

Terms of Reference

Technical Assessment of Sri Lanka's Renewable Resource Based Electricity Generation

1. Introduction:

The Electricity Sector in Sri Lanka. Sri Lanka currently has a traditional state-owned, vertically integrated power utility – the Ceylon Electricity Board (CEB), established in 1969 – that operates under the Ministry of Power and Energy. It generates about 80% of the country's power supply through a mix of hydro and thermal power plants, transmits all generated power and distributes around 85% of this power at the retail level. The balance is distributed by government-owned distribution utility, Lanka Electricity Company Ltd. (LECO), established in 1983 under the Companies Act. A growing number of Independent Power Producers (IPPs) supply around 20% of the total power under Power Purchase Agreements (PPAs) signed with the CEB. The total installed capacity of the generation system is around 2,200 MW including 300 MW of hired emergency power plants. Total installed hydro capacity is 1,150 MW, which contributed 2,588 GWh in 2002, which is considered to be a dry year. The total generation in the year 2002 was 6,810 GWh.

The power sector in Sri Lanka was in crisis due to inadequate new power generation capacity additions and sub optimal usage of fuel sources for power generation. The problems manifested in the form of chronic power shortages that led to procurement of expensive emergency power generation capacity, structural financial deficits in the power sector and unsustainable tariffs that weakens the competitiveness of local industries.

Recognizing the magnitude of the crisis, the Government of Sri Lanka (GOSL) established the Energy Supply Committee (ESC) under a special legislative provision in March 2002. The ESC, chaired by the Secretary to the Ministry of Finance has seven other ex-officio senior public servants as members, is the apex decision making body on power generation capacity procurement and acts as the interim energy regulator pending the establishment of the regulatory body proper. The ESC is also overseeing and guiding the ongoing power sector reform process.

Electricity Reforms. GOSL has embarked on a power sector reform program that will redefine commercial relationships among the industry players, within the framework of a single-buyer model and independent regulation. The reform program would result in separate state-owned electricity generation, transmission and distribution entities. The commercial relationships among the industry players would take place within the framework of a single-buyer model with the transmission company (Transco) acting as an intermediary between the generation and the distribution companies. The distribution assets of CEB and LECO would be divided among the four new distribution companies that are to be set up under the reform process.

The Electricity Reform Act provides for the regulation of the generation, transmission and distribution of electricity. It also provides for the re-organization of the electricity industry by ensuring that the functions of CEB and LECO relating to the generation, transmission (and bulk procurement), distribution and supply of electricity are clearly separated and discharged by separate companies incorporated for such purposes. The administration of the regulatory functions of the Electricity Reform Act is vested in the Public Utilities Commission of Sri Lanka (PUCSL).

Rural Electrification. The average rate of rural electrification of the country stands at around 47% whereas the rate for urban areas is above 80%, against a national rate of 64%. There are about 2 million households in the rural areas to be electrified today. This number will increase with the growing population. Therefore, it is expected that the total number of households to be electrified within the next five years will be approximately 1 million if one is to achieve 75% electrification target within that period.

Though the extension of the main electricity grid is the preferred option for unserved households, there are technical and financial limitations associated with this approach. It is estimated that only about 80% of the households in the country can be finally connected to the main grid due to these limitations. Even to achieve this level of electrification it will take about 10 years and very large investments. Therefore, while recognizing the superior benefits of having grid electricity, it is important to note that about 20% of the country's households can be rationally electrified only through off-grid systems. Even other rural areas may have to be electrified through off-grid systems during the transition period until the main grid penetrates into those areas in the future
(Please see Sri Lanka Rural Electrification Policy document attached).

Renewable Energy. Sri Lanka has a history of enabling local development of least cost renewable energy resources. It has more than 35 MW of grid connected renewable energy systems of which most are mini hydro systems. Nearly two hundred village based micro hydro systems and more than 35,000 solar PV systems for individual homes are also operating. It is estimated that more than fifty organizations with over 2,000 stakeholders are commercially involved in a rapidly growing renewable energy industry, which includes grid-connected, off-grid community and household based renewable energy systems. The stakeholders include micro-finance institutions, commercial and development banks, NGOs, project developers, consultants, and equipment suppliers.

As part of the Government's commitment to further accelerate the use of renewable energy systems as well as to integrate renewable energy within the energy sector, GOSL approved the joint World Bank and the Global Environment Facility (GEF) assisted Renewable Energy for Rural Economic Development (RERED) Project.

RERED Project. Through this project, GOSL, with the assistance of the World Bank and GEF, aims to foster rural economic development and improve the quality of life in rural areas by providing access to electricity, and expand the commercial provision of renewable energy. The executing agency of the RERED Project is the Ministry of Finance. Project co-ordination and management is the responsibility of the Administrative Unit (AU) set up within DFCC Bank.

2. Objective of the Assignment:

In this emerging reform environment and the prospect of a rapidly growing renewable energy industry, the Government is keen to establish a framework that enables the sustained and rational growth of renewable energy services in Sri Lanka. The objective of the assignment is to make a rapid assessment of technical issues including system planning and connectivity issues that could have a bearing on the country's ability to harness its renewable energy potential. The assessment should for example determine whether on-grid non-dispatchable embedded generation capacity has to be within certain limits of dispatchable capacity in order to maintain power and system stability and integrity. The consultant will investigate and assess the absorptive capacity of the transmission and distribution grids for renewable energy systems and propose actions where the limitations could be addressed with reasonable means. The consultant will train suitable officers to undertake such future studies on determining the absorptive capacity.

The assessment will enable policy makers to factor in any technical and system limitations in engaging on-grid renewable energy generation. The assessment will also provide inputs to the proposed development of a national renewable energy policy and implementation framework – The National Policy on Renewable Resource Based Electricity Generation.

3. Scope of Work:

To achieve the above objectives the consultant will address the following scope of work. This is an indicative list and the consultant should not be limited to these tasks, but the overall aim should be to provide meaningful and practical policy recommendations, which are strongly supported by data and analyses.

1. Acquire and briefly document relevant international experience with regard to management of on-grid embedded non-dispatchable generation and technical codes or practices or regulations that restrict the nature and extent of such generation in grid based electricity systems. In particular the consultant is encouraged to review such practices, if any in the systems of the following countries – China, Thailand, India, UK, Denmark, Germany and South Africa.
2. Document the potential technical issues that may arise from the introduction of substantial embedded and distributed on-grid renewable energy generation in the Sri Lankan power system. Investigate and thoroughly assess the absorptive capacity of the transmission and distribution grids for renewable energy systems, in particular, grid-connected mini-hydros, wind and biomass. The issue here is in respect of embedded generators (i.e. power plants connected to the distribution grid (33kV or less) and are non-dispatchable (i.e. not under CEB System Control Centre). In this context, 'absorptive capacity' refers to (i) maximum power plant capacity that can be connected to a particular distribution line, and (ii) total collective capacity of all embedded generators that can be connected to the country network. The consultant will, with the expectation of near term renewable energy site developments, identify the

technical constraints for integration into the grid. This includes the total MWs that can be added to the grid without compromising the stability and reliability of the local and national grid. The methodology used to assess the limitations will be based on internationally accepted standards that for example could be the ones adopted by Denmark, Germany or the UK.

For cases where it is felt that the technical limitations could be addressed within reasonable means, the consultant will propose actions (for example extension of a transmission line or upgrading of a substation).

The consultant will assess CEB's existing software for transmission planning and make recommendations as to whether (i) it is sufficient, (ii) it requires enhancement or (iii) new software needs to be procured. Suitable arrangements shall be made to ensure that the training provided by the consultant and the subsequent use of the software are consistent with the package used by the consultant during the assignment. The cost of any software to be procured by CEB for downstream use shall be borne separately and not included in this assignment.

The consultant will train suitable officers (3 to 6 people) to undertake future studies on determining the absorptive capacity.

The assessment should take account of possible sites for location of wind energy, hydro and biomass plants based on available data about resource assessments for these technologies. The assessment will also take note of (i) the possibility of some of this generation being of significant capacity (in the order of 20 MW or more) and being dispatchable, with a possible capacity payment for systems with a high plant factor, (ii) disposition of off-grid village hydro systems and the renewable energy systems connected to the distribution grids in the reform scenario and (iii) optimum and rapid usage/development of hydro, wind and biomass sites.

3. Prepare a discussion paper on the above-mentioned issues and brainstorm these with a group of main stakeholders. These include: both off-grid and grid-connected small power producers, the Small Power Developers Association, Solar Industries Association, Village Hydro Developers Association, other renewable energy organizations (biomass, wind), financiers, AU of the RERED Project, CEB, Ministry of Power and Energy, Ministry of Environment and Natural Resources and other GOSL agencies, and international donor organizations. Summarize the inputs and draw conclusions for the next stage of work.
4. Prepare a final draft report for review and comments and then a final report with analysis and recommendations, incorporating comments provided. The report will include an analysis of likely risks in implementing the recommendations.

4. Team:

The consultancy will be awarded to a firm that can field a team of at least two consultants with each having 8 to 10 years relevant experience on technical and commercial issues relating to system planning/management and load dispatch/management. The participation of a Sri Lankan expert in the team is encouraged so that local knowledge of systems and system conditions are considered in the analysis.

5. Deliverables:

The consultant will deliver the following:

1. Inception report with targets and detailed plan of time bound actions, statement of key issues and first analysis of global practice and any other relevant information;
2. Discussion papers containing assessments, presentations, handouts and background information for consultative workshops/brainstorming sessions, as necessary.
3. Final draft report on technical issues, absorptive capacity, methodology of calculations, corrective steps and training inputs.
4. Final report incorporating review comments and training completion report.