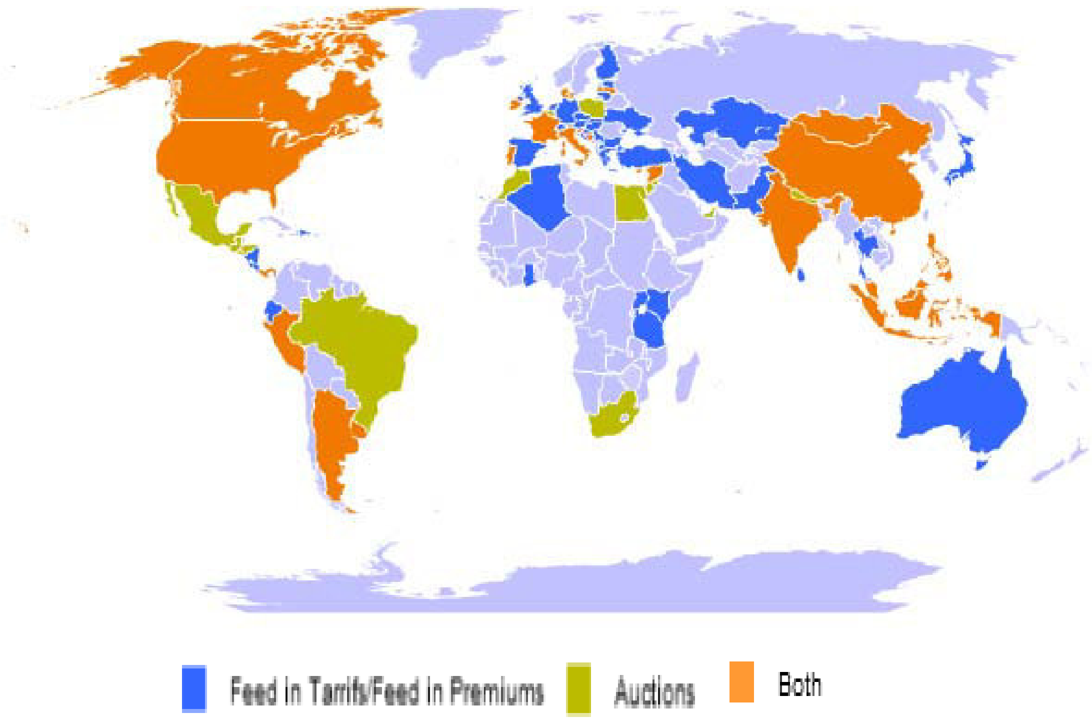
1. EXPERIENCE IN PPP ALTERNATIVES FOR RES-E

Traditionally in developed countries renewable energy projects are mainly developed fully private, while other schemes such as BOT, BOO, BOOT, etc. are commonly used for transport infrastructures, public services (health care, waste management), etc.

Although some developed countries have triggered the development of the renewable energy industry through PPPs (with significant subsidies to RES-E development), this scheme has been changed into the existing FIT scheme, where project developers are entitled to perceive a regulated tariff for the energy fed into the national grid over a period of time. Under this scheme, most of the installations were developed under a BOO agreements or directly by the power utilities that are mostly private. In summary, most of them are developed privately and the state is solely entitled to guarantee stream payments during the agreements. The next exhibits show the existing frameworks to tap renewable energy sources worldwide. Main mechanisms to promote these projects have been:

- FIT: Electricity produced using RES-E is sold to the network operator (or another identified buyer) at an administratively-set price (typically higher than the wholesale electricity price).
- Tendering procedures/Auctions: The state or the regulatory authority places a series of tenders for the supply of renewable electricity, which is then supplied on a contract basis at the price resulting from the tender.
- Green certificates: An obligation to produce or consume a specified minimum proportion of electricity generated using renewable sources is imposed on generators or consumers (more often on load-serving entities on behalf of consumers). The obligation may be fulfilled directly or by acquiring green certificates from other agents who produced electricity using renewable energy sources.

Exhibit 8 – RES-E support schemes at-a-glance

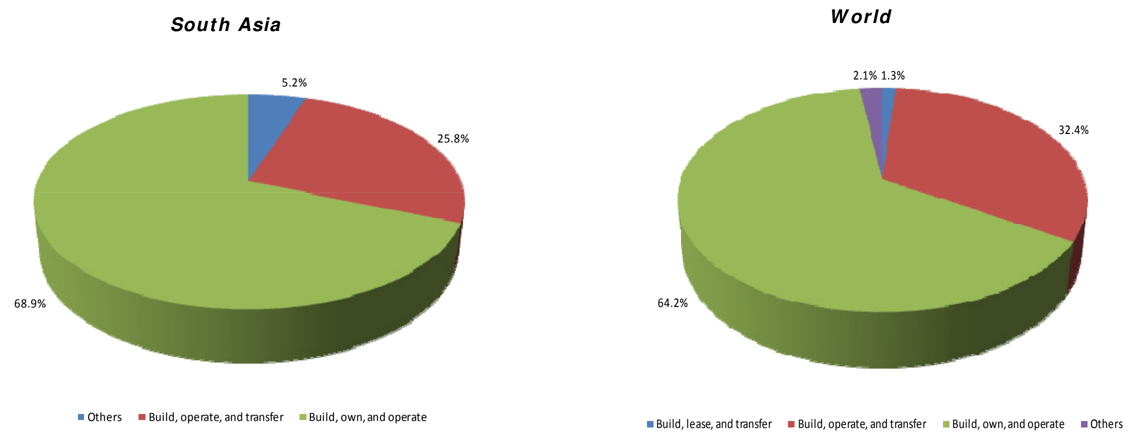


Source: IRENA "Support schemes", 2012

Besides these approaches, other schemes framed within PPPs have been used in certain circumstances. BOO and BOT have been implemented in developing countries and are usually supported by power purchase agreements (PPA) with existing utilities to ensure the payment stream between the purchaser (which used to be a state-owned electricity utility in developed countries and is still publicly owned in most developing countries) and a privately owned power producer.

The World Bank set up a database which gathers information on Data Participation of Private Sector in Infrastructure. Regarding RES-E projects (including large hydel), this database provides renewable-specific information on over 1000 projects that were implemented between 1993 and 2011 in 139 low- and middle-income countries. The next exhibit shows the breakdown of PPPs structures found till 2011.

Exhibit 9 - PPPs structures found worldwide (2011)



As shown above, the market is mainly based on BOT[33] and BOO, with few projects developed under BLT. The next table outlines some specific cases, some of which will be outlined due to their particular ownership, operation or funding structure. In south Asia, the predominant form is BOO.

Based on these experiences, few cases have been selected to provide a more detailed vision on how these operations were structured and potential lessons which may be applied or replicated in Sri Lanka. The cases analysed are[34]:

- India (125 MW PV power plant in Maharashtra): The project is structured under performance linked revenue sharing models which is considered of interest in case CEB or another state-owned entity develops this type of projects.
- India (Solar PV in public building rooftops): This alternative may be exploited in Sri Lanka whose features are relatively equivalent to India.
- Cape Verde (25 MW WPP under JV): It is one of the most interesting cases of JV in which public (treasury and utility), private and multilateral funds are participating.
- Morocco (Solar PV rural electrification): Opposite to previous experiences, in this case, a private contractor directly provides service to the end users and is entitled to collect fees for the provision of this service. The ownership of the installed devices is directly transferred to the national utility once it is installed.

125 MW Solar PV power plant in Maharashtra (India)

India is the only country which has launched simultaneously FIT and Renewable Portfolio Standard (RPS) schemes for promotion of all RES-E technologies. In fact, all new RES-E projects commissioned after March 2010 have the option of either getting the FIT (preferential tariff as named in India) or adopting the Renewable Energy Certificate (REC) mechanism (the market has recently started

[33] Build, operate, and transfer (BOT): A private sponsor builds a new facility at its own risk, operates the facility at its own risk, and then transfers the facility to the government at the end of the contract period. The private sponsor may or may not have the ownership of the assets during the contract period. The government usually provides revenue guarantees through long-term take-or-pay contracts.

Build, own, and operate (BOO): A private sponsor builds a new facility at its own risk, then owns and operates the facility at its own risk. The government usually provides revenue guarantees through long-term take-or-pay contracts.

WB database includes BOOT projects into BOT category.

[34] The selected cases are biased to solar PV as there is a consultant currently working in designing potential business models for WPPs.

operations). Since both policies operate at the same time, the regulation includes the following provisions seeking to track the scheme adopted by each RES-E project:

- RES-E projects that opt either for the FIT scheme or REC mechanism must continue under the selected approach until the end of the PPA or the entire tariff period, whichever is later.
- Existing projects for which long-term PPAs are already in place will be allowed to participate in REC scheme after the expiration of their existing PPA.

In assessing the Renewable Portfolio Standard (RPS) scheme in India, it is necessary to take into consideration that there are several states which may apply different provisions in its Renewable Energy policy. Maharashtra has been chosen as a reference because this state RES-E policy seems to be the most comprehensive and advanced in the country.

The concept of a RPS scheme was introduced in the Energy Act 2003, although the launching of a REC market dates from March 2011.

The provisions set forth in the RPS policy are outlined in the following headings; however, the main features can be summarized as follows:

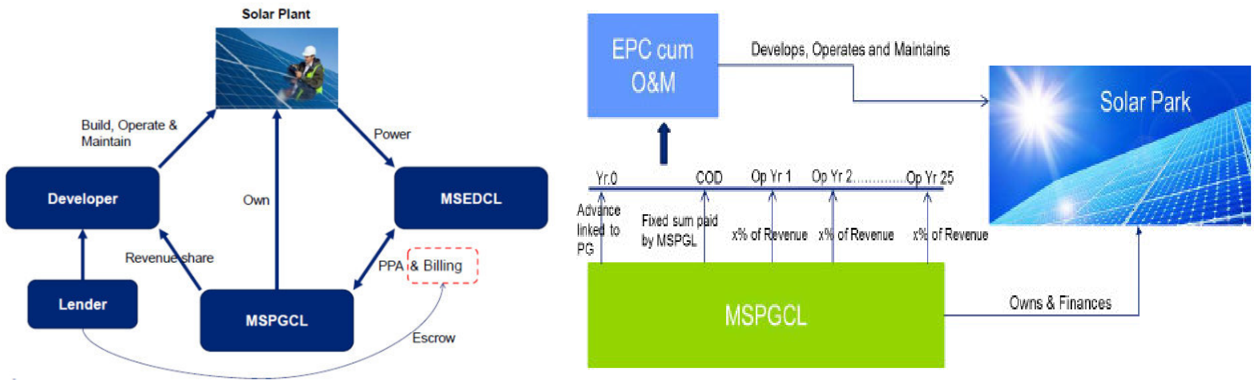
- The purchase obligations are set to all the distribution licensees. These obligations follow a marginal approach and are equally distributed among obliged entities.
- The purchase obligations are split into solar and non solar obligations.
- Different features aimed at monitoring the prices of the certificates –floor, cap and penalty- are included in the policy.
- The issuance of the certificates is based on the information surrendered by the developers to a central agency. This information shall be validated by the state load dispatch centers[35] which monitor the energy actually fed into the grid. The information about the certificates is tracked in a national registry.
- The trading of certificates started in March 2011.
- The Central Electricity Regulatory Commission extended the floor price for tradable renewable energy credits until March 2017, to help stabilize the REC market aimed at boosting the use of clean technologies.

Recently, Maharashtra proposed an innovative scheme to erect a solar PV based on PPP with the following features:

- Maha Genco will cater renewable energy to comply with existing renewable purchase obligations.
- Installations get feed-in tariff over the duration of PPA (25 year).
- Funded partly through public Equity, borrowings from ADB and CTF[36], and from the private sector.
- Operator shall stay for 25 years, and share risk through incentive + penalty structures.

The business model for this project is depicted below.

Exhibit 10 – Business model



Source: Maharahstra State Power Generation Co.

[35] Is the organism in charge of operating the system in the most economical way by load dispatching and merit order operation of the generation units.

[36] Maha Genco and Maha Transco are responsible for the interest rate and foreign exchange risks on USD loans.

As shown in the figure, cash flows and responsibilities can be described as follows:

- The project is based on the concept of sharing of risk and return of the project over the project life, named Performance-linked Revenue Sharing Model.
- The project developer receives a portion of his EPC cost on achieving successful commercial operation. The bidder will receive the rest of his payment as a share of revenue over the life of the project.
- Revenue share will constitute O&M expenses and deferred EPC cost payment.
- Incentive/ disincentive mechanism: bidder to guarantee a minimum power plant factor (PLF). The bidder will have to pay penalties for falling below this PLF and receive incentives for achieving higher PLF.

The operating model envisaged for the project has the following characteristics:

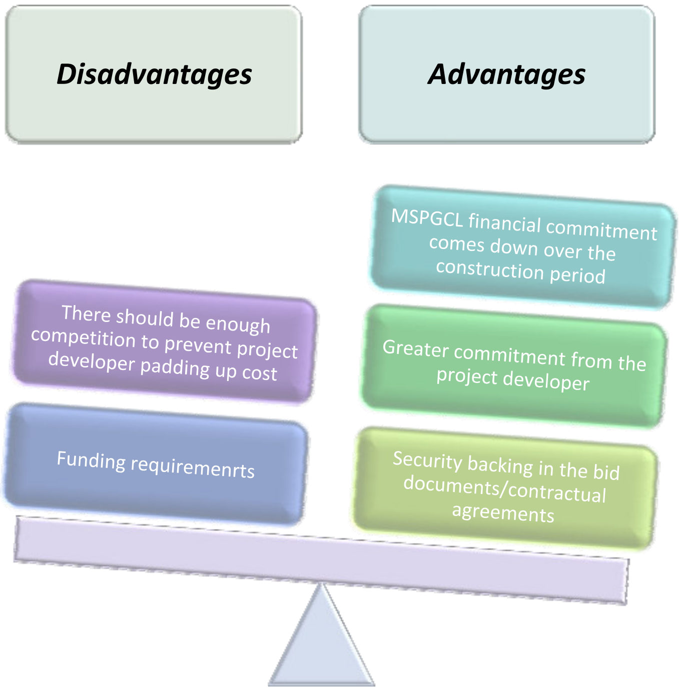
MSPGCL	Developer
• MSPGCL will acquire land and obtain necessary clearance for this project • Coordinate for evacuation of power from the project site to the state grid. ✓ PPA with MSEDCL/MSETCL ✓ Commercial dealing with MSEDCL/MSETCL • Part payment to developer towards capital cost during construction • Remaining payment to be paid to developer in equal instalments over the PPA period if plant meets Normative Performance Parameters • Share revenue with developer based on performance	• Build the solar plant (incl. design, engineering, supply, erection, testing and commissioning) and transfer it to MSPGCL • Part fund the capital expenditure • Provide invoice of the EPC contract value to MSPGCL • Operate & maintain the plant for term of PPA (25 years)

Under this structure, the project developer receives a portion of his EPC cost on achieving successful commercial operation. The project developer will be assigned through a competitive bidding process where bidders have to quote for the revenue share percentage. The developer quoting the least share will be awarded the contract and will receive the rest of his payment as a share of revenue over the life of the project.

Under this scheme, it worth highlighting three key features:

- Payment structure:
  - The successful bidder(s) will receive a fixed amount in Rs. Million/MW progressively during construction
  - The successful bidder(s) will receive the rest of the payment as a share of revenue based on the tariff approved by MERC (Maharahastra Energy Regulatory Commission) over the term of the PPA.
- Performance requirements
  - Project delays are naturally penalised as MSPGCL will suffer substantial loss and will not be eligible for the MERC approved feed-in tariff for a particular year. The project developer will also receive a revenue share from this project over its operating life. This will naturally incentivize and penalize the developer based on actual power generation.
  - Penalty for not achieving minimum generation.
    - Penalty to the extent of 100% of the revenue loss for MSPGCL if PLF<18%
    - Incremental revenue over the benchmark will be shared in a higher ratio to the developer
- Security for private investors: Several alternatives are planned to mitigate risks from this revenue sharing model. The most likely approaches are shown below:
  - Provide for default step-in rights for the project developer or its lender in case of default by MSPGCL
  - MSPGCL provides Letter of credit to developers
  - Escrow project revenue (Default Escrow Agreement) to the developer for his share of the revenue

Exhibit 11 – Pros and cons of this scheme



SOLAR PV IN PUBLIC BUILDING ROOFTOPS (INDIA)

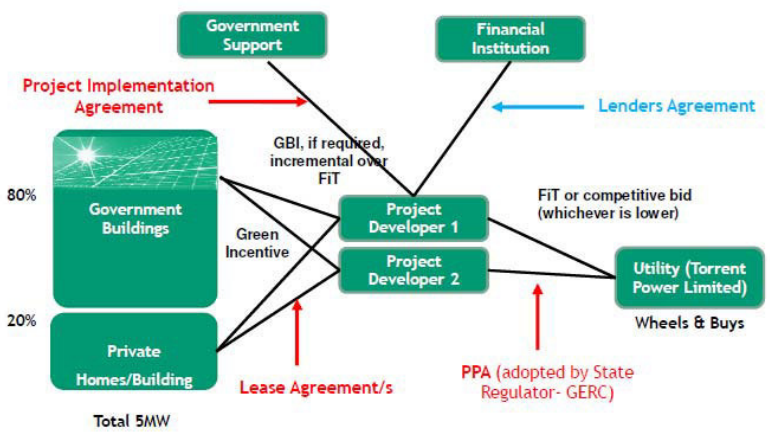
The existing framework that fosters renewable energy deployment was summarized above. Nonetheless, one market segment which may be attractive for Sri Lanka is the development of rooftop facilities; an important number of state rooftop solar policies may be found in India.

Gujarat sets a target of 500MW solar capacity in the state by March 2014. This would be partially achieved through the development of solar PV panels in rooftops, in which the state envisages pilot 5 MW grid-connected distributed rooftop solar projects in Gandhinagar on a PPP model. This program is expected to be extended to 5 more cities.

- Mehsana, Vadodara, Surat, Rajkot, Bhavnagar with total capacity 25MW
- This project is designed to further demonstrate and scale up projects based on gross metering model and,
- Encourage a shift to significant use of private rooftops (relative to the Gandhinagar pilot, where 80% of buildings were government/public owned).

The business model for this project is depicted below.

Exhibit 12 – Business model

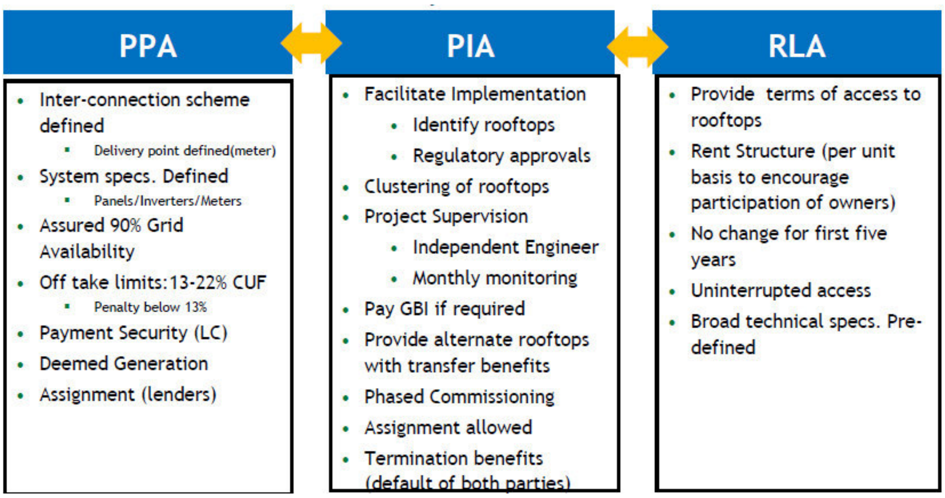


Source: IFC

In this sense, the government provides access to roofs of buildings it owns, facilitates agreements with power procurer for electricity generated and guarantees a subsidy if required; on the other hand,

the developer is responsible for identifying private buildings that will participate in the project, producing solar power and delivering it to the grid. The contracts to be signed include.

Exhibit 13 – Contracts to be signed[37]



Source: IFC

For the time being, Sun Edison Energy India Pvt. Ltd. and Azure Sun Energy Pvt. Ltd. won the 25-year concession for a 2.5 MW solar rooftop project each. Some of the key findings extracted from this project are listed below.

- Attractive feed-in-tariff is a must until grid parity is achieved to attract third party ownership.
- This scheme will enable Renewable Purchase Obligations for renewables/solar (roof-top solar as a separate category) to progressively increase, contributing to the sustainable development of India.
- Incentives for individual rooftop owners to encourage participation.
- Robust payment security mechanism for investors (letter of credit, escrow, reliable credit ratings etc) conditioned private appetite to invest.
- Access to finance is required. Indeed, IFC role was crucial to this project.
  - Financial analysis & project structuring: financial analysis; transaction structure.
  - Technical aspects of project: Inter-connection scheme, consultation with incumbent utility, technical specifications of system, etc.
  - Site analysis and rooftop assessment.
  - Stakeholder consultations: Government, bidders, regulator, rooftop owners, utility.
  - Managing the bid process: Preparation of bid documents, bid evaluation.

25 MW JV WPP IN CAPE VERDE

Cape Verde is one of the 15 countries with best wind resources in Africa. The plentiful wind resource is confirmed by studies by the World Bank - an average wind velocity of 7.5 m/s. Recent developments have been made to the sector through collaboration between the Africa Finance Corporation, the Finnish Fund for Industrial Cooperation and Infraco, a consortium for African infrastructure development, in the Cabeólica project, operated by Cabeólica S.A. This project has triggered the implementation of PPPs in Africa.

So far, the government has developed a Renewable Energy Plan (2010-2020) in 2010, with a target of producing 50% of the country’s energy requirements from renewables by 2020. The government aims to achieve this solely through the promotion of the private sector, without the use of any form of feed-in tariff mechanism, Law n1/2011 setting out a framework for Independent Power Producers (IPPs) in the country. The Law established a regime for micro-generation, and guaranteed a Power Purchase Agreement (PPA) for 15 years for all IPPs utilising renewable energy, as well as setting out conditions for self-producers, and codifying the tax exemption on the import of RES-E equipment.

However, the Cabeolica project relies on a tailor-made long-term PPA supported by certain government guarantee arrangements and tax and duty exemption agreements that secure the normal activity of the company through at least 20 years. This PPP has the following features.

[37] PIA-Project implementation agreements stands / RLA-Roof Leasing agreement stands

Exhibit 14 – PPP structure in Cape Verde

	Description
Project description	Cabeolica Wind Power project was to construct, operate and maintain four wind farms, with a combined capacity of 25.5 MW, on four islands (Santiago, São Vicente, Sal, and Boa Vista) of Cape Verde.
Developers	Cabeolica was jointly developed by the Government of Cape Verde, Electra (the state-owned power utility company) and an infrastructure development company, InfraCo. InfraCo, which is privately managed but publicly funded by Multilateral Institutions, was heavily involved in upstream activities to design and structure the project. The early stage development risks of the project were borne by the developers which paved the way for other investors to participate in the project.
Project structure	The project was based on a PPP structure[38] involving the Government of Cape Verde, Electra, a private equity fund (FinFund), the Africa Finance Corporation (AFC) and InfraCo. The project was developed using a Build Own Operate (BOO) procurement model implying that the operators would bear the risk of building, operating and maintaining the project. Infraco holds more than 50% of the shares.
Financing	The total cost of the project was EUR 64 million of which the sponsors (The Africa Finance Corporation, InfraCo, FinFund, Electra and the Government of Cape Verde) mobilized equity financing worth Euro 19 million. Apart from indirectly providing equity funding to the project through InfraCo, DFIs further contributed all the debt financing. The AfDB and EIB provided Euro 15 and 30 million respectively in senior loans with a tenor period of 15 years and a grace period of 2 years.
Risk management	To enhance the bankability of the project, several risk mitigation measures were adopted, as described below: • The private sponsors of the project were insured against political risk through the World Bank's Multilateral Investment Guarantee Agency (MIGA) facility. • A 20-year 'take or pay' Power Purchase Agreement was signed between the project company (Cabeolica SA) and the national power utility company (Electra) to purchase all the electricity produced by the project. • A Support Agreement was signed by the Government and Cabeólica SA to guarantee that any payment deficiency on the part of Electra would be covered by the Government. • A turnkey Engineering Procurement and Construction (EPC) contract and a service agreement, in the form of an Operation and Maintenance (O&M) contract, were signed with a leading company in wind energy technology to reduce the sponsor's exposure to risks during construction and operation of the project. • Due to the volatility of the local currency, the price for electricity purchased from the project in accordance with the PPA was

[38] Cabeolica Shareholders:
- GoCV 18%
- Elektra 11%
- InfraCo 71%

Sub-Loans:
- Finnfund:EUR 8m
- AFC:EUR 8.1m
- InfraCo:EUR 2.1m (sub-loan)

Senior Loans
- EIB:EUR 30m

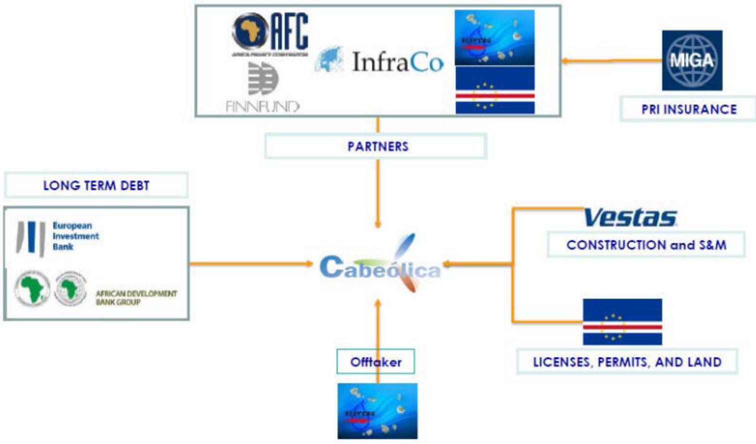
AfDB:EUR 15m

expressed in Euros.

Source: AfDB 2010

The business model for this project is depicted below.

Exhibit 15 – Business model



Source: Africa Finance Corporation

Under this scheme, it is worth highlighting some of the key roles Africa Finance Corporation plays:

- Project development advisory and co-ordination to ensure all elements of the project are bankable, completed on time, and appropriately funded.
- Attracting the right investors who would provide a base for debt/equity raising and ultimate project success.
- Provide financial advisory services.

It is interesting to note that the key private shareholders of the project company (Cabeólica S.A.) – Africa Finance Corporation, Finnfund and Infraco – are institutions with a development mandate.

SOLAR PV BASED RURAL ELECTRIFICATION IN MOROCCO

In order to provide an overall review of the existing practices in the implementation of PPP to foster the development of RES-E in different sectors that may be replicable in Sri Lanka, the applicability of PPP for the development of RES-E projects to contribute towards the electrification of isolated areas has been widely analysed and implemented in different countries.

In this sense, Morocco is one of the references. Summarizing, the electricity sector in this country is managed through a vertically integrated company named ONE (National Power Office) which is responsible for generating, transmitting and distributing electricity to the costumers.

The next exhibit shows the main milestones that have paved the way to launch an electrification program based on RES-E sources through the implementation of PPP schemes.

Exhibit 16 – PPP Morocco

In 1994
- •Moroccan Government issued policy for rural electrification

In 1995Rural Electrification Pilot Program (PPER) launched by the Moroccan government supported by the French government
- •Installation of 2,000 photovoltaic (PV) systems

In 1996, the ONE launched the Global Rural Electrification Program (PERG)
- •To increase rural electrification from 18% in 1995 to 98% in 2007.
- •ONE decided to form PPPs with private operators

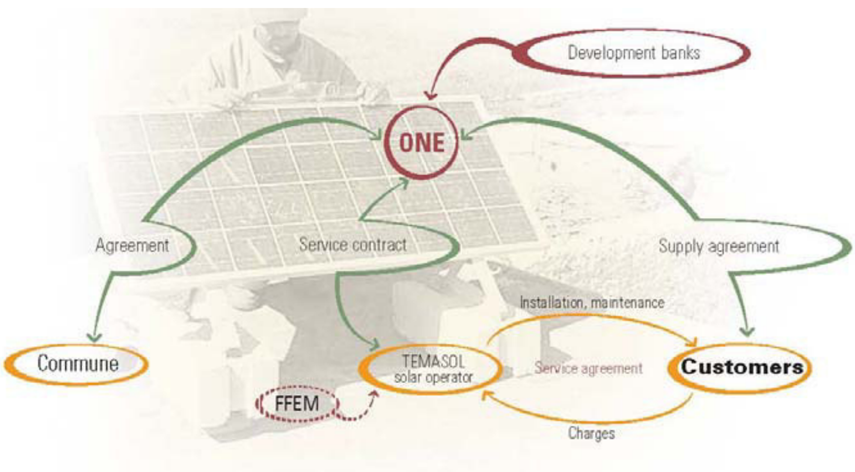
In 2002, ONE signed the first PPP contract with a private operator (Temasol) for installation of 16,000 solar home systems in 4 provinces

In 2004, ONE issued another tender and the same private operator won the new contract for 37,000 more solar home systems in 20 provinces.

Source: Asian Development Bank

The business model for this project is depicted below.

Exhibit 17 – Business model



As shown in the figure, cash flows and responsibilities are as follows:

- Contract between ONE and the operator is on sale of service (rather than sale of equipment) model (to ensure maintenance).

- The operator purchases and installs the equipment.
- Once installed and working, the equipment's ownership transfers to ONE.
- Despite the user is considered to be a consumer of ONE, the operator is responsible for maintenance and collection of user's fees.

The operating model envisaged for the project has the following characteristics:

Exhibit 18 – Main features

The National Electricity Office (ONE)	Private Developer/ Operator: Temasol
• The National Electricity Office (ONE) managed the overall coherence of the rural electrification project. ✓ Ensuring the private operator maintains its commitments to the project, ✓ Measuring the satisfaction of the operator's consumers, and ✓ Providing subsidy funding, enabling the private operator to provide the service at affordable rates[39].	• Temasol, a renewable energy service company (owned by a French oil company, a French electricity company and a French photovoltaic systems company), implemented the solar program: ✓ Supplying and installing the solar home systems ✓ Maintaining the installed systems ✓ Replacing equipment when needed, and ✓ Collecting users' connection & monthly fees. ✓ The equipment is dismantled if the consumer failed to pay the monthly fee for 3 consecutive months.

[39] The subsidy was made possible through grants and loans from bilateral aid agencies

2. COMPARISON OF GENERAL PROMOTION INSTRUMENTS

Even if Sri Lanka's RES-E policy is focused in the development of a traditional FIT and relevant authorities pave the way towards the implementation of this mechanism, in this section, the consultant outlines alternative mechanisms which may complement a traditional FIT scheme.

Worldwide, policy instruments most frequently used to promote RES-E deployment include the following:

- Price based instruments:
  - FIT: Electricity produced using renewable energy sources is sold to the network operator (or another identified buyer) at an administratively-set price (typically higher than the wholesale electricity price).
  - Premium: Electricity produced using renewable energy is entitled to receive an additional price component, which is typically set administratively, in addition to the electricity price that it can obtain in the market. The premium system has historically been considered as a kind of feed-in tariff.
  - Subsidies, fiscal incentives, etc.
- Quantity based instruments:
  - Tendering procedures: The state or the regulatory authority places a series of tenders for the supply of renewable electricity, which is then supplied on a contract basis at the price resulting from the tender.
  - Green certificates: An obligation to produce or consume a specified minimum proportion of electricity generated using renewable sources is imposed on generators or consumers (more often on load-serving entities on behalf of consumers). The obligation may be fulfilled directly or by acquiring green certificates from other agents that produced electricity using renewable energy sources.

Historically, feed-in tariffs have been the main instrument used for promoting renewable energy. As they are administratively set and usually constant over a predefined period of time, they provide a high degree of certainty for developers on their expected stream of revenues. In some cases, feed-in tariffs have been set at such levels that investors were able to recover the investment costs over a period of only a few years, raising the concern of authorities and civil society. In many cases, the conclusion was that FITs should be set by a tendering procedure so the market (competition for the market) reveals the actual cost of providing certain type of RES-E. At a glance, it seems to be a small change but in a deeper analysis, it means to change the type of promotion mechanism. In many countries FITs are complemented with other incentives provided by the Government (e.g. India- tax and investment incentives).

As a summary, the following table provides the main pros and cons of the different mechanisms discussed above.

Exhibit 19- Pros and Cons of Incentive Mechanisms for RES-E Development

Policy Instrument	Advantages	Disadvantages
Feed-in tariffs	• International experience shows it has been effective to attract an high volume of investments in developed economies • Low risk for investors • Permit strategic support for technology innovation • Simple procedure that facilitates decentralization	• Lack of control on quantities • Less compatibility with internal markets • Need regular adjustment to fine-tune FIT level • May overcompensate investors and thus imply higher costs for consumers • Calculation of feed-in tariffs need reasonable knowledge of expected return of investors
Price premiums	• Effective • Efficient due to the medium	• Lack of control on quantities • Risk of over-compensation in the case of high electricity

	risk for investors • Good compatibility with internal markets • Permits strategic support for technology innovation	prices without appropriate adjustment • Calculation of appropriate premiums need reasonable knowledge of expected return of investors
Investment subsidy	• Good complement for some technologies	• Inefficient as a main instrument
Fiscal measures	• Good secondary instrument	• Good results only in countries with high taxation and for the most competitive technologies
Green certificates	• Full control on quantities • Good compatibility with internal markets • Competition between generators • Supports the lowest-cost technologies unless banding is implemented	• Less efficient due to higher risks and administrative costs; better designs can overcome this issue • Not very appropriate for developing medium- to long-term technologies
Tendering procedures	• Full control on quantities • Fast development, provided political will • No risk of failure for inappropriate setting of fixed incentives • Fair revenue for investor with no extra benefits	• Requires of some level of planning to establish quantities to bid • Higher transaction costs • Emerging price from tender may be too high if competition is not enough • Tender may received no bids if not properly design or caps lower than investors expectations

FEED-IN TARIFF

FIT has been the selected scheme in most European countries which have successfully achieved significant RES-E penetration on their energy mix. Sri Lanka has followed this approach as well. The next heading provides an overall review of the main aspects that should be defined to set this regulatory framework.

a) Initial support level

It has been shown in the past that the level and the guaranteed duration of support, as well as investment security, have been crucial to attract investors and increase the exploitation of RES-E. Therefore, one of the most important aspects of a feed-in tariff design is the determination of the tariff level; it should be noted that, in one way or another, the cost of the incentive is finally included in the electricity price and therefore is transferred to the electricity consumers - high FITs lead to benefits for the investors, but also to a higher burden on society. It is a challenge for the energy policy to determine an appropriate level of FITs, which will lead to new installations of RES-E technologies while, at the same time, keeping the burden on the electricity consumers at a moderate level.

The initial support level can be estimated based on bottom-up or top-down approaches. Below is a description of both approaches, with its advantages and disadvantages.

- Bottom-up approaches; this is the usual approach and it includes many different alternatives:
    - Private avoided cost: the private avoided cost can be estimated by either the prices in the electricity market (if possible), or through an estimation of the LRMC (long run marginal cost) of the system/s. This is the simplest approach but it has been heavily criticised because it does not take into account the externalities and, in general, FITs based on private avoided cost are not enough to foster the development of RES-E generation.
    - Social avoided cost: FITs are set based on an estimation of the LRMC, including externalities. Basically, the most commonly considered externalities are local (SOX, NOX, particles, etc.) and global (CO2e) pollution and security of supply. This is the simplest acceptable approach, but it only allows setting a single FIT. Technology-wise FITs require ad-hoc adjustments.
    - RES-E cost-based: this alternative requires having at least a minimum set of information about specific projects (some wind measurements, solar irradiation measurements, pre-feasibility studies for small scale hydro, geothermal plants, etc.) that can be assumed as "typical" of each technology. A pricing study of these projects should be done, including a reasonable rate of return on investment. This approach allows to estimate relatively easily technology-wise FITs, but it has some drawbacks: a single project pricing does not allow assessing the full supply curve for each technology, and thus the FIT that is set may be not enough to develop a reasonable amount of RES-E generation (which is even more awkward if the FIT is below the social avoided cost), or higher than necessary to develop the target, generating large inframarginal rents to RES-E producers.
    - RE-conventional energy supply equilibrium (optimal penetration approach): this is definitely the best approach from the economic point of view, as it removes all the limitations of the previous alternatives at the cost of increasing the complexity and the information required many times. It identifies the optimal penetration for a given period (generally 10 years ahead) based on a comprehensive assessment of the long run social supply curves of conventional energy and RE. The RES-E supply curve is developed by adding the full supply curves for each RES-E technology, based on a mid-term feasible economic potential. The main problem with this approach is that it requires a huge amount of data that may take more than two years to be gathered if, for instance, wind atlas (at 30 mt. height), irradiation maps, biomass commercial potential, pre-feasibilities studies, etc., are not still developed to cover at least a relevant share of the potential RE. This type of study is nowadays commonly seen in many countries; even for the whole EU (OPTRES study) a similar assessment was carried out, but in many cases, at the beginning FITs were set based on other, less precise approaches, in order to kick-off the process.
- Top-down: Nowadays, due to the experience accumulated in many countries in setting FITs, a benchmarking of existing feed-in tariffs may be an initial alternative until more sophisticated studies are developed. There are many countries, both developed and emerging ones, where references can be found; as mentioned in the previous section, it is not possible to identify systematically higher FITs in emerging countries (for instance, due to higher cost of capital), potentially because there is a compensation of the different costs. This is a relatively simple approach that may be used for most of the technologies if bottom-up practices cannot be implemented in the short term.

Although the supply curve methodology is considered as the most appropriate approach in some cases, it requires a huge amount of data on existing resources, potentials, etc. Therefore, the cost based approach is used worldwide since information requirements are less time consuming. Sri Lanka has chosen this approach to define FIT. The Consultant supports this mechanism, though more complex mechanisms such as supply curves may be considered in the future to set more accurate tariffs to RES-E, avoiding certain drawbacks of the cost based methodology.

The methodology for determining the FIT is very important for the development of RES-E. Until the present difficulties are solved by RES-E FIT determining system established by law the MOPE should set the RES-E FIT based on an acceptable independent procedure.

Methodologies applied in different countries are difficult to assess. Most countries do not disclose the mechanism used to define the tariffs approved for RES-E power plants. RES-E costs based approach seems to be the most common procedure to define such tariffs, though frequently there is a lack of

transparency on investment costs, O&M, load factors, etc. WACC figure might be more easily found in some cases.

A remaining important issue is to compare the estimated FIT with those observed abroad in order to determine whether the promotion scheme is in-line with current trends, assuming the limitation that any benchmark exercise has (different CAPEX costs, different cost of labour, terrain issues, different country risk, etc). To perform this benchmarking exercise, the Consultant has calculated the average solar PV and wind FIT across EU Member States and other relevant countries, and the results are presented in Exhibit 20 – International benchmark wind FITs and Exhibit 21 - International benchmark solar PV FITs . Some European countries set size wise tariffs for small scale facilities. The reference tariffs depicted below are for installations with an installed capacity of over 1 MW.

Exhibit 20 – International benchmark wind FITs

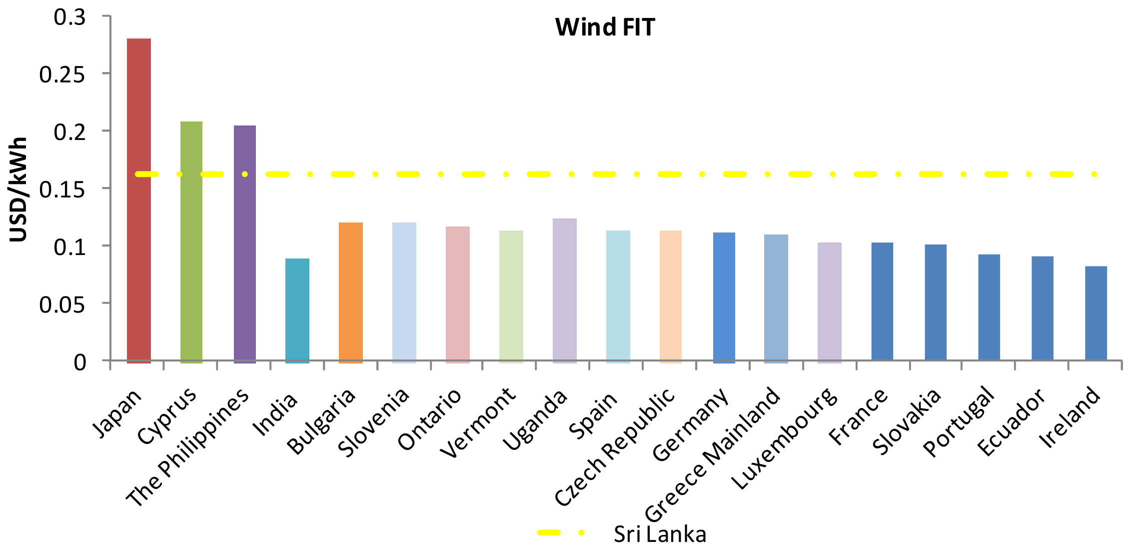
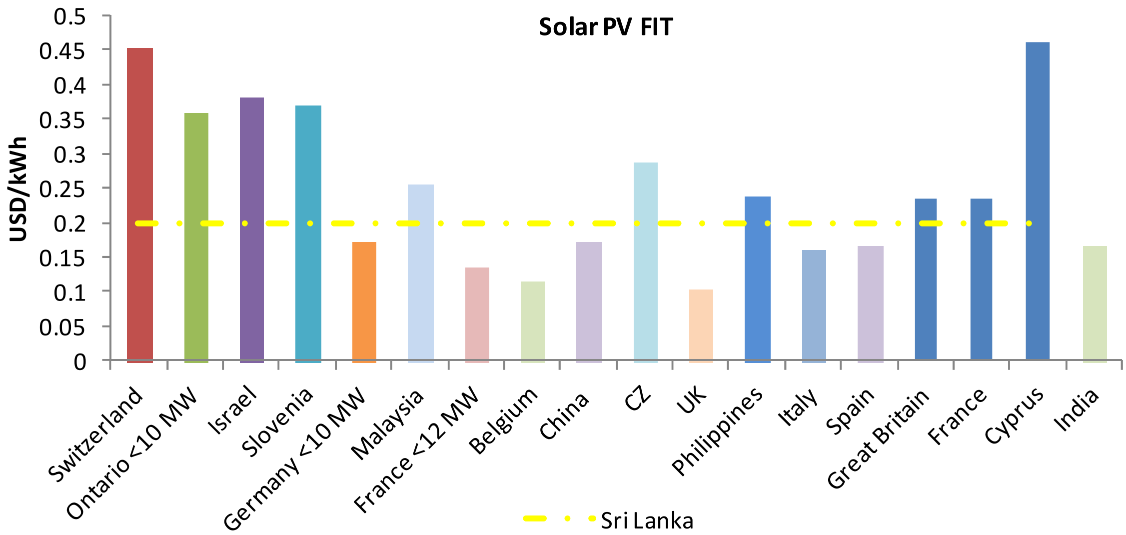


Exhibit 21 - International benchmark solar PV FITs



As shown above, the existing FITs are above the average figures for WPPs. In the case of SPPs, we should bear in mind the outstanding decrease in costs which this technology is experiencing in the recent years, which is being translated in continuous reductions of FITs for SPPs.

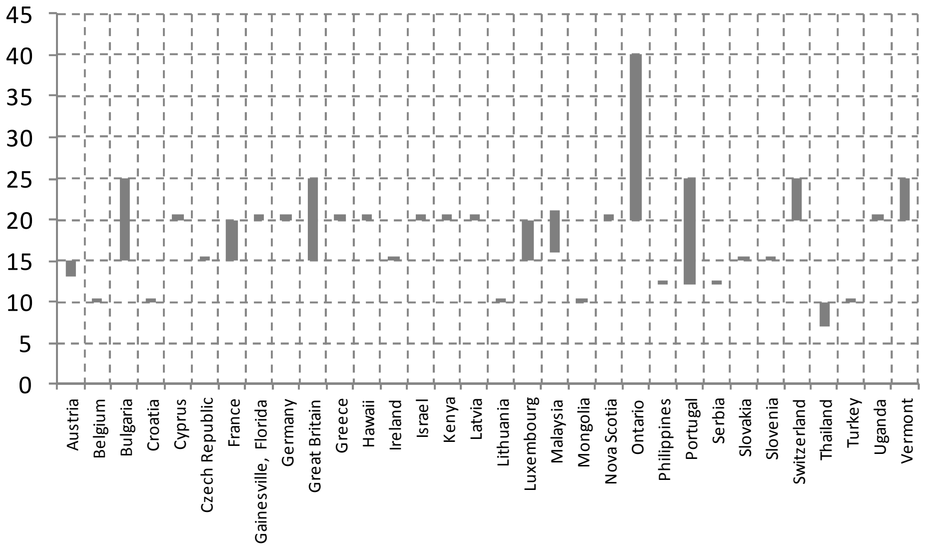
b) Duration

There are three main approaches regarding the duration of the incentive:

- Fixed: definitely, this is the most common approach.
- Unlimited: there are few cases where the incentive is applied permanently, but generally it is related to advanced FITs (premiums) rather than traditional ones (Spain[40], Hungary).
- Based on output: ever since the development of the tariff was based on estimated plant factor, a discussion on the convenience of setting the incentive's duration based on a specific number of hours of running, rather than on a fixed period has been initiated. Under this approach, if the plant has a plant factor higher than a benchmark that was employed for setting the FIT, the duration of the incentive will be shorter; on the contrary, the duration will be longer if the plant factor is lower. This is a very interesting approach gaining popularity across Europe. Nowadays, this approach is employed in France and Portugal, among other countries. Another option would be to adjust the FIT level instead of the duration of the incentive, such as in the cases of France and Germany. The adjustment based on the FIT level (rather than on the duration) is sometimes preferred, as it matches better with the projects' financing constraints.

The most common approach is to set the incentive period based on a fixed number of years that most likely range from 10 to 25 (see Exhibit 21 - International benchmark solar PV FITs).

Exhibit 22 International benchmark FITs duration



c) Indexation

The most important function of inflation adjustment is to protect the equity invested in long-lived capital projects, like renewable energy technologies. Without the inflation protection, investors need a higher price relative to investments with inflation protection, before they put their capital at risk; therefore, in most countries, the only index considered in the indexation is the local inflation. However, the share of inflation that is allowed to be passed through to FITs is quite different across experiences. The most aggressive scheme (from the view of reducing costs for consumers) is not adjusting the FIT at all; this is the case of Germany, where the level of FIT is decreasing in real terms year by year. There are countries that allow adjusting the FIT by approximately 25% of the local inflation, such as Greece; in the case of France and Spain, about 70 % of the inflation can be employed for updating the tariff every year – in Spain, this figure was lowered down to 50% from 2012 onwards. Other countries (Ireland, Portugal, etc.) allow 100% indexation based on the local inflation every year.

In BRIC countries, in most of the cases, full pass through of local inflation is allowed (FITs are calculated and applied in local currency). Thus, in the case of Brazil, where inflation adjustments are made once a year, there has been an obstacle for the participation of foreign capital in the form of

[40] FIT scheme in Spain was temporarily halted due to the precarious budgetary situation.

either debt or equity, because the country has a history of large devaluations. Most of the Programme of Incentives for Alternative Electricity Sources (PROINFA) has been developed by local capital. As a matter of fact, most of the developed and BRIC countries do not require (or aim to attract) foreign capital and thus, full or partial pass-through of local inflation does not affect the power of the incentive.

Unfortunately, in emerging countries, there is not enough experience so as to get final conclusions. Some countries set the tariff directly in hard currency (generally in US dollars); for instance in Kenya, Cape Verde and Turkey, where no inflation is foreseen. Others apply the old practice of composite indexation considering local currency devaluation (for instance, Thailand, Philippines). It is clear that the regulation should provide a risk-adjusted return to investors if RES-E wants to be fostered, but a full pass-through of currency devaluation may increase the cost of the policy when the society is in a worse condition and cannot afford it.

d) Tariff review

There are two main issues to discuss regarding tariff review:

- Backward or forward looking approach
- Periodical review vs. capacity dependent reviews

Regarding the first issue, in most of the cases, a forward looking approach is employed in order to ensure the stability of the incentive for already installed facilities, thus creating stronger signal for investment. The idea behind the tariff review is that investment cost changes over time (e.g. technological innovation), or the best resources are exhausted and thus tariffs may need to be increased; but in all cases, the need for adjustments is related to new installations. In relation to the frequency for tariff reviews, there is no clear trend across countries; for instance, in the Czech Republic, the level of remuneration for new installations is reviewed annually; other experiences employed longer periods.

There are many cases of capacity-dependent tariffs' adjustment, i.e. Portugal, Germany, Spain, Denmark, etc. Portugal applies a system wherein the tariffs for an RES-E technology are revised when a certain capacity of power plants is reached nationwide (Solar PV: 150 MW, Biomass: 150 MW, Biogas: 50 MW). Similarly, in Spain FITs set in 2004 apply until the following threshold is reached: 150 MW for solar PV, 200 MW for solar thermal, 13,000 MW for Wind energy, 2,400 MW for small hydro (≤ 10 MW), 3,200 MW for biomass and biogas, 750 MW for WTE, etc. Very recently, a new cap (i.e. a value of installed capacity above which FIT or other supports can be reviewed) for installation regarding solar PV and thermal and wind onshore was established after hard negotiations with stakeholders, as the cost of the policy is becoming difficult to afford by the consumers and highly innovative approaches have been defined; for instance, in the case of solar PV, FIT level changes depending on the amount of MW installed per year following an algorithm defined in the regulation. In Germany, for instance, the new legislation (2009) states that tariffs for solar PV will not be reviewed directly, but by adjusting the tariff digression. If the overall newly installed capacity in one year exceeds a certain amount (growing from 1,500 MW in 2009 to 1,900 in 2011), the digression is raised by 1%, while if it falls short of a certain value, it is lowered by 1%. In 2012, Germany set a new schedule for PV tariffs adjustments based on monthly digression.

Exhibit 23-Volume based monthly digression Solar PV

Installed capacity during prior 12-month period	Monthly degression
7,500 MW	2.8%
6.500 MW	2.5%
5,500 MW	2.2%
4,500 MW	1.8%
3,500 MW	1.4%
2,500 – 3,500 MW (target corridor)	1%
Less than 2,500 MW	0.75%
Less than 2,000 MW	0.5%
Less than 1,500 MW	0%
Less than 1,000 MW	-0.5%

Source: BMU 2012. (June 28, 2012). *Die wichtigsten Änderungen der EEG-Novelle zur Photovoltaik 2012.*

This new procedure might be a valid alternative to a tariff review. Capacity-dependent adjustment is highly recommended but it should be carefully implemented – details are crucial– as there is one critical issue: as there is a capacity constraint, some developers will probably chose to apply for the FIT, but not all of them; thus, the question is how to select them. The answer is not as simple as in

the case of "the first movers" because, at the end of the day, the installations may be not developed because of different problems. This is a very difficult issue that should be carefully addressed.

Although a stable policy framework with long periods of fixed FITs may lead to high investment security and to high RES-E exploitation, RES-E tariff review cannot be avoided as the system should properly pass through to consumers' part of the efficiency gains because of technological advance. Therefore, it is a challenge to have a system that is flexible enough but that also leads to high investment security.

e) Size wise tariffs

For many RES-E technologies, the specific electricity generation costs per MWh differ according to the plant's size; this is typical of solar PV, small hydro, biomass and biogas, geothermal, small wind turbines, etc. Almost all EU countries are applying FITs with different levels of remuneration, according to the size of the plant in those technologies. By applying this approach, lower/higher electricity generation costs due to economies/diseconomies of scale can be taken into account.

The range of prices could be very large. In Germany, the tariff level for hydro plants with a capacity between 500 kW and 5 MW ranges between 130 and about 40 € /MWh, while in the extreme example of UK, FIT starts at 61 €/MWh for 5 MW up to 270 €/MWh for 15 KW plants. In Exhibit 24, a comparison is provided.

Exhibit 24 - Hydropower size-based FIT

		€/kWh	USD/kWh
Germany	<500 kW	0.13	0.17
	>500 kW<2 MW	0.08	0.11
	>2 MW<5 MW	0.06	0.08
	>5 MW<10 MW	0.06	0.07
	>10 MW<20 MW	0.53	0.69
	>20 MW<50 MW	0.04	0.05
	>50 MW	0.03	0.04
UK	<15 kW	0.24	0.32
	>15 kW<100 kW	0.23	0.30
	>100 kW<500 kW	0.18	0.24
	>500 kW<2000 kW	0.14	0.18
	>2 MW<5 MW	0.05	0.07

This profile is not only observed in hydropower. In Exhibit 25, it can be seen how the FITs for wind vary when the size of the plant increases for some countries. Similarly, in Exhibit 26, solar PV FITs are drawn against plant size showing the same profile of decreasing FITs when size becomes larger.

Exhibit 25 - Wind size-based FIT

		€/kWh	USD/kWh
Bulgaria	<800 kW	0.08	0.10
	>800 kW	0.07	0.09
Italy	>1 kW<20 kW	0.29	0.38
	>20 kW<200 kW	0.27	0.35
	>200 kW<1,000 kW	0.15	0.20
	>1,000 kW<5,000 kW	0.14	0.18
	>5,000 kW	0.13	0.17

Exhibit 26 - Solar PV size-based FIT

		€/kWh	USD/kWh
Belgium	<1 MW	0.25	0.33
	>1 MW >50% self consumpti	0.15	0.20
	>1 MW <50% self consumpti	0.09	0.12
Germany	<10 kW rooftop	0.16	0.20
	>10 kW<40 kW rooftop	0.15	0.19
	>40 kW<1000 kW rooftop	0.13	0.17
	Groundmounted and rooftop	0.11	0.14
Malaysia	<4 kW	0.29	0.38
	>4 kW<24 kW	0.28	0.37
	>24 kW<72 kW	0.28	0.36
	>72 kW<1,000 kW	0.27	0.35
	>1 MW<10 MW	0.22	0.29
	>10 MW<30 MW	0.20	0.26

As shown above, several countries apply a sophisticated system, in which RES-E technologies are remunerated with a FIT according to the plant's size.

When setting the FIT based on size, the development of a consistent pricing is critical; for instance, it is important to avoid constructing two small plants instead of a large one, because it is just more convenient from a financial point of view.

Other countries have applied different tariffs depending on the fuel which is used for power generation; Sri Lanka already applies this approach for power plants based on biomass.

f) Degression

One goal of the energy policy should be to reduce the electricity generation costs of RES-E for final consumers, as far as technological learning (innovation, economies of scale, etc) allows. Decreasing costs should be reflected by the supporting policy. This can be done by reducing the FIT level for new installations during the tariff reviews as explained before or by defining a predefined digression of the tariff level by a certain percentage per year for new installations. Under a tariff degression, the tariff level depends on the year when the RES-E plant starts to operate. Each year, the level for new plants is reduced by a certain percentage. However, the remuneration per kWh for commissioned plants remains constant for the guaranteed duration of support. Therefore, the later a plant is installed, the lower the reimbursement received. Ideally, the rate of degression should be based on the empirically derived progress ratios for the different technologies. Germany (see Exhibit 23), France (for wind energy) and Italy (for PV) apply a support system for RES-E with a tariff degression.

In France, a tariff degression of 2% annually is applied for electricity from new wind turbines from the year 2008. Besides, policymakers introduced an automatic, recurring degression of up to 9.5% for photovoltaic tariffs that occurs four times a year and depends on the capacity additions in the previous quarter.

Under tariff degression, the predetermined percentage of degression causes higher transparency and security for potential investors than reducing the tariff level during a periodical revision, and additionally, it provides incentives to build a plant early in time, which may be very interesting to kick off markets; however, rising prices of input factors, like steel for wind turbines or silicon for PV devices, may lead to an unexpected increase in the price of RES-E plants that are not considered in degression, mostly if degression is set for many years.

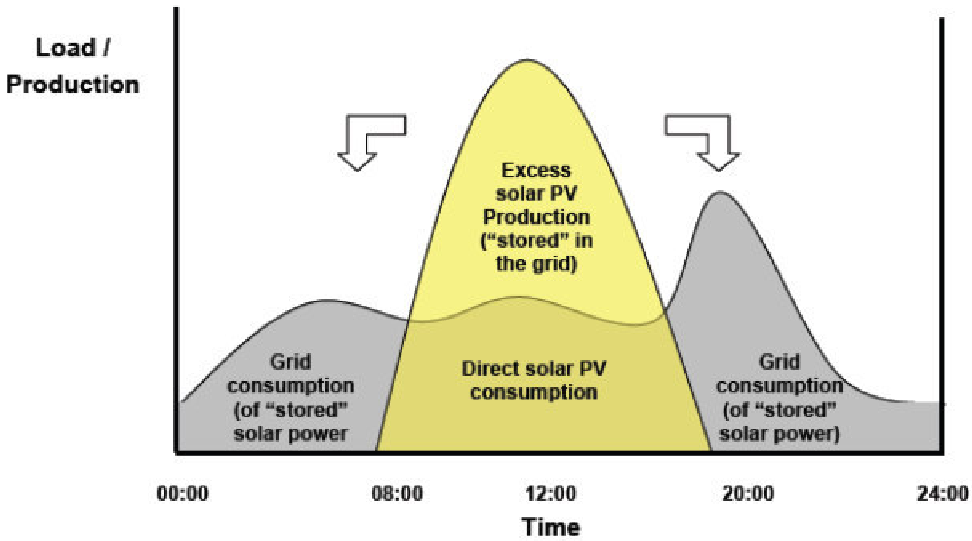
g) Net-metering

Net-metering describes the practice of metering the relative energy consumption of an electricity consumer who also generates electricity from his own energy producing facilities (mostly common for PV and small wind facilities). Although net-metering is most common in the USA, some EU countries like Italy, Denmark and Germany apply it too, though not in the same way.

In many US states net-metering allows small scale-producers to feed excess electricity into the grid by netting consumption, or by generating credits in case of net surplus, but in all cases, energy is valued at retail price. Therefore, it is not enough to develop a huge installation of small devices that

are actually even more expensive than larger ones. Net-metering, in essence, allows small scale renewable energy power producers to "bank" or "store" their electricity in times of over-production (e.g. for solar energy during peak production in the day) in the grid to feed other consumers.

Exhibit 27 – Net-metering



Source: GIZ

In Germany, prior to 2012 PV amendment, where self consumption bonus was removed, regulation offered incentives for producers of electricity from PV to directly consume their auto-produced energy. The revised regulation offers small-scale producers the option of a "split tariff" for the generated electricity. For solar energy used directly by the producer, a compensation of 250 € /MWh (about 25% higher than retail price) and 430 € /MWh is sold to the grid. Italy revised its former Net-metering policy in 2007 and introduced a new regulation which allows PV systems with a nominal power up to 20 kW to apply Net-metering; a tariff of 445 /MWh is paid regardless of whether the power is fed into the electricity grid or consumed by the small scale producer itself.

The following table summarizes the features of net-metering schemes in several states of USA. Concretely, eligible technologies, applicable sectors, capacity thresholds for the eligibility and other key aspects which impact the development of these facilities are presened at a glance.

Exhibit 28 - Benchmark net-metering schemes USA

State (or Utility)	Eligible Renewable/ Other Technologies	Applicable Sectors	Limit on System Capacity	Limit on Aggregate Capacity	Net Excess Generation (NEG)
California	Photovoltaics, Wind, Fuel Cells, Biogas from manure methane production or as a byproduct of the anaerobic digestion of biosolids and animal waste	Commercial, Industrial, Residential, Agricultural	1 MW (10 MW for up to three biogas digesters)	5% of utility's peak demand (statewide limit of 50 MW for biogas digesters; 112.5 MW for fuel cells)	Credited to consumer's next monthly bill at retail rate. After 12 month period, consumer may opt to have net excess generation roll over indefinitely, or to have the utility pay for any net excess at a rate to be determined by the rate making authority. If consumer makes no affirmative decision, net excess generation will be granted to utility with no compensation.
Florida	Solar, Wind, Biomass,	Commercial, Industrial,	2 MW	None	Credited to consumer's next bill at retail rate;

	Hydroelectric, Geothermal Electric, CHP/Cogeneration, Hydrogen, Tidal Energy, Wave Energy, Ocean Thermal	Residential, Nonprofit, Schools, Local Government, State Government, Tribal Government, Fed. Government, Agricultural, Institutional			excess reconciled annually at avoided-cost rate
Hawaii	Photovoltaics, Wind, Biomass, Hydroelectric	Commercial, Residential, Local Government, State Government, Fed. Government	100 kW for HECO, MECO, HELCO consumers; 50 kW for KIUC consumers	3% of utility's peak demand for HELCO and MECO; 1% of utility's peak demand for KIUC and HECO	Credited to consumer’s next bill; granted to utility at end of 12-month billing cycle
Iowa	Photovoltaics, Wind, Biomass, Hydroelectric, Municipal Solid Waste, Small Hydroelectric	Commercial, Industrial, Residential	500 kW	None	Credited to consumer's next bill at retail rate; carries over indefinitely
Missouri	Solar, Wind, Hydro, Fuel Cells using Renewable Fuels	Commercial, Industrial, Residential, General Public/Consumer, Nonprofit, Schools, Local Government, State Government, Fed. Government, Agricultural, Institutional	100 kW	5% of a utility’s single-hour peak load during the previous year	Credited at avoided-cost rate to consumer’s next bill; granted to utility at end of 12-month billing cycle
Washington	Solar Thermal Electric, Photovoltaics, Wind, Hydroelectric, Fuel Cells, CHP/Cogeneration	Commercial, Industrial, Residential	100 kW	0.25% of a utility’s 1996 peak load	Credited at retail rate to consumer's next bill; granted to utility at end of 12-month billing cycle

Source: Interstate Renewable Energy Council

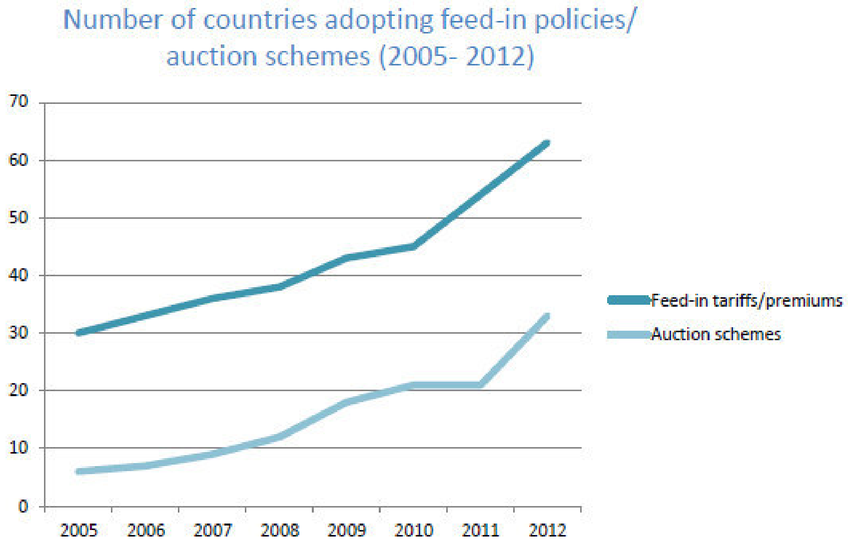
RES-E TENDERING

Auctions have been used in some nations to implement a government’s stated policies to foster the development of non-conventional renewable energy. They have proven to be a viable alternative to the traditional, administratively set feed-in-tariffs used by most developed countries worldwide.

As a matter of fact, since 2007, auctions have been increasing at a higher rate than FIT and premium schemes as a promotion mechanism for RES-E, though this approach entails two weaknesses which are critical to trigger the market, especially at its first stages. These issues are:

- Competition must be ensured, in opposite case, prices resulting from the auction may be higher than cost-based FIT (or could result in failure if a price cap is set in the tender)
- Need to set up the mechanism for the tender: this included, among others, (1) institutional set up, (2) tender rules (technology-wise?, participants eligibility, pricing, etc), (3) what to tender (amount of MW, bunch of projects, individual projects, etc) and (4) enforcement (ensure that awarded investors actually develop the projects)

Exhibit 29 – Trends in international support schemes



Source: REN 21 (2005, 2007, 2010, 2011, 2012)

Renewable energy auctions can be bundled and auctioned in different ways, depending on the level of competition and specificity desired. It can be done when all forms of renewables are eligible to participate in the same auction process or when the participation may be restricted to particular types of technologies or sites that take place at several levels, such as technology-neutral auctions, or renewable-specific, technology-specific, or technology and site-specific auctions.

a) Technology-neutral Renewable Auctions

Technology-neutral auctions allow participation of any generation source (and possibly demand-side bidders). The idea is to foster maximum competition, select the most efficient sources, and achieve a least-cost expansion plan. However, it is difficult for non-conventional renewable sources to compete head to head with base-load coal or large hydro, except under special circumstances. Therefore such auctions are used very seldom, while the governments prefer establishing auctions that target one or more types of technologies.

b) Technology-specific Renewable Auctions

To enable an effective outcome in terms of least-cost procurement of electricity, different renewable technologies should ideally compete on a level-playing-field basis. However, if governments have a preference for particular technologies driven by energy policy concerns, this element should be reflected in the auction design. The selection of a particular technology is often driven by energy or economic policy considerations.

The usage of technology specific auction mechanisms, in which potential investors compete for long-term energy contracts for demand to be served for a number of years after the auction occurs, arose as an alternative in Latin America, led by Brazil in 2004. Chile, Peru, Colombia and Panama also implemented auction-based schemes during 2005–2009. In Europe, France and Italy modified existing FIT laws to include tenders for large-scale installations. Other countries, such as Denmark, have launched tenders for certain technologies, mainly those less mature. The Exhibit below presents a summary of some relevant cases.

Exhibit 30 – Design of auctions

Sealed-bid auctions		Hybrid auction
First-price sealed-bid auction	**Pay-as-bid auction**	**Descending clock stage followed by pay-as-bid auction**
• One single product to be allocated • One contract as winning bid	• Multiple units of same product to be allocated • Multiple contracts awarded with different prices	• Multiple units of same product to be allocated • Multiple contracts awarded with different prices
• Limited volume auctioned • Usually technology specific in specific locations	• Number of bids selected to match the set volume target • Technology neutral or technology specific	• Number of bids selected to match the set volume target • Technology neutral or technology specific
• No price ceiling	• Ceiling price (disclosed or not) used for selection	• **Ceiling price discovery in phase of descending clock auction**
• Selection based on price and other qualification conditions and evaluation criteria	• Selection based on price and other qualification conditions and evaluation criteria	• Qualified bids that pass the first phase are selected based on price/ quantity offered at given price
• Winning bid price not necessarily disclosed	• Average price disclosed at the end of auction round	• Average price disclosed at the end of auction round
• Simple , easy to implement , handles weak competition • No ceiling price discovery		• Speeds auction convergence, handles weak competition, good ceiling price discovery • Not easy to implement

The main advantage of conducting auctions differentiated by technology is the possibility of explicitly introducing energy policy concerns, such as the greening of the energy matrix, promoting regional economic development, or developing some forms of generation technology. Another advantage is that, given the similar features of a given technology, bids can be compared on an "apples-to-apples" basis. On the other hand, its main disadvantages include the criteria from which the quotas for different technologies should be selected and the fragmentation of the procurement process, which could possibly lead to the reduction of competition and increased costs for end-users.

The experience in managing such auctions, as well as the descriptions of the achieved results, are presented below.

(i) Brazil

In 2002, in Brazil the Proinfa ("Incentive Program for Alternative Energy") program was launched. It was not a competitive procurement process *per se*. When it was first launched, the auction mechanisms for power contracts had not yet been established. However, the program emerged to provide an allocation mechanism, similar to a "beauty contest", to help the government implement its policy on renewables. This program resembled technology specific feed-in tariffs, with the average[41] price established at the level[42]:

- Wind = 154 US $/MWh
- Bioelectricity = 77 US $/MWh
- Small hydro = 96 US $/MWh

In the first phase of this program, the objective was to contract 3,300 MW of new renewable capacity by 2007. The target was reached already in 2005.

In 2004, in parallel to the implementation of Proinfa, Brazil had been reorganizing its power sector. The new power sector model in Brazil foresaw two main types of energy auction:

- Regular new energy auctions, which contract an amount declared by the distribution companies in order to meet demand growth in the regulated market, and

[41] Actual price depends on reference load factor

[42] Values as on 2010

- Reserve energy auctions[43], which are used to contract supplementary energy to increase the system's reserve margin.

Demand for reserve energy is entirely determined by the government following its own criteria of security of supply and energy policy, and the costs of these contracts are split among all consumers by means of a system charge. While the energy contracted in regular energy auctions is essential to meet demand, and therefore must be backed up by a certain amount of firm generation and covered by firm energy contracts (FEC), reserve energy contracts do not provide firm energy to the system and thus may have much more flexible terms.

In both auction types (regular or reserve), the government can intervene with the necessary policy decisions. The first auctions were launched in 2005 with tendering new hydro capacity. Then in 2008, the attention of the government switched to the bioelectricity projects (mainly tendering at reserve energy auctions). This 2008 auction was responsible for the development of a method to facilitate network integration for small renewable facilities, based on the cooperative planning of an integrated transmission and distribution network and sharing collector substations.

Wind power was initially excluded from auctioning due to the higher costs comparing to other technologies. Its turn finally came in December 2009, when an exclusive reserve auction for wind farms took place. It was a result of the large price drop for wind equipment in European countries, and therefore, an increased competition among different equipment suppliers. This exclusive energy auction attracted a large number of investors – 13,000 MW of new wind generation capacity in total applied for participation in the auction.

The results of this first auction turned to be very surprising for the organisers: 1,800 MW of new wind capacity was contracted at an average energy price of 95 US$/MWh, representing a 21% discount relative to the government's initial requested price, and a 44% discount from Proinfa prices. These large discounts can be attributed in no small part to the lowered investment costs in 2008, but also to the competitive environment of the auctions and aggressive behaviour of investors, as well as significant improvements observed in capacity factors, which averaged an impressive 44% for the winning projects – among the best in the world.

The excellent results obtained in the 2009 auction surpassed most expectations and showed that wind power was very close to being competitive with other renewable energy sources. This accelerated dramatically the process of insertion of wind power technology in the Brazilian energy mix: in 2010, wind power was allowed to compete on equal grounds with small hydro and bioelectricity projects in two energy auctions for energy delivery in 2013 (one regular, for firm energy; and one reserve). The contract offered in the new energy auction, like the one formulated in 2009 for reserve wind power contracting, presented robust hedge mechanisms and accounting processes in order to shield the investor against wind generation variance. Wind power outclassed its competitors in both auctions, being responsible for nearly 80% of all energy contracted and reaching average prices of 80 US$/MWh (regular auction) and 73 US$/MWh (reserve auction). A total of 1,500 MW of wind capacity was contracted under regular contracts, and 500 MW under reserve contracts.

In August 2011, once again two energy auctions (one regular and one reserve) for delivery in 2014 were organized, allowing for the participation of wind power. However, while the reserve energy auction remained exclusive for non-conventional renewable sources, in the new energy auction wind power was allowed to compete directly with natural gas-fired thermal plants. In yet another important landmark for the full development of the technology, wind power was able to successfully compete with these thermal plants: the average wind energy price in these auctions was 60 US$/MWh, lower than the average natural gas energy price (62 US$/MWh). An energy mix including 1,000 MW of wind capacity was contracted in this auction; while in the reserve energy auction an additional 860 MW of wind capacity was acquired. Remarkably, competitiveness of wind power in Brazil was achieved in only two years without taking into account positive externalities relative to carbon emissions: wind and gas projects competed in the 2011 auction using a purely economic criterion (the lowest $/MWh

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[43] The first technology-specific reserve auction for the regulated market was carried out in 2007 and only renewable energy could participate. With limited participation, results were disappointing. The main reason alleged was that prospective developers preferred to sell the energy to large end-users—that is, those consumers willing to pay a higher price for the energy due to the fact that they were eligible for discounts on the use of the transmission and distribution system. This non-economic subsidy favoured direct trading between the renewable source and the large, non-franchised user. Apart from this initial setback, the "reserve energy" auction model has been considered successful. It is interesting to note, that mainly biomass/biogas participated in the reserve energy auctions, due to the natural production synergy with hydro generation, as far as bio-production occurs during the harvest period, which coincides with the dry season and low availability of hydro resources – main generation source in Brazil.

offered defined the winner). It is worth saying that the amount of RES-E tendered allowed the development of local wind turbines manufacturing industry that has helped to price reductions.

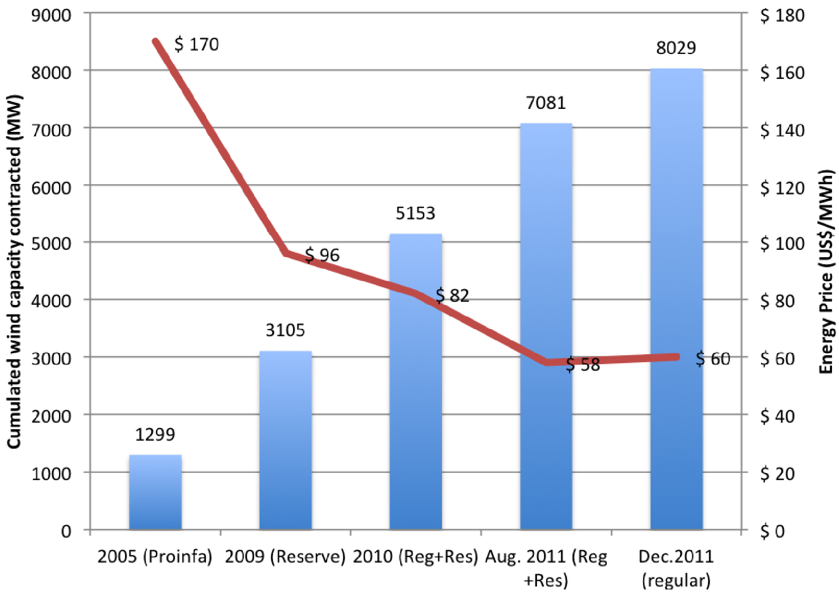
Exhibit 31 – RES-E Auctions Brazil[44]

Outlock for RES-E energy auctions

- Long-list of technical pre-requisites to register a project, e.g.:
  - Prior environmental license & grid access, financial qualifications, certified production for wind
- Specific products offered
  - Long-term contracts ahead of delivery
  - In case of wind, product converges to a FiT with some revenue stabilization and with a scheme for penalties/incentives for production above/below a threshold
  - Contracts indexed to inflation
- Auction tasks coordinated among the different institutions:
  - Definition of auction mechanisms & suggest price caps
  - Definition of auction product, preparation of tender documents, etc
  - Coordination with transmission planning & grid access (grid tariffs are known to bidders before the auction takes place)

A final regular new energy auction took place in December 2011, to contract energy for delivery starting in 2016. Despite the longer construction times, final prices were quite similar to the ones obtained in the August auctions. The evolution of the contracting of wind power throughout Proinfa and all auctions carried out in Brazil is summarized in the exhibit below. Remarkably, the energy auctions from 2009 to 2011 increased wind capacity in the country eight-fold.

Exhibit 32 – Brazil auctions



Since 2005, these auctions have resulted in the contracting of 31 GW of new capacity (40% of which is conventional hydro, and 20% non-conventional renewable), awarding US$ 300 billion in long-term contracts.

(ii) Peru

[44] To ensure that new projects auctioned will be built termination of contracts and several penalties are placed if developer delays project implementation.

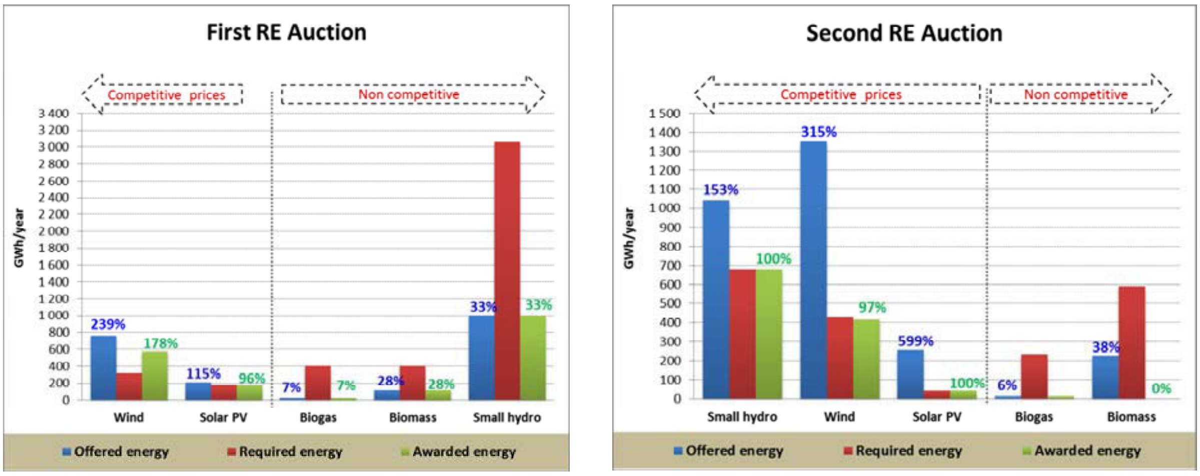
Peru has tried twice to implement technology-specific auctions. The first time was in 2008, when the country organized an auction dedicated to hydropower, without great success and with limited bidders. Peru has adopted technology-specific RES auctions in February, July 2010. The main objective was to fulfil the RES targets established by the government. The technologies eligible for tendering are small hydro, photovoltaic, wind and biomass generation. The winners were awarded by the contracts with distribution companies for up to 20 years to deliver the annual amount of energy offered at its offered price in three years from the moment of auctioning. The main features of the auction scheme set forth in Peru are shown below.

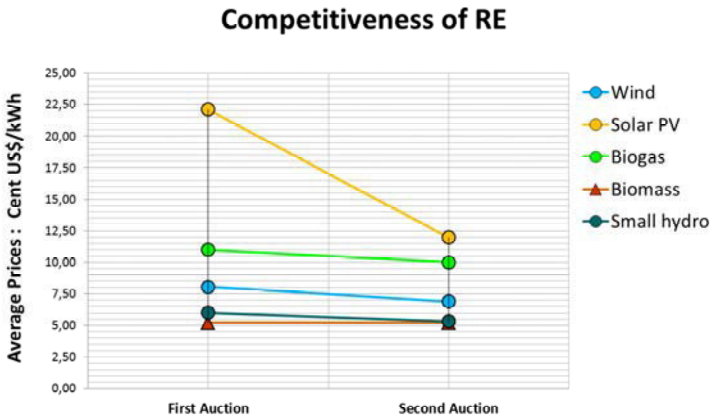
Exhibit 33 - RES-E Auctions Peru

How often are these held?	The auctions will be called at intervals of not less than 2 years.
What is auctioned?	The energy required will be auctioned in MWh / year for renewable non-traditional energy and in MW for small hydro plants.
Who organize the tender?	OSINERGMIN (Organism overseeing investment in energy and mining)
How much energy is auctioned?	•The Ministry of Energy and Mines (MINEM) sets a % target every 5 years. •For the first 5 years it is up to 5% of national consumption. •This energy requirement is for all RER technologies.
Who defines the allocation for the required energy by technology?	•The MINEM is the competent authority and defined according to the policies of the country's energy development. •The MINEM must approve the National Plan for Renewable Energy.

About 150 MW of wind power were competitively contracted at energy prices averaging 80 US$/MWh. Contracting of 160 MW of small hydro (at the average price of 60 US$/MWh) and 90 MW of solar plants (at the average price of 220 US$/MWh) was possible through contract durations of 20 years and delivery for three years ahead. These energy prices were 50% (biomass), 27% (wind) and 18% (solar and small hydro) lower than the auction price cap and winning investors were mostly foreign private companies.

Exhibit 34- Peru RES-E auction results at a glance




Competitiveness of RE
Average Prices : Cent US$/kWh
25,00
22,50
20,00
17,50
15,00
12,50
10,00
7,50
5,00
2,50
0,00
First Auction
Second Auction
Wind
Solar PV
Biogas
Biomass
Small hydro

VIII POLICY RECOMMENDATIONS

1. CAN THE CURRENT FRAMEWORK FOR PROMOTING SOLAR PV AND WIND BE IMPROVED? - WHICH ARE THE GAPS IN THE CURRENT POLICY?

According to the current development of wind and solar PV facilities, certain aspects should be highlighted. The existing framework for promoting wind technology should be considered as effective so far, despite current problems in setting the FITs for the new period, with over 70 MW installed and more than 20 MW expected to be in place soon. Conversely, solar PV facilities have not attracted private investors yet, potentially due to the insufficient incentives for installing this technology and, additionally, signals from the policy may discourage investors from developing solar installations, i.e. this category is not even included among eligible technologies as a specific one, though these plants are offered with a tariff of Rs 25.09 / kWh. However, efficiency of the mechanism is at least controversial, as there are a number of evidence that may suggest that it is not maximized (potential high FIT, loss of economic of scale, wind turbines of about 1 MW average been installed, etc)

The following list summarizes the main issues that should be addressed:

- At present, FIT is constrained to RES-E facilities of less than 10 MW. This has restricted the advantage of economy of scale especially for wind power and has made interconnection of generation at 33kV a requirement. The artificial 10 MW barrier has been placed probably for a technical reason but it is distorting the RES-E penetration. There is a lack of a clear-cut promotion mechanism for RES-E facilities larger than 10 MW.
- The current regulation requires that level public sector participation is decided by GoSL on a case-by-case basis for the development of RES-E facilities with an installed capacity beyond 25 MW.
- A lack of clearly and properly allocated institutional responsibility. On specific problematic issue is FIT approval.
- There is not a clear trigger for FIT review. In practice, FITs are reviewed quite often.
- Level of FIT for WPP is controversial, FIT for Solar PV and wind do not necessary look low when compared internationally, but a lot of concerns have been raised locally about if they are high enough to foster the market.
- The safety practices existing at present may hinder the connection of net-metering consumers.
- Net-metering regulation may require some adjustment when compared with international experience.
- Need for issuance of a Grid Code including operational and connection conditions for intermittent RES-E generation.
- While Energy fund for supporting RES-E development is not operational, end consumers should equally assume the extra costs (difference between avoided cost and average FIT level) from renewable technologies. This is actually happening, but the mechanism is legally weak and may require a careful assessment.
- There are some market niches that may require innovative PPP design to be developed.

ADJUSTMENTS ON RES-E SUPPORT SCHEME

In order to overcome the previously mentioned barriers towards the development of certain renewable and following the international experience outlined in the previous headings, the main findings on the existing framework regarding the suitability of existing schemes to foster RES-E in Sri Lanka are summarized below.

Even if Sri Lanka's RES-E policy has been focused in the development of a traditional FIT for small and mid-size installations, in this section the consultant outlines alternative mechanisms that may complement or even replace a traditional FIT scheme to some extent.

Although it seems faster and simpler to kick-off the market based on a traditional FIT, tenders are an interesting alternative to fine-tune the level of tariff for future developments, and reduce costs accordingly. Thus, the Consultant recommends for certain facilities to call for tenders to assess investors' appetite and accuracy of FITs.

The main advantages of tendering procedures in relation to FIT are:

- Allows GoSL to control the amount MW installed.
- Minimizes costs to achieve the penetration targets, if competition is enough.
- Reduce the potential for large infra-marginal rents due to miscalculation of the cost-based FIT. There could be several reasons for appearance of the windfall profit, among which is underestimation of the plant factor and/or overestimation of the technology-specific costs.

The preferred alternative is hereby described:

- Competitive procurement for large developments to find out investors expectation.
- Regarding smaller facilities – those smaller than 3 to 5 MW -, a FIT scheme as today providing some minor adjustments (described below) can be implemented provided that the GoSL wants to specifically promote this size of installations[45]. If this is not the case, FIT can be removed for WPPs and SPPs. This report assumes that the GoSL intends to foster small scale developments. Unfortunately, while FITs are kept, it is very difficult to prevent larger wind parks being divided into 5MW blocks if prevailing FIT is higher than the results of the auctions; however, given the smaller threshold, transaction costs are an important dis-incentive to do so.

Fine tune net-metering scheme.

Exhibit 35 – Recommendation at-a glance

	Net-metering	FIT	Tendering
Size	Up to 2 MW	3 / 5 MW	Above 3 / 5 MW
Eligible technologies	All RES-E	All RES-E	All RES-E
Review	No review	4 years or target achieved	Tender program set in the RES-E Plan. Price cap is the prevailing FIT (w/wo. A discount) at the moment of the auction
Responsible agency	-	MOPE sets FIT	SLSEA develops the planning MOPE approves tendering rules and price caps CEB/SLSEA prepares the sites to tender CEB calls for tenders

a) RES-E up to 5MW

a.1) Net-metering

In Sri Lanka, the selected approach for buildings and householders who decide to implement RES-E facilities will remain traditional net-metering. This means that the energy produced shall be used for self-consumption, and the exceeding –if any- will be "sold" to the grid and used to offset future consumption, the energy banking period, currently set at 10 years.

First of all, the banking period could be reduced down to 1 year for wind and solar installations (though it is not the scope of this report, in case of small scale hydropower facilities, the reduction of the banking period should be limited down to 5 years to consider inter-annual hydrological

[45] There many be many reasons for this policy – despite that small installations may need a high tariff – i.e. development of local manufacturing, development of local communities or small scale local developers, etc.

variations). In case there is an excess of credits at the end of the year, two options may be available: (1) CEB buys the credit at a discount over the relevant retail tariff or (2) the credit is carried forward for the next year provided that the credits were generated in the 3 immediate previous years. It should be mentioned that banking allowance of 10 years is significantly above international best practices. Current end consumer tariffs should be enough to enable the development of these facilities with attractive returns.

The consultant proposes to amend current net-metering scheme by reducing the threshold down to 2 MW. This will facilitate technical and connection requirements and will ensure a streamlined operation of the electricity grid, without hampering its behaviour due to the development of these facilities. As mentioned in section VII.2, international experience shows that limits are mostly below 1 MW per installation.

Furthermore, other feature which might be needed for this scheme to be more efficient, though probably affecting the perceived benefits by the consumers. On one side, in some cases, it has been usual to define the maximum penetration target in the system (or per subsystem) of these installations for safety reasons; as shown in Exhibit 28, generally this target is set between 1 to 5 % of the peak load of the distribution area. On the other side, given that the current retail tariff is not based on a pure cost-reflected two parts tariff, back-up charges may be needed to cover the fixed cost of the networks that the consumers may need (i.e. in case solar PV panel breaks down) and if not paid by the net metered consumers, it is to be paid by the rest of the consumers because it is sunk cost that D/L should recover.

Other promotion mechanism that it becoming more spread worldwide is the option of virtual net-metering; this means to allows tenants[46] of a building to install a single solar system to cover the electricity load of both common and tenant areas connected at the same service delivery point. The electricity does not flow directly to any tenant meter, but rather it feeds directly back onto the grid. The utility then allocates the kilowatt hours from the energy produced by the solar PV generating system to both the building owners and tenants' individual utility accounts, based on a pre-arranged allocation agreement. Though nowadays in Sri Lanka, the number of Multi-tenant building is limited, it is increasing very fast; therefore, this solution should be further analyzed.

An extension of the virtual net-metering concept is to allow generating RES-E in a premise but consume the excess in other premise (instead of generating credits) provided that both consumptions belong to the same legal entity. This type of arrangements is not only common for small facilities but for large ones (generally under a regulation of co/self-generation) and it is interesting because not only fosters the development of RES-E, but is the simplest way to open the generation market. However, for the case of Sri Lanka where there is no single provision for wheeling, it is very premature to move in this direction.

a.2) Feed in Tariff

Besides the reduction in the capacity threshold for eligibility, this consultant is proposing the following adjustments to mitigate the currently arising barriers. The consultant proposes the following process:

- MOPE should calculate and approve FIT for all eligible RES-E technologies. Though worldwide a clear-cut picture cannot be outlined, in many countries –FITs are set by the Government as FITs are not exactly a tariff as such (see Exhibit below); it is by nature, a subsidy to promote some technologies. Legal assessment is needed to understand what changes in the primary legislation may be required, if any.

[46] Multi-tenant building with individual electric meters for each tenant faced difficulties installing distributed solar PV systems because of the problem of assigning the benefits of the generation to each occupant. A system could easily be connected to a common area load or to an individual tenant, but if it was connected directly to multiple loads, there would be no way of ensuring equitable distribution of the generation. Some tenants would benefit more than others. Installing multiple systems, one for each tenant or load in the building, is cost prohibitive

Exhibit 36 – FIT approval authority

	Government/ Ministry	Regulator
Netherland	X	
Spain	X	
Germany	X	
UK		X
Lithuania		X
Portugal	X	
Czech Republic		X
Denmark		X
Estonia	X	
France	X	
Greece	X	
Hungary	X	
Philippines		X
India		X

- FIT should be set for an indefinite period of time. Tariff review provisions will define the events to change these tariffs based on a volumetric degression scheme. Jointly with the FIT, an installation target will be defined for that technology. The approved FIT will remain valid until the target is achieved. Once the target is achieved, the FIT is recalculated. The speed to fulfil the target is an indication of over/under estimation of the FIT.
- When the installation target is by far not achieved within the period targeted (4 years is recommended), FIT is reviewed as well. A criteria to decide when the target is fulfilled needs to be defined; initial recommendation could be to link the target to the amount of MW of each technology with final permit[47] by SLSEA. Duration of the FIT may be further explored with alternative option as there is always an important uncertainty regarding the expected plant factor. The alternative based on cumulative generation instead of a fixed period of time as described in section VII 2.b), seems to better allocate the risk between producers and off-takers.
- The provision of FIT alternatives (Flat/3-tier) with different clauses for indexation is unnecessary complex. In case of a flat option, all currency and inflation risk was charged to developer (no indexation of any kind) – though conceptually is valid and mostly used in developed countries– this approach generates higher initial FITs that other approaches in emerging economies.

The following table summarizes the features for the proposed amendment to the FIT scheme.

Exhibit 37 – Amendment to FIT scheme

Feature	Approach
Capacity limit	3 to 5 MW (this limit has been applied in other countries where quota promotion mechanism are set for larger facilities)
Installation targets[48]	Technology-wise defined based on the results of the RES-E master plan, economic efficiency and total burden for consumers the GoSL is willing to accept. (see next heading in relation RES-E planning)
Determination of FITs	Reference cost-based by MOPE
Duration	SPPA (20 years) or cumulative generation
Currency nomination and indexation	One part tariff nominated in local currency FITs adjusted by mix of external cost drivers.

[47] Permit for engaging in and carrying on of an on-grid renewable energy project

Review of FITs	When the installation target is achieved[49],[50], FITs are review to reflect cost reduction or correct potential mistakes in the previous calculation. When the installation target is by far not achieved within the period targeted (4 years is recommended)SLSEA will monitor the amount of permits for each technology.
Allocation of network costs	For the case of SPPA, the consultant supports that the best approach for this issue is the shallow method of connection charging. Under this framework the RES-E producers just pay for the connection cost to the grid and it's the grid operator the one who takes up the cost derived from grid reinforcement –if any- or other additional charges.

Even though this is recommended as an overall approach, it is focused in solar PV and wind technologies, other RES-E technologies may need more analysis in specific issues (mostly in biomass and biogas technologies).

b) RES-E above 5 MW

Competitive bidding mechanisms through tenders for a given quota of renewable energy supply or capacity are becoming very popular. Auctions are country-specific:

- They are used for different purposes
- They are designed to serve defined goals
- They can have one or two phases
- Requirements for qualification and selection criteria vary from one auction to another

This approach was successfully implemented in Latin American countries such as Peru and Brazil. In Europe, France and Italy modified the existing FIT laws to include tenders for large-scale installations.

The drivers which have triggered the application of this mechanism internationally make us envisage its suitability for the development of this market in Sri Lanka. The next issues should be highlighted among the identified drivers:

- Promote larger scale projects.
- Promote immature technologies, whose costs references are not wide spread.
- Set auctions as the mechanism to allocate the energy quotas and to discover market prices.
- Monitor the development of certain technologies/facilities.

We should also be bear in mind that the tendering mechanism is not free of risks:

- Risk of stop-and-go when auctions are done on a irregular basis, which may hinder the straightforward development of the market.
- Risk of uncompetitive auctions and distorted results, especially when the market is very immature as is the case.
- Risk of institutions not been able to implement the mechanism properly, when dealing with something absolutely new.
- Without a change of Law, for facilities larger than 25 MW, always public participation will be needed and this may distort competition depending on how the business model is structured.

This mechanism is deemed as an interesting alternative for mid/large scale facilities and may pave the way to fine-tune the level of tariff for future developments.

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[49] This generally refers to a technology-wise registry in which once the issued permits amounts equal to the installation target, a review process for FIT is triggered for the new comers. It is absolute critical that qualification criteria to get the permits are strong enough to avoid speculation.

[50] Sri Lanka has encountered – to a certain extent – problems in which companies apply for Provisional Approvals with the intention of selling these PAs at a profit. These issues have appeared in Thailand as well. In Thailand, one company accounts for 445 MW of signed PPAs for grid-connected solar PV. None of these projects have yet to be built. Similarly, in Sri Lanka companies have tied up key micro-hydro sites with PPAs that have failed to develop into projects even after a number of years.

Based on the international experience discussed above, initial recommendations summarised in the current section are proposed (focused in solar PV and wind technologies, it can be enlarged to include other RES-E technologies but some specific issues of some technologies should be addressed).

Exhibit 38 – Recommendations for tendering scheme in SL

Issues	Initial recommendations
Institutional set up	SLSEA should develop a RES-E master Plan for 10 years in which: Provide the most accurate appraisal (in non-binding manner) of the regional plant factors for wind and solar power generation. Define the maximum penetration in general and per promising identified region in coordination with T/L. Define the technology-wise installation targets for facilities under FIT and for facilities for tendering. This analysis should be included in the LTGEP. Existing planning procedure for formulating the LTGEP will need to be amended accordingly. MOPE calculates the technology-wise price cap based on the best available information. If FIT for that technology is available, the cap should be based on the value of the FIT, potentially with a discount to consider economics of scale. SLSEA define the tender timeline plan for a 5-year period. MOPE will approve the tendering rules based on recommendations by a technical Working group including but not limited to SLSEA, MOPE, PUCSL, CEB, civil society, developers among others. The tenders will be launched and managed by the CEB according to the Plan defined by SLSEA.
Tenders' organisation and management	The preferred product under tendering is a project of certain amount of installed MW rather an amount of MW without identification of the precise site. This approach will streamline the process of developing potential sites, since has some advantages (i.e. land management which is one of the major issues in case of WPP). SLSEA would be responsible of preparing and selecting the best sites. Tariff will be one-part expressed local currency. The regulated FIT (with or without a discount) (if existing) will represent the price cap for each auction. The tendering process will consist of two phases: prequalification and auction. At the prequalification stage, the selection will be based on analysis of the standard documentation submitted by potential investors that would prove the technical feasibility and environmental acceptance of the project, as well as the credit worthiness of participant. The prequalification criteria should entail the minimum technical and financial qualifications that a developer has to meet in order to be eligible for submitting the bid. Ultimate success of each tender (actual installation of RES-E facilities in due time) should be supported by a dual system of guarantees / penalties properly sized for each project. • The auction process will require depositing a guarantee (about 1% of the estimated investment value) that would ensure contract signature by the winner. The amount will be returned to the winner at the moment when the contract is signed. Those who have not won will receive their deposited guarantees within the week (or any other period of time defined by the auctioning rules) after the auction. • The guarantees for timely project completion will be deposited by winners (around 5% of the estimated investment cost) at the moment of the contract signature. Those guarantees will be released back when the project's construction landmarks are met. In the case of non-fulfilment (delays in construction) the deposited funds will be entirely (partially)

	executed. The scope of force major should be defined, as well as the conditions to invoke it, including the indication of the public entity to declare the force major. The tendering mechanism should be built on a "First-price sealed-bid" (FPSB) type of auction, pay-as-bid payment. Even if neighbouring countries as India has chosen reverse auction approaches, this scheme is suitable where tenders are multiple tranche procurement. In the case of Sri Lanka FPSB is deemed simpler and straightforward and no significant t advantages are envisaged under reverse auction alternative. A PPA will be granted to the winners for 20 years based on the amounts offered and selected. The PPA template is made public before the auction. The Grid Code including the technical connection and operational requirements for intermittent generation must be known before the first auction takes place.
Allocation of network costs	For these facilities, the current deep connection charging policy can be kept as today though flexibility to address specific case should be allowed.

OTHER RECOMMENDED ADJUSTMENTS

Besides the previously mentioned amendments of the existing framework, other regulatory amendments may be implemented to enhance RES-E development in the future.

- Fine tune technical connection conditions in the distribution code. The maximum size of an installation should be based by a maximum unit size feeding a single electrical circuit at each "declarable" voltage (220kV, 132kV, 33kV, 11kV, LV).
- As mentioned before, a Grid connection including requirements for wind and solar power plants connected to high voltage should be issued, defining main protection and power quality requirements. These requirement should include, but no be limited to:
    - Frequency Requirement
    - Voltage Requirement
    - Power Factor and Reactive Power Support
    - Voltage Ride Through Capability
    - Harmonics
    - Flicker
- SLSEA should include in RES-E Master Plan the development of Solar PV rooftop and specifically, should tender the available space in all public building for developers to install and operate as described below.
- The legal umbrella for PUCSL passing-through the full cost of RES-E to the final customers should be clarified.
- Another action could be to evaluate the possibility and opportunity of extending the scope of the Renewable Energy Guarantee Fund to help small RES-E installations (less than 5 MW) to get debt financing.
- PPA should include clauses allowing the compensation for curtailment, as the threshold for the "guaranteed" non-curtailment is exhausted.

2. IS IT NEEDED TO FOSTER DIFFERENT TYPES OF PPP FOR RES-E DEVELOPMENT? – WHICH ONES?

As mentioned before, PPP arrangements are common in the Sir Lanka experience, and specifically, in the RES-E generation, the participation of the private sector has been very important. Internationally, most of the RES-E expansion is developed by the private sector as the size of typical plants and the scalability of the technologies allows not only large international investor but mid-size – even local – investor to participate in the development. Moreover, the ability of private sector to develop RES-E generation has other advantages: (1) free own or borrowed financial resources of the state that are limited and thus is better to channel them where the social return is maximum (even if private cost

for capital may be higher than for the state) and (2) generally (if incentives are properly designed) private operation is considered more efficient.

For facilities able to get FIT, for most technologies, private participation under SPPA has been active; therefore, there seems not to be the need of pushing for more innovative PPP models. The same applies to net-metering in private facilities.

There are however, market segments in which more sophisticated business models may be explored even in small size facilities.

- One specific case is needed to develop the RES-E potential (mostly hydropower) in hands of the state; there is a lot of RES-E small potentials in facilities/lands owned by the Irrigation department or the Mahaweli Authority. One option is to enter into Performance-linked Revenue Sharing agreements. Under this scheme, the project developer (to be chosen in a transparent way (tendering procedure) will design and build the facility but different from other traditional approaches, the project developer will receive a portion of his EPC cost on achieving successful commercial operation and the rest of his payment as a share of revenue over the life of the project jointly with O&M. Both payments, O&M expenses and deferred EPC cost payment will be linked to performance criteria depending on the technology (i.e. availability for hydropower plants). The ownership of the plant will be in hand of the corresponding public organization but the operation may be separate or private.
- In order to set a suitable framework, through cutting edge PPP schemes, to tap this hydro potential in Sri Lanka, bundling of irrigation projects is proposed. Under this scheme relevant irrigation authority would select a number of projects (with a total capacity around 10 MW) which will be grouped and tendered together.
- On the other hand, where these projects do not reach relevant volume , they will be developed under traditional FIT and conventional PPP schemes such as BT/BOT.
- Another case is required to foster net-metering in public facilities (buildings, sanitation facilities, schools, etc). Net-metering in public facilities (basically solar PV) will not be developed naturally (even if economically convenient) as in private facilities, unless a specific business model is designed and implemented by the competent authorities. One potential alternative is conceptually similar to the scheme described above, in which the project developer will design and build the facility but it will receive a portion of his EPC cost on achieving successful commercial operation and the rest of his payment as a share of revenue over the life of the project, jointly with O&M linked to performance criteria (i.e. average annual generation per square metre of rooftop/land used). The main difference is that the criteria for selecting the developer should be based on a tendering procedure in which the winner is the one who has bid the highest rental per square metre of rooftop/land.

Regarding small scale facilities, SLSEA should undertake promotional projects (similar to the Magampura in Hambantota solar plant), in collaboration with MOPE and through government owned entities such as CEB. Specially, to serve CEB consumers in inhabited islands who do not have continuous power following a RERED-like approach. Even when internationally more sophisticated approaches can be found (i.e. off-grid concessions), the scale of the off-grid facilities needed in Sri Lanka does not make sense to look for more complex schemes.

Private sector can participate directly up to 25 MW, CEB or other state-owned companies can participate keeping full ownership (through traditional PPP arrangements such DBT, BOT, etc) or entering into JV with private participants (with/out a controlling share). There is nothing that impedes this type of approach to be implemented in Sri Lanka and further economies of scale for RES-E facilities with capacity over 25 MW are envisaged.

As we are dealing with WPPs and SPPs, this consultant agrees with the initial recommendation provided by the consultant analysing business models for Mannar WPPs, in the sense that for economic and commercial reasons, to limit the project up to 25 MW each may have a lot of advantages, such as:

- More competition among developers. This is extremely critical for the success of a promotion policy based a tendering mechanism.
- Manageable size to encourage local developers
- More diversified financing sources
- Insulation from risk of failure of a large project
- Ability to build capabilities in a wider development community and supply chain
- Limited dis-economies of scale

As we are suggesting to tender projects out (instead of MWs), it would be recommendable that the parks are developed largely by the GoSL agencies (either CEB or SLSEA), and thereafter transferred

to the selected bidder(s) through a bidding process. Developing costs may be paid back up-front or through shares in the project.

In any case, this approach requires some political and policy commitments:

- That private sector can develop RES-E facilities without intervention.
- That CEB – given the still limited level of unbundling – will behave competitively (i.e. it will not unnecessary block the connection to the grid of a private developers or other JV in which CEB is not participating).
- That the tendering will be developed in a fully transparent way.
- That not all the sites have been previously locked by state-owned or private corporations (i.e. all SLSEA permits are in hands of a few players).