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PROJECT PERFORMANCE ASSESSMENT REPORT

Democratic Socialist Republic of Sri Lanka

RENEWABLE ENERGY FOR RURAL ECONOMIC DEVELOPMENT PROJECT
(IDA-36731 IDA-36730 TF-51248)

June 25, 2014

IEG Public Sector Evaluation
Independent Evaluation Group

Currency Equivalents (annual averages, select years)

Currency Unit = Sri Lankan Rupee (LKR)

2002	US$1.00	LKR96.7
2005	US$1.00	LKR102.0
2010	US$1.00	LKR111.1
2011	US$1.00	LKR113.9
2012	US$1.00	LKR128.2
2013	US$1.00	LKR126.9

Abbreviations and Acronyms

AU	Administrative Unit
DFCC	Development Finance Corporation of Ceylon
GEF	Global Environmental Facility
IDA	International Development Association
IEG	Independent Evaluation Group
IFC	International Finance Corporation
kW	Kilowatt
MW	Megawatt
MWh	Megawatt-Hour
NCRE	Non-Conventional Renewable Energy
PCI	Participating Credit Institution
PUCSL	Public Utilities Commission of Sri Lanka
PV	Photovoltaic
RERED	Renewable Energy for Rural Economic Development (Project)
SEA	Sustainable Energy Authority
SHS	Solar Home System
SPPA	Standardized Power Purchase Agreement
VHP	Village Hydro Project

Fiscal Year

Government: July 1 – June 30

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This report was prepared by Varadarajan Atur, who assessed the project in March 2014. The report was peer reviewed by Raihan Elahi and panel reviewed by Robert Lacey. Romayne Pereira provided administrative support.

Principal Ratings

	ICR*	ICR Review*	PPAR
Outcome	Satisfactory		Satisfactory
Risk to Development Outcome	Negligible to Low		Negligible to Low
Bank Performance	Satisfactory		Moderately Satisfactory
Borrower Performance	Satisfactory		Satisfactory

* The Implementation Completion and Results (ICR) report is a self-evaluation by the responsible Bank department. The ICR Review is an intermediate IEG product that seeks to independently verify the findings of the ICR.

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About this Report

The Independent Evaluation Group assesses the programs and activities of the World Bank for two purposes: first, to ensure the integrity of the Bank's self-evaluation process and to verify that the Bank's work is producing the expected results, and second, to help develop improved directions, policies, and procedures through the dissemination of lessons drawn from experience. As part of this work, IEG annually assesses 20-25 percent of the Bank's lending operations through field work. In selecting operations for assessment, preference is given to those that are innovative, large, or complex; those that are relevant to upcoming studies or country evaluations; those for which Executive Directors or Bank management have requested assessments; and those that are likely to generate important lessons.

To prepare a Project Performance Assessment Report (PPAR), IEG staff examine project files and other documents, visit the borrowing country to discuss the operation with the government, and other in-country stakeholders, and interview Bank staff and other donor agency staff both at headquarters and in local offices as appropriate.

Each PPAR is subject to internal IEG peer review, Panel review, and management approval. Once cleared internally, the PPAR is commented on by the responsible Bank department. The PPAR is also sent to the borrower for review. IEG incorporates both Bank and borrower comments as appropriate, and the borrowers' comments are attached to the document that is sent to the Bank's Board of Executive Directors. After an assessment report has been sent to the Board, it is disclosed to the public.

About the IEG Rating System for Public Sector Evaluations

IEG's use of multiple evaluation methods offers both rigor and a necessary level of flexibility to adapt to lending instrument, project design, or sectoral approach. IEG evaluators all apply the same basic method to arrive at their project ratings. Following is the definition and rating scale used for each evaluation criterion (additional information is available on the IEG website: http://ieg.worldbankgroup.org).

Outcome: The extent to which the operation's major relevant objectives were achieved, or are expected to be achieved, efficiently. The rating has three dimensions: relevance, efficacy, and efficiency. *Relevance* includes relevance of objectives and relevance of design. Relevance of objectives is the extent to which the project's objectives are consistent with the country's current development priorities and with current Bank country and sectoral assistance strategies and corporate goals (expressed in Poverty Reduction Strategy Papers, Country Assistance Strategies, Sector Strategy Papers, Operational Policies). Relevance of design is the extent to which the project's design is consistent with the stated objectives. *Efficacy* is the extent to which the project's objectives were achieved, or are expected to be achieved, taking into account their relative importance. *Efficiency* is the extent to which the project achieved, or is expected to achieve, a return higher than the opportunity cost of capital and benefits at least cost compared to alternatives. The efficiency dimension generally is not applied to adjustment operations. *Possible ratings for Outcome:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

Risk to Development Outcome: The risk, at the time of evaluation, that development outcomes (or expected outcomes) will not be maintained (or realized). *Possible ratings for Risk to Development Outcome:* High, Significant, Moderate, Negligible to Low, Not Evaluable.

Bank Performance: The extent to which services provided by the Bank ensured quality at entry of the operation and supported effective implementation through appropriate supervision (including ensuring adequate transition arrangements for regular operation of supported activities after loan/credit closing, toward the achievement of development outcomes. The rating has two dimensions: quality at entry and quality of supervision. *Possible ratings for Bank Performance:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

Borrower Performance: The extent to which the borrower (including the government and implementing agency or agencies) ensured quality of preparation and implementation, and complied with covenants and agreements, toward the achievement of development outcomes. The rating has two dimensions: government performance and implementing agency(ies) performance. *Possible ratings for Borrower Performance:* Highly Satisfactory, Satisfactory, Moderately Satisfactory, Moderately Unsatisfactory, Unsatisfactory, Highly Unsatisfactory.

Preface

This Project Performance Assessment Report, prepared by the Independent Evaluation Group (IEG), evaluates Sri Lanka's Renewable Energy for Rural Economic Development Project (2002-2011).

The project was approved on January 22, 2002 with an IDA Credit (IDA-36731) and GEF Grant (TF-51248) of US$ 75 million and $8 million respectively. Additional IDA financing of US$ 40 million (IDA-36730) was approved in 2007 to meet the greater than expected demand for financing sub-projects. The final IDA contribution was US$121 million, about 5 percent higher than planned, while the GEF grant was close to the planned amount of US$8 million. The total project cost was US$254 million, about 10 percent higher than the original estimate of US$232 million. The project was restructured twice – first, on October 18, 2010 to reduce the target for the 'off-grid renewables' component from 161,000 units to 113,500; and next on June 16, 2011 to extend the closing date by six months to enable ongoing investments to be completed. The project was closed on December 31, 2011, three and a half years after the originally planned completion date of June 30, 2008.

The project supported the country's priorities for providing sustainable electricity access to its unserved population, especially for improving the quality of life in rural areas, by utilizing off-grid renewable energy technologies and promoting private sector involvement in renewable energy resources for the main grid. The project also sought to reduce atmospheric carbon emission by removing barriers and reducing implementation costs for renewable energy and removing barriers to energy efficiency.

IEG considered several factors in choosing this project for an assessment. Sri Lanka is widely regarded as having made significant progress in improving generation capacity and electricity access over the last decade and as having effectively employed both off-grid and grid-connected renewable energy in the process. In this effort, the role of microfinance institutions and the private sector is particularly noted. Collectively, these efforts are seen to have placed Sri Lanka on the road to universal access to electricity, in sharp contrast to the other large countries in South Asia that lag behind in electrification. The World Bank has played a significant role in supporting the electricity sector in Sri Lanka over the past fifteen years, providing nearly US$300 million for investment, policy reform and technical assistance. Examining the performance of this project can add to our understanding of the Bank's role and effectiveness in supporting Sri Lanka's electricity sector, and can provide valuable feedback for future engagements of a similar nature in this country as well as in other country situations. The findings and lessons from this assessment will also be an important input to the forthcoming IEG evaluation of the World Bank Group's Support for Electricity Access.

IEG prepared this report based on an examination of the relevant Project Appraisal Documents, Implementation Completion and Results Report, legal agreements, project files and archives, as well as other relevant reports, documents, memoranda and working papers. An IEG field mission visited Sri Lanka during March 2014. Discussions were held with Bank staff in Washington, DC and in Colombo, and government and other

officials in Colombo and other locations in the country. The mission discussed the project's experience and the effectiveness of Bank assistance with other stakeholders including the project developers, commercial banks, think tanks, independent consultants, citizens, and the Asian Development Bank. Site visits were undertaken in locations with mini-hydro, community-based micro hydro systems, Solar Home Systems (SHS) in the Ratnapura region.

The mission expresses its appreciation of the generous time and attention given by the Borrower and all concerned parties. A list of persons met by the mission is in Annex D.

Following IEG practice, copies of the draft report were sent to government officials and implementing agencies, and no comments were received.

Summary

This Project Performance Assessment Report assesses the development effectiveness of Sri Lanka's Renewable Energy for Rural Economic Development (RERED) project. The project sought to (i) improve the quality of rural life by utilizing off-grid renewable energy technologies to provide energy services to remote communities; and (ii) promote private sector power generation from renewable energy resources for the main grid. The project also sought to reduce atmospheric carbon emission by removing barriers and reducing implementation costs for renewable energy and improving energy efficiency.

Project performance and ratings

The RERED project helped catalyze and scale up grid-connected and off-grid renewable energy with private sector participation. The project built upon the foundation laid by the Bank's previous Energy Services Delivery project (1997-2003) for Sri Lanka. The project also benefited from the Bank's experience with large renewable energy and energy efficiency projects in Africa and Asia.

The Overall Development Outcome of the project is rated **satisfactory** due to the improvements in social and economic welfare in rural areas through increased electricity access, and from increased private sector activity in renewable energy; as well as the substantial efficiency with which the project was implemented. Risk to development outcome is rated **low** as there is significant on-going private sector activity in renewable energy; and continued use of the majority of solar home systems installed under the project, even alongside newly acquired grid-based electricity. Bank performance is rated **satisfactory** based on generally good quality at entry and quick adaptation to changing project, market, and country circumstances. Borrower performance is rated **satisfactory** due to steady commitment to the project objectives, and sound project implementation.

Lessons

Local participation and involvement, suitably incentivized, is crucial to promoting distributed power generation activities. Active local participation drove the momentum and successful implementation of the 68 mini hydro projects and the 173 community-based micro hydro projects supported by the project. The participation came in the form of local political support and the newly-formed village level electricity consumer societies, which were incentivized by opportunities for selling a part of the generation to the grid through 'net metering'.

Involving the private sector effectively in a decentralized developmental effort requires flexibility in implementation arrangements and space for adapting to market conditions. In spite of past lessons informing the design of the project, almost all major aspects – financing and disbursement parameters, procurement policies and approach, SHS business model – had to undergo modifications to keep up the pace of implementation. Without such adjustments, the project would likely have stalled /failed.

An appropriate feed-in-tariffs policy and its consistent and transparent application are crucial to spur growth of small scale and non-conventional renewable energy

generation. The low transaction costs enabled by attractive feed-in-tariffs crowded in project developers and investors, as well as commercial/investment banks to develop and invest in a variety of distributed generation projects. Market confidence was enhanced by consistent and transparent application of the policy by the regulator / government.

Investments in off-grid electrification could be underutilized or even abandoned in the event of a faster than expected arrival of the electricity grid. To mitigate this, the expansion of the grid should be coordinated with off-grid investments, and, where warranted, the off-grid facilities should be made grid-compatible to ensure their continued utility. In Sri Lanka, as the electricity grid expanded faster than expected, the decreasing necessity and relevance of off-grid electrification was not foreseen early enough, resulting in some off-grid facilities falling into disuse or neglect. This experience points to the need for planning ahead for a coordinated access rollout, and making policy and technical provision for making the off-grid facilities grid-compatible and economically viable.

Caroline Heider
Director-General
Evaluation

1. Background and Context

1.1 Sri Lanka has become a lower middle-income country, with GDP per capita reaching US$3,194 in 2013, putting the country ahead of others in the South Asia region in this respect. The country is shifting from a predominantly rural-based economy to an urban economy oriented around manufacturing and services. Currently, services account for 59 percent of the economy, followed by manufacturing at 30 percent and agriculture at 11 percent. Growth in Sri Lanka has been inclusive, with poverty rates declining dramatically to 9 percent in 2010 from 22 percent in 2002. Moreover, inequality in per capita consumption expenditure has declined as reflected by a drop in the Gini coefficient[1] from 0.40 to 0.36 between 2002 and 2010. Sri Lanka notably outperforms the South Asia average on progress towards meeting the Millennium Development Goals. While South Asia as a whole is on track or is an early achiever for only nine indicators, Sri Lanka manages this for 15 of the 22 Millennium Development Goal indicators. (WDI 2013)

1.2 The end of the civil war in 2009 and a well-educated workforce are expected to facilitate Sri Lanka's economic growth in the coming years. The Government's vision for future development, as presented in its 2010 'Mahinda Chintanaya' – Vision for the Future, has targeted GDP per capita of above US$4,000 by 2016 through sustained real growth of over 8 percent per annum. While economic activity has been mostly private sector driven through strong private consumption and investment, public investment has contributed through large infrastructure projects, including post war reconstruction efforts in the Northern and Eastern provinces. The economy's growth is expected to drive up demand for energy, especially electricity. Energy demand in the industry sector is expected to grow at 3.0 percent through 2035 and electricity demand in particular may see an even higher rate of increase at 5.5 percent per year (ADB 2013), driven also by increasing consumption by households.

POWER SECTOR

1.3 In 2002, nearly 60 percent of the then 19 million population of Sri Lanka had access to electricity and the levels of access varied significantly among regions of the country. The Western Province had about 80 percent access to electricity while other Provinces (e.g. Uva) had less than 30 percent.[2]

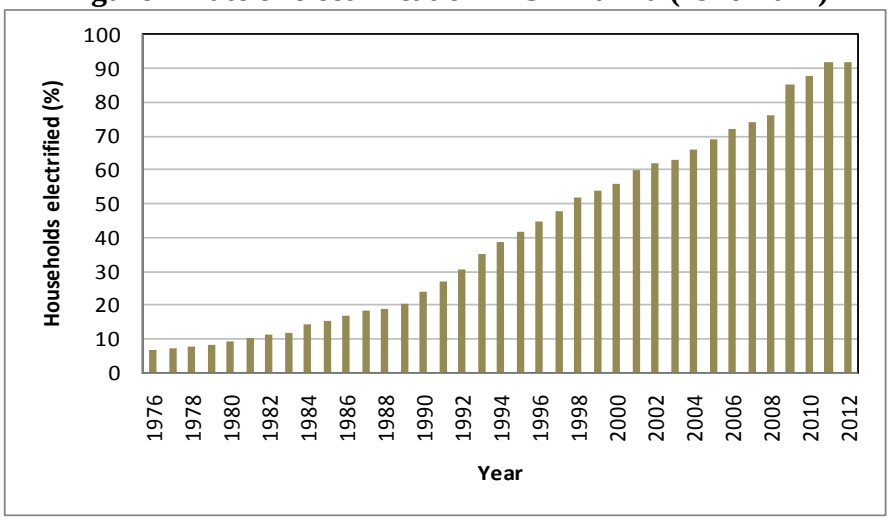
1.4 Recognizing the importance of electrification to the expansion of the economy and for the country's overall development agenda, the Government set a target of 75 percent electrification island-wide by the year 2007, which was achieved with a year's delay in 2008. By end-2012, the access rate had reached 94 percent of households in the country through aggressive grid expansion. The Government plans to provide access to the remaining unconnected population within the next couple of years to reach universal

[1] Gini coefficient measures the degree of inequality in the distribution income in a country. The more nearly equal a country's income distribution, the lower its Gini index

[2] Ministry of Finance; Ministry of Power and Energy.

access status. About 40,000 households in remote areas are identified for off-grid options, including solar, mini-/micro-hydropower.

Figure 2 Rate of electrification in Sri Lanka (1976-2012)



Source: Ceylon Electricity Board

Institutional Structure

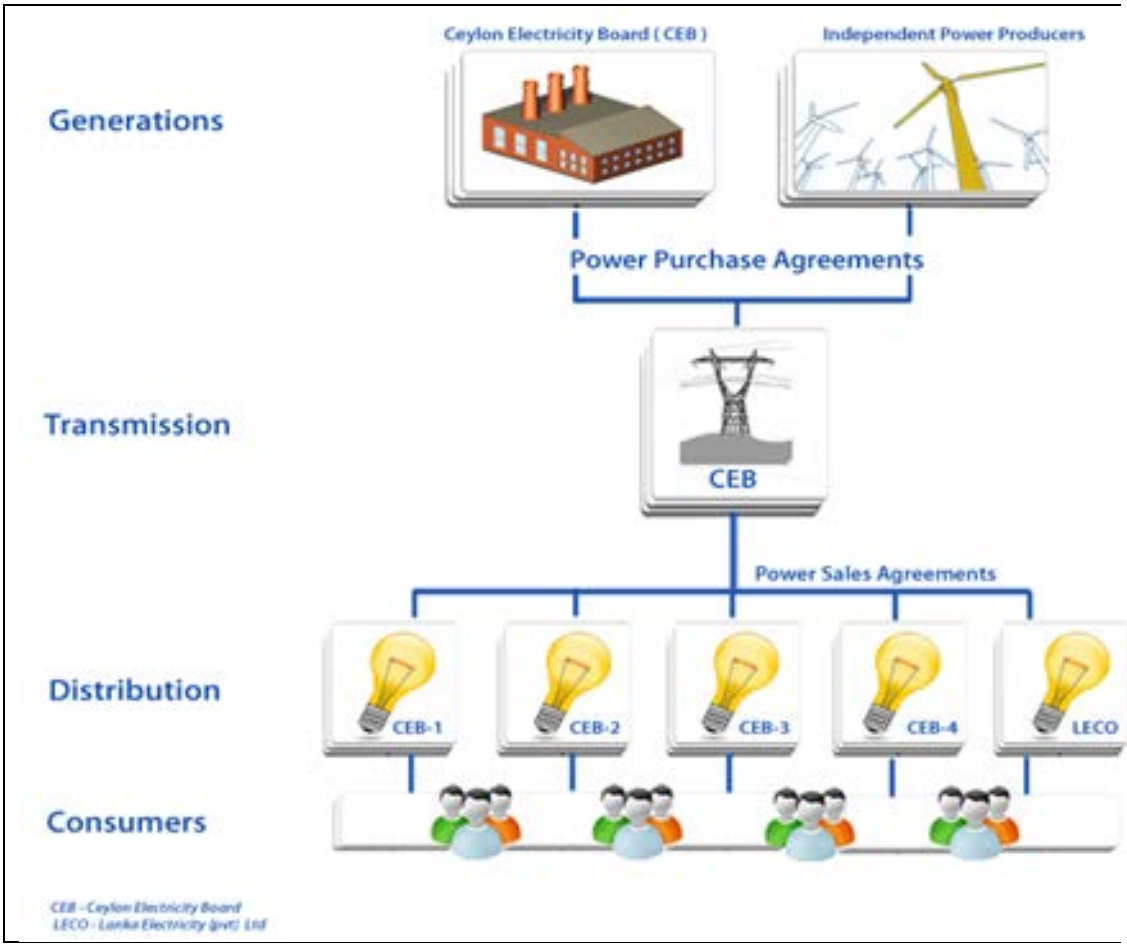
1.5 The Power sector is overseen by the Ministry of Power and Energy (MPE), which is also responsible for policy making. The Ministry of Power and Energy sets policy goals, targets and broad strategies periodically, including the institutional responsibilities for achieving the same. The Sustainable Energy Authority (SEA) was established in 2007 under the Ministry of Power and Energy to plan, promote, facilitate and coordinate the development of non-conventional renewable energy (NCRE, e.g. solar, wind, biomass, mini- and micro-hydro). In 2013, the policy and oversight responsibilities for renewable energy were transferred to the Ministry of Environment and Renewable Energy (MERE); the Sustainable Energy Authority also moved under the MERE.

1.6 The power sector is regulated by the Public Utilities Commission of Sri Lanka (PUCSL). The PUCSL was set up in 2002 under an Act to regulate infrastructure sectors; currently electricity, water and petroleum industries are under the purview and responsibilities of PUCSL. In the power sector, PUCSL has since gradually developed capacity to carry out its responsibilities covering several aspects, namely, consumer protection, tariff setting, dispute resolution, licensing, performance standards, grid code, etc. The PUCSL also set feed-in-tariffs for non-conventional renewable energy, approved standard power purchase agreements and net-metering regulations. These functions are typical and represent the core of regulations for a sector.

1.7 The electricity supply is dominated by the Ceylon Electricity Board, which is a vertically integrated utility responsible for generation, transmission and distribution. The Ceylon Electricity Board is functionally organized into separate generation, transmission and several distribution entities within its corporate structure, which adopt power sales agreements for entity level activity and performance tracking. Among the distribution entities, Ceylon Electricity Board also owns majority shares in the Lanka Electricity

Company (LECO), which is a private limited company established in 1983 to carryout retail sales to certain industry customers and large domestic customers. Lanka Electricity Company distributes about 10% of Ceylon Electricity Board's total sales. In the generation, there are a number of independent power producers (IPPs) who supply to the Ceylon Electricity Board. The Energy Policy of 2008 contemplated unbundling of the Ceylon Electricity Board into separate generation, transmission and several distribution companies and stops short of introducing competition in the electricity market. The schematic of the current industry structure is shown in Figure 2 below.

Figure 2. Structure of the Electricity Industry in Sri Lanka



Source: PUCSL Annual Report, 2012

Demand-Supply Balance

1.8 Sri Lanka is the only country in the region to have installed adequate generation capacity to meet demand. The evolution of demand and supply capacity over the 2000-2012 is summarized in Table 1 below for select years.

Table 1: Evolution of Installed Capacity and Peak Demand (2000-12)

	2000	2005	2010	2011	2012
Installed Capacity (MW)					
Major Hydro	1,137	1,207	1,207	1,207	1,357
Thermal	685	1,115	1,389	1,689	1,695
NCRE	16	89	221	244	315
Total (MW)	1,838	2,411	2,818	3,141	3,368
Maximum Demand (MW)		1,748	1,955	2,163	2,146
Gross Generation (GWh):					
Major Hydro	2,813	3,222	4,988	4,018	2,727
Thermal	3,512	5,339	5,063	6,896	8,416
NCRE	47	282	731	725	735
Total (GWh)	6,372	8,844	10,738	11,628	11,879
Sales (GWh)	5,443	7,253	9,209	9,990	10,407
System losses (%)	14.6%	17.2%	14.2	14.1%	12.4%
Ave. Revenue (LKR/kWh)	4.85	7.99	13.10	13.42	15.73
Ave. Revenue (US cents/kWh)	na	7.83	11.79	11.78	12.27

Source: SEA Statistics (2012)

1.9 Sri Lanka's power supply is heavily reliant on thermal power plants, mostly oil-based. The share of oil-fired power gradually increased from 1995 and quickly reached 54.2 percent in 2000, and has since stayed around 50 percent.[3] Most of the country's hydropower resources have already been developed. The country has no domestic production of coal, crude oil, or natural gas, and as a result all the fossil fuel demand is met through imports. The high reliance on oil-fired power, together with growing international oil prices, has pushed up the cost of electricity generation, whereas the tariff adjustments, though aggressive, lagged the levels required for full-cost recovery. For example, in 2011 and 2012, the average revenue / tariff levels were approximately LKR 2.20/kWh below the level that were necessary for the Ceylon Electricity Board to avoid operating losses[4]. The April-2013 tariff adjustment expected to result in average tariff of LKR 17.73 to 18.60/kWh[5], and hence the 2013 financial outcome for the Ceylon Electricity Board and the sector is expected to be positive.

1.10 In parallel with tariff adjustments, and in response to rising power generation costs, the Government supported the construction and operation of two coal-fired power stations with a total capacity of 1,400 MW, of which 300 MW in the first phase of the Norochcholai coal-fired power plant was already commissioned in 2011; an additional 600 MW of capacity is under construction. Since a large part of the cost is attributed to oil-based generation to meet peak power demand, base load coal power plants are unlikely to lower the overall supply costs significantly, whereas non-conventional renewable energy plants should be able to replace the oil-based peak load power plants, thereby helping lower the costs of supply (see Figure 3 below). On the tariffs side, the average level for 2013 is estimated to exceed US cents 14.0/kWh, the highest in South

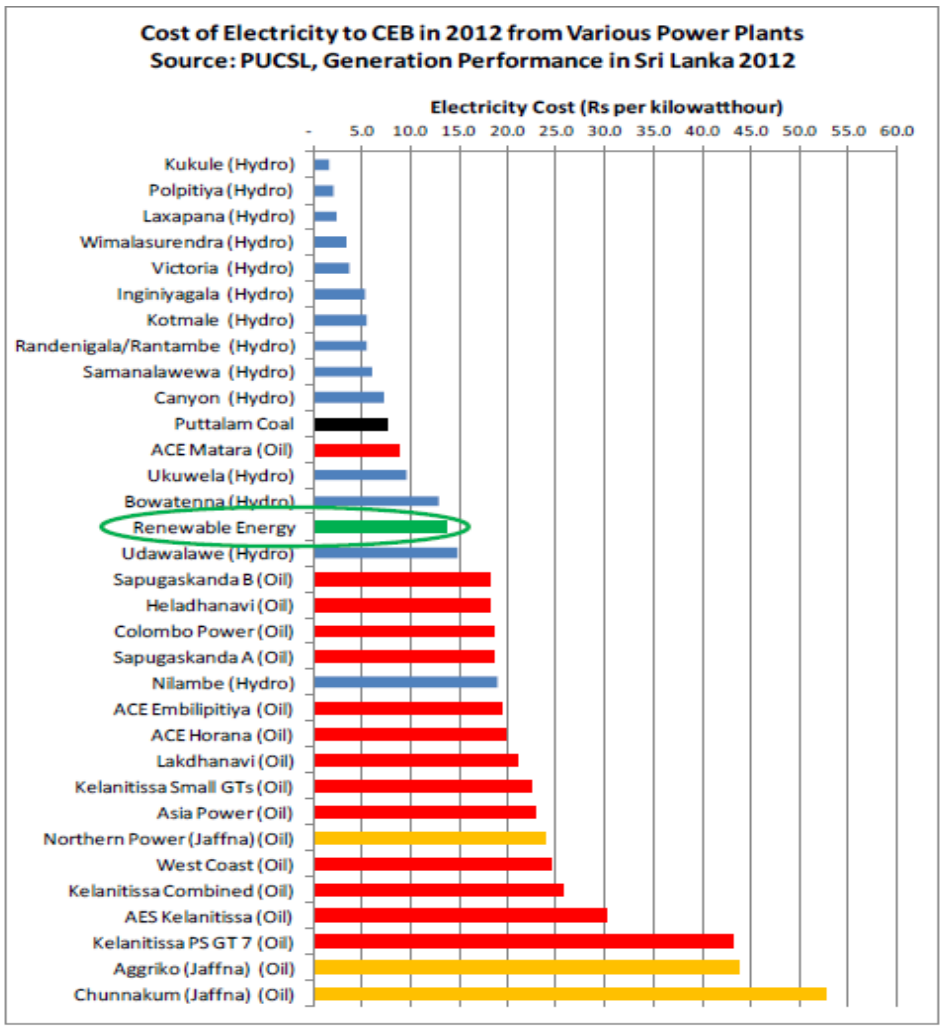
[3] International Energy Agency Statistics; IEA.org

[4] Author's estimate using CEB operating statements

[5] Based on CEB and PUSLK documents

Asia. Increasing further to cover higher fuel costs would likely be difficult for socio-political reasons and Sri Lanka has opportunities to explore and realize cost reduction in electricity supply. Therefore, the growth and diversification of sources of electric power generation that also lower average cost of supply is an urgent issue for Sri Lanka's power sector.

Figure 3: Cost of Power Generation (LKR/kWh) from Various Power Plants



Source: PUCSL

Reliability and Quality of Supply

1.11 Sri Lanka's power system losses (see Table 1 above) indicate an improving trend and the level of losses at about 12.4% in 2012 is not unusually high for a rapidly growing network in developing countries, but could be further improved. According to Enterprise Survey (2011), the number of electrical outages in a typical month stood at 4.1 (compared to 18 for South Asia) and the duration of a typical electrical outage was 1.1 hours (compared to 1.2 in South Asia). This is also corroborated by a survey by World

Economic Forum[6] which showed consistent improvement in quality of electricity supply from 2006 through 2013. The index[7] was at 3.8 in 2006 and improved to 5.0 by 2012.

World Bank Group support for Sri Lanka's electricity sector

1.12 The World Bank has played a significant role in supporting the electricity sector in Sri Lanka over the past two decades providing nearly US$300 million for investment, policy reform and technical assistance. The Energy Services Delivery project (1997-2003) financed by the World Bank and Global Environment Facility (GEF) demonstrated that off-grid systems – such as solar home systems (SHS) and community-level independent grids – were a viable option to serve the population living in remote rural communities where the grid had not reached. It also demonstrated that mini-hydro and other renewable energy technologies such as wind and biomass had potential to contribute to the energy mix in the grid and could add diversity to electricity generation. As renewable energy technologies use indigenous resources, this would lead to a reduction in the import of fossil fuels for power generation. The Energy Services Delivery project had also proven to be a catalyst for engaging the private sector to invest in renewable energy development.

1.13 IFC has contributed through a program called PADGO or Portfolio Approach to Distributed Generation Opportunity. The IFC supported an innovative risk sharing facility with two commercial banks, in combination with advisory services, in supporting small hydro and wind power projects with total installed generation capacity of 65.4MW thus far, enabling 72,000 MT GHG emissions reduction yearly. IFC has also provided direct financing for wind power generation.

1.14 Building upon the earlier Energy Services Delivery project, the RERED project helped scale-up renewable energy with participation of private sector investors and financing in a significant way. Across the stakeholders group, the RERED project remains the pioneer in establishing the framework for private sector led renewable energy development in Sri Lanka, institution and capacity building, and as a catalyst for critical policy development in the sector. Deepening the liquidity in the financial sector for much longer-term financing that is more suitable for financing utility scale renewable energy projects is a pressing need in Sri Lanka. Such financing would not only lower the annuitized tariffs, but also help Sri Lankan project developers to compete with international bidders for such types of power plants, e.g. large solar and wind farms being prepared.

1.15 In the following sections, the RERED project is assessed, followed by lessons drawn from the overall project experience.

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[6] World Economic Forum (WEF): The Global Competitiveness Index data platform. Available at http://www.weforum.org/issues/competitiveness-0/gci2012-data-platform/

[7] The index measured the response to: "How would you assess the quality of electricity supply in your country (lack interruptions and lack of voltage fluctuations)?"[1=insufficient and suffers frequent interruptions; 7=sufficient and reliable].

2. Renewable Energy for Rural Economic Development (RERED) project

Objectives, Design, and their Relevance

OBJECTIVES

2.1 According to the Project Credit Agreement (June 12, 2002), the project development objectives were to (i) improve the quality of rural life by utilizing off-grid renewable energy technologies to provide energy services to remote communities; and (ii) promote private sector power generation from renewable energy resources for the main grid.

2.2 The global environment objective as stated in the Project Appraisal Document was to reduce atmospheric carbon emission by removing barriers and reducing implementation costs for renewable energy and removing barriers to energy efficiency. There is no statement of the global environment objective either in the Project Credit Agreement or the GEF Project Agreement[8] documents.

RELEVANCE OF OBJECTIVES

2.3 ***Relevance of the project development objectives is rated High***. The objectives of the project were highly relevant to Sri Lanka's priorities, the Bank's partnership strategy, and global energy and climate concerns, both at the time of project appraisal and project completion.

2.4 The grid-connected renewable energy development under the project is in line with the Government's October 2006' National Energy Policy and Strategies of Sri Lanka'[9] which sought to: (i) provide basic energy needs; (ii) improve energy security; and (iii) use indigenous resources for these purposes. It is also consistent with the Government's 'Mahinda Chinthanaya – Vision for the Future' which commits to increasing generation from renewable energy (excluding large hydro) to 20 percent of total generation by 2020 corresponding to about 4,000 GWh/year (or approximately 1300 MW in installed capacity). The off-grid effort under the project remains highly relevant to the Government's priorities: to achieve a 100 percent electrification goal, the Government has been investing significantly in network expansion, including off-grid means to electrify roughly 40,000 customers who are "beyond the last mile," and adding new generation capacity.

2.5 While the foundations had been laid for sustainable growth of the renewable energy industry in Sri Lanka – to which the Bank's earlier Energy Services Delivery project had contributed significantly – critical barriers still needed to be addressed to maintain the momentum: the relatively small size of the market; lack of a level-playing

[8] The GEF Project Agreement refers to the "the objectives of the Project as set forth in Schedule 2 to the Development Credit Agreement', but there is no statement to be found there.

[9] Government of Sri Lanka: Gazette Notification No. 1553/10 – June 10, 2008

field for private sector participants; limited access to long term financing with domestic fund mobilization being mainly short term; integrating renewable energy in the country's overall electrification strategy; and establishing a sustainable and transparent basis for subsidies for rural electrification.

2.6 The project continues to be relevant to the latest Country Partnership Strategy (FY2013-16) that supports sustained private and public investment; and improving living and standards and social inclusion. The project was also consistent with the World Bank's Country Assistance Strategy (FY97-99) which included promotion of sustainable private-sector led growth; increasing efficiency in delivery of infrastructure, especially in rural areas; preserving the environment; and working closely with communities and non-Governmental Organizations (NGOs) to generate development solutions. The project objectives were also aligned with the GEF Operational Program 6 which covers promoting renewable energy by removing barriers and reducing implementation costs. The development of grid-connected renewables responds to the 2009 Country Assistance Strategy goals of improving infrastructure provision, improving the business environment for stronger entrepreneurship and knowledge-based economy, and improving economic opportunities in North and East of the country.

DESIGN

2.7 The project financed investments in renewable energy, energy efficiency and demand side management as well as technical assistance to support capacity building and implementation, and M&E surveys.

Component 1. Grid-Connected Renewable Energy Power Generation (At appraisal: US$150.3 million; At completion: US$204.9 million): Continuation of refinancing support for mini-hydro projects provided under the preceding Energy Services Delivery Project, and support for two other commercially available renewable energy sources - wind and biomass, to result in an increase of nearly 85 MW of grid-connected small-scale renewable energy capacity.

- Mini Hydro Projects: In addition to a pipeline of eight projects, totaling 39 MW, in an advanced stage of development, an additional 20-25 MW.
- Wind Projects: Commercialization and up-scaling of wind development, including exploring the possibility of off-shore development. Technical assistance would be provided for business development, feasibility studies, and off-shore resource assessment.
- Biomass: Support the marketing of viable grid-connected biomass projects. Focus initially on small-scale co-generation/gasification projects in the coconut and tea-industry and on larger scale projects with potential biomass plantations. Technical assistance for business development, feasibility studies, and regional trade shows, as well as longer term financing for developers through the Participating Credit Institutions (PCIs). Additional support for pilot biomass gasification investments was to be determined and implemented during the life of the project. Subprojects anticipated were one 8 MW project (coconut-based) and about 4-5 smaller biomass generators in the range of 1-2 MW based on wood waste (from saw mills) and/or new plantations.

Component 2. Solar PV Investments (At appraisal: US$63.7 million; At completion: US$43.7 million): Credit and grant support for solar PV investments for household, commercial, and institutional use to enable the market to become fully commercial. In particular, the Project's proposed refinance, grant, and technical assistance support would seek to solidify the existing middle-range solar home system market and expand service to other applications such as: (i) smaller systems accessible to poor households; and (ii) community applications for health clinics, schools, street lighting, etc. Further capacity building would be provided in respect of micro-finance institutions and other household financing organizations serving limited communities to expand credit access. These measures would enable Sri Lanka to achieve the indicated target of 85,000 solar systems.

Component 3. Independent Grid Systems (At appraisal: US$5.3 million; At completion: US$2.6 million): Support further commercialization of village hydro and other community-based independent grid systems through refinancing and grant support for investments and project preparation support. Additionally, technical assistance would address such issues as daytime electricity use for income generation activities and mechanisms for disposal of assets once an area served by an independent grid is connected to the national system (stranded assets). The status of independent grids within the sector reform agenda would also be emphasized in the broader sector technical assistance. The indicative target was access for 15,000 new households and enterprises through independent grids - village hydro projects, as well as projects based on biomass and other technologies, where feasible.

Component 4. Energy Efficiency and Demand Side Management (DSM) (At appraisal: US$2.0 million; At completion: US$0.3 million): Provide TA and limited credit support for further private sector development for provision of energy efficiency services, including a framework for integrating sustainable implementation of such programs into sector reforms. It was envisioned that responsibility for energy efficiency/demand-side management (DSM)-related policy and regulatory issues, as well as implementation of public-policy type DSM programs would rest with the Government, regulator, or utility, while private sector enterprises such as Energy Service Companies (ESCOs) would implement commercially viable energy efficiency projects.

Component 5. **Cross-sectoral Energy Applications** (At appraisal: US$4.9 million; At completion: US$0.04 million): Provide rural enterprises credit support for larger systems. Provide TA to service institutions for the development of energy, and standardized energy packages to create awareness and to integrate energy provision into improved service delivery. In addition, co-financing support would be provided for investments in selected areas. Commercial/institutional support would include TA aimed at mainstreaming productive applications in off-grid systems. The project sought to connect at least 1,000 institutional and commercial systems, spurring interventions that are critically important in restoring economic development in the country's northern and eastern areas.

Component 6. Technical Assistance (At appraisal: US$5.7 million; At completion: US$2.3 million): In addition to the component-specific assistance described above, technical assistance under the Project was projected for the following activities: project administration/ promotion; subproject promotion/development support; technology/

market introduction/ promotion/capacity building related to renewable energy and energy efficiency; cross-sectoral energy applications; sustainability; and monitoring and evaluation.

2.8 **Additional financing**: Following a mid-term review in 2005, which noted an increase in demand for independent power projects, an additional financing of US$40 million was approved by IDA in 2007.

2.9 **Project Restructuring**: The first restructuring (level 2, implying that project objectives were not changed), which was carried out on October 18, 2010, revised the end-of-project target for component 2 ('off-grid renewables) from 161,000 households, small and medium enterprises and public institutions to 113,500 as recommended by the Ministry of Power and Energy. The Bank considered the reduced target was appropriate given the faster than anticipated pace of grid expansion, which reduced the demand for off-grid renewable solutions. A second restructuring (level 2; June 16, 2011) extended the closing date by 6 months. This was necessary to enable ongoing investments to be completed and to make up for the delay in effectiveness of the Additional Financing credit.

Relevance of Design

2.10 ***Relevance of project design is rated Substantial***. The Project had two distinct objectives, the first to improve the quality of life in rural areas through provision of off-grid electricity, and the other to augment generation capacity for the grid through promoting private sector involvement in renewable energy resources for the main grid. Both the objectives were united by the focus on renewable energy, and on augmenting the available generation capacity in the country. The global development objective of decreasing Greenhouse Gas (GHG) emissions derived from the use of renewable energy to displace fossil fuels.

2.11 In tracing the results chain, provision of off-grid rural electrification was an appropriate choice based on the assessment – at appraisal – of the speed at which the grid was expanding to rural areas. The provision of off-grid electricity would give a jump-start to the rural areas distant from the grid, to experience the expected social and economic benefits from rural electrification. In retrospect, the pace of grid expansion turned out to be much faster than anticipated due to greatly increased emphasis on grid expansion by the Ceylon Electricity Board with the support of Government[10] during the project implementation period.

2.12 Given the limited options for expanding generation capacity (Sri Lanka has low indigenous fossil fuel resources and has exploited most of its large hydro potential) the choice or pursuing new renewable sources (Mini-hydro, Solar, Wind, Biomass) to feed the grid was appropriate, as these would help replace higher cost liquid fuel based power plants. Also, because of the distributed nature of such resources, the potential for local development and savings in GHG emissions was significant.

[10] The AU pointed out that national integration was an important goal pursued by the Government, which also helped faster grid expansion. e.g. during 2008-12, the access increased by nearly 20% (from 75% to 94% of households)

2.13 The inclusion of energy efficiency as a small component was expected to help consumers through reduced consumption and bills, and the utility by rationalizing load management and supply. In retrospect, this component did not fit into the overall design and objective, although a more broad-based intervention would still be necessary to effectively address the issues, institutions and processes for orienting consumer behavior towards energy efficiency, which is also borne out from experience with other Bank projects.

Implementation

Planned vs. Actual Costs

2.14 The project cost at completion was US$254 million, about 10 percent higher than the planned US$232 million. The increase resulted from revised output targets during implementation, and also due to exchange rate variations. Almost all of the additional financing of US$40 million was provided to the grid-connected renewable generation and solar PV components. The two components accounted for about 97.5% of total expenditures. The grid connected hydro and wind power investments incurred about 36% more total costs and corresponding allocation than was envisaged at appraisal.

2.15 The independent grid systems component was relatively small in terms of expenditures (approximately 1 percent). The expenditures under the remaining components were far lower than estimates. The component on cross-sectoral energy applications was not implemented as the greater than expected grid expansion during the project implementation period made these activities either less useful or unnecessary.

Implementation Experience

2.16 The project was approved on June 20, 2002 and became effective as scheduled on October 7, 2002. The project was implemented through an Administrative Unit (AU) located in the DFCC Bank, a commercial entity, which continued the role that it had played under the prior Bank's Energy Services Delivery project. The project was ultimately extended by three and a half years – for reasons explained in the following paras – and closed on December 31, 2011.

2.17 A mid-term review was carried out in September 2005, which noted that the grid-connected renewable energy effort (component 1) was behind schedule, and that the independent grid systems (component 3) were facing constraints. The delays related to dealing with sub-stations that had reached their maximum capacities, obtaining required approvals from the Central Environmental Authority and other agencies, and acquiring land. The mid-term review made recommendations to overcome these constraints, which required the cooperation of the Ceylon Electricity Board and Central Environmental Authority.

Financing terms and procurement issues

2.18 Following remedial actions through the mid-term review, the Participating Credit Institutions encountered problems with refinancing subprojects. As per the participation agreements, a Participating Credit Institution to which refinance had been committed by

the Administrative Unit or AU located in the DFCC Bank, (which was the implementing agency for the project) would face cancelation of the refinance if there was no offtake for 12 months. This long interval increased the prospect of other needy Participating Credit Institutions being blocked from refinance, and leaving them little time to apply after unused funds was released. To address this issue, the Bank and the AU agreed in 2008 to allow refinancing requests on a first-come first-serve basis until the available funds were exhausted. This modified approach resulted in an increase in disbursements and ensured that the IDA Credit would be fully disbursed by the closing date of the project or during the grace period.

2.19 Subsequently, the Participating Credit Institutions found that the interest rate stipulated by the project was not in line with prevailing market interest rates. The original IDA Credit and GEF grant agreement stipulated an interest rate to Participating Credit Institutions that was based on a six-month average of the Average Weighted Deposit Rate (AWDR). After additional financing was approved, this was changed to a blend of AWDR and the Average Weighted Fixed Deposit Rate (AWFDR), with the intention of bringing the interest rates closer to market rates. However, market interest rates began to rise soon after, putting upward pressure on the financing terms for renewable energy project loans, which resulted in a considerable decline in loan applications[11]. Even after market rates began to decline rapidly in the second half of 2009, the refinance was slow to adjust because it was adjusted only every six months. To address this matter, the Bank agreed to speed up this adjustment to three month intervals. This helped to improve the flow of loan applications and financing of sub-projects increased.

2.20 Many project sponsors and Participating Credit Institutions determined that the requirement to use International Competitive Bidding (ICB) procedures for small value projects resulted in delays and sometimes in cost overruns. The thresholds set in 1997 under the previous Energy Services Delivery project were carried over to this project without taking into account the sustainable price increases since then. Hence, the thresholds for the procurement of goods, works, and turnkey contracts was increased in mid-2009 from US$ 2 million, 3 million and 5 million respectively to US$ 6 million, 9 million and 15 million, above which ICB would apply. Both Participating Credit Institutions and project sponsors met by the mission underscored this point and also expressed their appreciation of the Bank's responsiveness in this regard.

Impact of grid expansion on solar PV component

2.21 Under component 2, sales of SHS fell from 2,000 per month in 2005 to 800 per month in 2008. The shrinking of the market was caused by a rapid expansion of the grid during project implementation and by a reduction or cessation of SHS loans from financial institutions as the rate of defaults on loans began to rise sharply. Customers who had purchased SHSs stopped payments when they were connected to the grid, which offered functionally superior energy for their applications and needs. The Participating Credit Institutions could not resell or salvage the repossessed SHSs effectively. Responses to resuscitate this segment such as importing of more cost-effective systems,

[11] Commercial Banks met by the mission indicated that project cash flows were sensitive to interest rates in many cases.

and more radical changes to business model by shifting to cash sales and modification of the sales services networks were unsuccessful. By 2009, the AU and the Bank realized that the targets for solar PV component sales would not materialize, and finally in late 2010 the target for the off-grid renewables component was reduced from 161,000 households, enterprises and institutions to 113,500. Ultimately the number of solar PV vendors fell from 14 to 2[12] due to market forces. The current vendors are supplying SHS systems on a cash basis or providing credit on their own to consumers.

Capacity issues with certain project developers

2.22 Under the component for Independent Grid Systems (component 3) there were issues related to the quality and technical capacity of some of the village hydro developers and equipment suppliers. Project preparation grants were made available for village hydro projects, to be released in instalments on reaching agreed milestones. The Participating Credit Institutions found that many such grants made initially were not resulting in timely project preparation activities and/or viable projects. This matter was addressed through the introduction of a pre-qualification process for all village hydro developers and suppliers, mandatory testing of equipment prior to installation, and stricter oversight. This led to better utilization of grant funds, fewer number of incomplete projects and overall, a more efficient implementation of the village hydro component, as noted by the AU.

Poor uptake of energy efficiency and cross-sectoral energy applications

2.23 There was little demand for Energy Efficiency and DSM (component 4) which sought to support energy efficiency sub-projects and awareness campaigns. The main reason for this was that the Environmental Friendly Solutions Fund (E-Friends) supported by Japan International Cooperation Agency, offered similar support at better terms than the Bank. The AU decided to focus its attention on the more significant components with potentially larger impacts on the achievement of the project development objectives and the global environmental objectives. However, the allocation to this component was increased by US$0.5 million at the time of additional financing.

2.24 The cross-sectoral energy applications (Component 5) also had limited demand. The grid was expanding rapidly and most rural public institutions such as schools and hospitals were gaining access to grid electricity and, as such, a long term renewable energy-based solution was not a priority. AU also did not push this component and devoted its attention to the main (larger) components, namely 1 and 2. The allocation to this component was unchanged at the time of additional financing.

Counterpart funding by Government

2.25 During project implementation, the Government requested that the percentage of expenditures financed for the technical assistance categories of the IDA Credit and GEF Grant be increased to 100 percent. This was due to the difficult fiscal situation at that

[12] One microfinance and guarantee company (Sarvodaya) and a solar company (Wisdom Solar) have been resilient and indicated their resolve to capture the remaining off-grid market, especially in the northern region of the country. They also indicated the prospects for expanding solar street lighting with municipalities.

time which was further aggravated by the global economic crisis. At the height of the military conflict, solar subsidy payments were delayed by the Government, resulting in severe cash flow problems to SHS vendors. This often resulted in payment delays to suppliers and reputational risks for the Bank. The increased financing facilitated the implementation of a critical technical assessment of the power grid absorption capacity as well as capacity building activities and other technical assistance geared towards scaling-up investments in new renewable energy technologies such as wind and biomass. The increase in expenditures was covered by a reallocation of non-utilized funds from other categories.

Restructuring and additional financing

2.26 The Bank was generally responsive to the emerging implementation issues and helped resolve them as noted above. The Bank also responded with additional financing of US$40 million to scale up the components in demand. With an average gestation period of about two years from inception to commissioning, the Bank also approved a three-year extension to the closing date (up to June 30, 2011) to allow sufficient time for the additional financing credit to be committed and disbursed.

2.27 A second project restructuring was carried out in June 2011 to extend the closing date further by 6-months to December 31, 2011. This was partly to make up for the delay in effectiveness of the Additional Financing credit, and generally to allow activities that were under implementation to be completed and to ensure satisfactory closure of the project.

2.28 **Safeguards**. The project was placed in Category B under the Bank's environmental and social safeguard policies. The proposed project was expected to yield net positive environmental effects. The off-grid electrification sub-projects would reduce use of kerosene and lead-acid automotive batteries. No significant negative impacts were expected from the run-of-river village-hydro projects, as demonstrated by the 20 existing village hydro projects. Because of their small size, the grid-connected mini-hydro sub-projects were also unlikely to cause significant environmental damage. No resettlement was envisioned because the project did not involve land acquisition with settlements.

2.29 IDA had required prior review of: (i) all biomass projects; (ii) mini-hydro projects with a capacity of more than 5 MW; (iii) wind projects with a capacity of more than 10 MW; (iv) all projects involving land acquisition and/or resettlement; and (v) the first two environmental assessments of each Participating Credit Institution for mini hydro, biomass and wind power projects. Mini-hydro subprojects would be reviewed by the Central Environment Authority for compliance with environmental policies. Participating credit institutions would ensure that project sponsors obtain GOSL and IDA-mandated environmental clearances, where necessary.

2.30 Discussions with the project's task team during the PPAR mission confirm that the AU followed these procedures diligently. In addition, the AU contracted consultants to conduct environmental and social assessments of every grid connected sub-project before approval, and on a sample basis after commissioning, which also included site visits. Based on these assessments, two projects were denied refinancing because of non-

compliance with environmental safeguards. An environmental review for a Pilot Wind Farm confirmed that it would have minimal environmental impacts, entailed no relocation of local population and would be located more than one mile outside the Bundala and Yala wildlife reserves. Overall, the task team reports that the project was in compliance with the Bank's environmental and social safeguards requirements.

2.31 The discussions with the Participating Credit Institutions indicated that the project had enabled their institutions to develop knowledge, skills and approach to handling safeguards issues in energy projects. One wind project sponsor felt that the paper work involved due to specific requirements of World Bank over and above the government regulations and requirements was excessive.

2.32 **Financial Management**. The AU had well-established procedures for approval of disbursements of loan and grant resources and adequate financial management (FM) staff with sufficient capacity to undertake those responsibilities. Participating credit institutions were required to submit refinancing application packages comprising a complete set of documents. The Refinance disbursements were made only after providing proof that Participating Credit Institutions had already disbursed their loans to developers and such funds were utilized for the stated purpose. Co-financing grants were disbursed on submission of proof of installation. Other grant payments were generally based on reaching specified verifiable milestones. Verification of installation of SHS was carried out on a sample basis. The Task team reports that these verifications did not find any indication of unjustified payment requests. The AU kept detailed records on all payments made. To ensure adequate fiduciary controls, IDA reviewed: (i) the first two refinancing requests, irrespective of size, submitted by each Participating Credit Institution; (ii) refinancing applications above US$ 3.5 million; (iii) each Participating Credit Institution's first solar home system refinancing request; (iv) each Participating Credit Institution's first grid-connected hydro, wind and biomass refinancing request; and (v) each Participating Credit Institution's first village based hydro, wind and biomass refinancing request. The task team confirmed that there were no qualified audits.

Achievement of the Objectives

OBJECTIVE 1: IMPROVE THE QUALITY OF RURAL LIFE BY UTILIZING OFF-GRID RENEWABLE ENERGY TECHNOLOGIES TO PROVIDE ENERGY SERVICES TO REMOTE COMMUNITIES. *Rated Substantial*.

Outputs

2.33 The original target formulated at appraisal was to provide 161,000 households, rural small and medium enterprises and public institutions access to electricity services through off-grid renewable energy schemes. In the following years, a greatly increased emphasis on grid expansion by the Government resulted in an increase of grid connected domestic customers from 2.82 million in 2004 to 3.96 million by 2010 – an increase of 1.14 million. Presently, grid electrification now serves 94 percent of households making off-grid less relevant than originally anticipated at Project Appraisal. In response to these developments, the target was reduced to 113,500 based on the forecast demand for off-grid electrification. The final accounting for off-grid electrification showed that the

project had provided access to electricity to 110,575 households through the sales of SHS while 6,220 households were electrified through independent grid systems, mainly village hydro. In total the project provided 116,795 households access to electricity, which exceeded the revised target by a small margin.

2.34 Of the 110,575 SHS sold to rural households an estimated 20,000 had to be repossessed because households defaulted on their loans. In general, the Participating Credit Institutions only repossessed the modules which were deemed as their only collateral. The value of the repossessed modules was insufficient to recover the outstanding balance. Further, a small number of SHS and village hydro systems are no longer used because the households have since been connected to the electricity grid. On the other hand, while several village systems have now been connected to the grid, under a net-metering scheme similar to a Standardized Power Purchase Agreement but for smaller systems, the off-grid village systems connected to the grid can now sell power to the utility at an agreed tariff. This is a win-win situation for the village-communities who have invested money and sweat equity into their off-grid systems as they can now benefit from the reliability of the national grid, while continuing to earn revenues from the sale of electricity generated by their village hydro schemes back to the utility at an agreed tariff. Following the pilot scheme adopted by a village hydro (21 kW at Athuraliya village in Ratnapura), net metering spurred the growth of distributed renewable energy projects.

Outcomes

2.35 Feedback to the IEG mission from beneficiaries in the field confirms that access to electricity for the first time – both from SHS and the grid – has had a transforming effect on their lives. The more significant impacts on the quality of life appear to have come from better lighting and use of television, even though newly electrified households and small businesses activities have indicated little improvements in income.

2.36 The Bank team attempted to capture outcome data for the project during implementation through surveying 1,500 households, small/medium enterprises and public institutions targeted for electrification from the original IDA Credit (1,000) and the Additional Financing (500). The results of the surveys are summarized in the "Completion Report" which reports on achievements in the period September 2004 to September 2008.[13]

2.37 The surveys had found that even in small quantities, electricity consumption brings about significant lifestyle changes in families, mainly by making home life more convenient and housework easier. One finding from the surveys, which was confirmed by this mission's conversations with beneficiaries, is that while access to electricity does not reduce the overall work load of women, it makes their work easier. Off-grid electricity is also extensively used for watching television, leading to more awareness of the outside world, in addition to providing entertainment. This is considered the next highest benefit of electricity as it serves to bring remote rural communities closer to the outside world.

[13] Resources Development Consultants (Pvt) Ltd.: Monitoring and Evaluation of the Renewable Energy for Rural Development Project. September 2004 - September 2008. Completion Report submitted to RERED AU.

Further, the level of social interaction within households and communities increase with electricity, which contributes in numerous ways to social capital development. Men spent more time with the family (80 percent of the respondents in surveys) and reduced time spent outside of the house including alcohol consumption in the evening (20 percent of respondents).

2.38 One home owner conveyed that the lighting has given a feeling of safety for her and her children. This point was also found in the survey when villagers reported that they feel safer (60 – 87 percent of the respondents of different surveys) and an increase in socio-cultural activities resulting from the presence of electricity at religious places in the villages (80 percent of the respondents). The use of computers was also observed in a few houses electrified by village hydro schemes.

2.39 Contrary to expectation, the availability of electricity did not stimulate the development of new enterprises. However, it improved operation of existing enterprises. According to reports from Participating Credit Institutions and consultants, access to electricity improved economic activities of 742 (household) enterprises or 0.6% of total number of electrified households. Economic activities that benefited from access to electricity include grocery shops, bakeries, battery-charging stations, communication centers, computer training centers, grinding/rice milling and cinnamon processing.

2.40 Not all rural households using off-grid schemes have benefitted from the expansion of the national grid as approximately 40,000 households are expected to still remain without access to the national grid (including some who are on small islands.) This is in addition to thousands who are still using off-grid schemes or other means such as kerosene for lighting today. However, for those who have benefitted from faster than anticipated grid expansion this was a positive development as it provides a higher level of services and is more affordable for households. Off-grid electricity supply provided access to electricity several years before the arrival of the grid to their communities, and for those households who have yet to receive grid power; the off-grid schemes are still very much valued. On the whole, off-grid installations under the project have demonstrated that SHS and/or independent mini grids are a viable option for rural areas where the cost of grid extension would be prohibitive for the utility.

OBJECTIVE 2: PROMOTE PRIVATE SECTOR POWER GENERATION FROM RENEWABLE ENERGY RESOURCES FOR THE MAIN GRID. *RATED HIGH.*

Outputs

2.41 The target for this objective was the installation of 135 MW of small-scale renewable grid-connected power generation capacity (85 MW at appraisal and 50 MW added under the Additional Financing). At completion, the project had supported the installation of about 185.3 MW grid-connected renewable energy sub-projects. This included 2 wind projects (19.8 MW total capacity), 1 biomass project (1 MW capacity) and 68 mini hydro projects (164.5 MW of total capacity). All of these projects are reported to be functioning with the exception of the lone biomass project which stopped operations due to difficulties with fuel supply. All these projects were promoted by

private sector developers, using loans provided by commercial banks participating in RERED. The Participating Credit Institutions extended loans totaling US$ 122 million (LKR 12.84 billion), which is on average 59.5% of total project cost. The total investment was about US$ 205 million (LKR 21.55 billion).

2.42 As of end-2013, there were 146 non-conventional renewable energy projects commissioned. The total installed capacity from those was 367.3 MW of which about 271 MW (~74%) were mini hydropower based. In addition, there is a pipeline of about 73 projects for which a Standardized Power Purchase Agreement has been signed between private developers and the Ceylon Electricity Board, and are expected to add about 246 MW when completed. The total energy generated during 2013 from non-conventional renewable energy capacity was 1169 GWh, which is about 9.6% of total generation. Please see Annex C for details.

Outcomes

2.43 Since the close of the project, investments in new projects have continued as evidenced by the pipeline of projects mentioned in para 2.42. Developers have shown a continued desire to undertake private investment in renewable energy generation even after support from the project has ceased, since commercial banks continue to finance these investments. Sources of funds include private equity, funds raised through stock markets, foreign equity investors and support from a small IFC loan guarantee facility. The Participating Credit Institutions and IFC indicated to the mission that the project had helped create the momentum for non-conventional renewable energy projects in the country and that there is now competition among banks and investors to invest in these projects.

2.44 Feedback to the mission from government officials, Participating Credit Institutions and developers suggests that the project was instrumental in developing a vibrant renewable energy industry in Sri Lanka. Greater demand for support services is noted, including project development, technical design, construction, equipment manufacturing, and financing, though no specific data was available in this regard. The project has contributed to the formation of several developer associations, including for solar, wind, village hydro and small hydropower. The IEG mission met with select developer associations that continue to be active today and play an important role in representing their industry in government, regulatory and other consultations. The collective feedback from government officials, Participating Credit Institutions and developers supports the claim that Sri Lanka now has a viable renewable energy industry. A significant number of developers, manufacturers, and financiers are venturing abroad to undertake investments in renewable energy projects in other countries in Asia and Africa. A few examples include: five Sri Lankan mini hydro developers are now active in East Asia; Lanka Ventures, an equity financier, is investing in mini hydro projects in East Africa; VS Hydro undertakes its own contracting and manufacturing of turbines in Sri Lanka and has investments in Uganda, Tanzania and Kenya. An 18 MW plant in Uganda uses three 6 MW turbines manufactured in Sri Lanka.

2.45 The AU and the Sustainable Energy Authority noted the value added from several technical assistance initiatives under the project. The regulatory agency (Public Utilities

Commission of Sri Lanka) noted that the project had enabled a better understanding of structuring Power Purchase Agreements. Across the stakeholder groups, the project is credited to have enabled knowledge sharing through periodic consultative meetings, which were reported to have helped many project sponsors and Participating Credit Institutions to fine tune their activities and interventions. One independent consultant and energy expert noted that this was effective because of the relatively higher level of skills and absorption capacity among institutions in Sri Lanka.

2.46 As a result of increased renewable energy activity, rural communities have benefitted from both temporary and long-term employment opportunities from construction and operations of the sub-projects and overall improved infrastructure as Government has undertaken construction of new roads and/or repair of existing ones to facilitate the construction activities for some of these sub-projects. A number of villages benefitted from piped water supply, construction of houses, school facilities, community centers and improved facilities at places of worship. Developers carried out these improvements mainly to create goodwill among the villagers, while some were done as compensation payments to the villagers.

GLOBAL ENVIRONMENTAL OBJECTIVE

GLOBAL ENVIRONMENTAL OBJECTIVE: TO REDUCE ATMOSPHERIC CARBON EMISSION BY REMOVING BARRIERS AND REDUCING IMPLEMENTATION COSTS FOR RENEWABLE ENERGY AND REMOVING BARRIERS TO ENERGY EFFICIENCY.

2.47 The indicators for achieving the global environmental objective were: (i) avoiding emissions of 1.25 million tons of CO2; and (ii) promotion of the adoption of renewable energy by removing market barriers and reducing implementation cost.

2.48 The team's estimates of CO2 avoidance are straightforward and credible. Assuming an average carbon emission coefficient for Sri Lanka of 0.8 kgCO2/kWh[14], the resulting avoided emissions of sub-projects commissioned to date is 1.84 million tons CO2; surpassing the target of 1.25 million tons of CO2 by 47 percent (the quantifiable indicator was not increased with the additional financing). By estimating the total expected generation from all plants commissioned in 2012 or those expected to be commissioned by year's end, the volume of avoided CO2 emissions would be 2.15 million. The avoided emissions are calculated from the actual renewable electricity production and conservative estimates for the total annual electricity generation over the lifetime of the sub-projects. The resulting reduction in carbon emissions can also be attributed to the off-grid schemes as well, though these are far smaller in volume than emissions avoided from the grid-connected sub- projects. The coefficients used for estimates of CO2 evidence at appraisal continue to be valid at present. Ongoing activity in grid-connected renewables and off-grid renewables following project completion continues to add proportionately to CO2 avoidance.

[14] This value is for marginal power plants which are diesel and fuel oil based, and can be displaced by the new renewables financed under the project.

2.49 The design of the project also included an engagement on energy efficiency through a small component; however, the limited resources allocated for energy efficiency and demand-side management (DSM) (US$ 2 million equivalent or 0.9% of the total financing) made a significant impact unlikely. Moreover, a low interest credit line for energy efficiency extended by the Japan International Cooperation Agency (JICA) made RERED funds far less attractive. The project therefore did not result in any direct CO2 reductions from the energy efficiency and DSM component.

2.50 The removal of market barriers is evident from the additional installed capacity of grid-connected renewable energy, improved all-round sector capacity, and viable private sector activity in this area as describe in the discussion under objective 2 above. In contrast to the situation prior to the project there is now far greater familiarity and willingness to lend by commercial banks for grid-connected renewable energy projects and the Ceylon Electricity Board is far more oriented to purchasing electricity from grid-connected renewable energy plants.

Efficiency

2.51 ***The efficiency of the project in meeting its objectives is rated Substantial***. The economic and financial analysis was based on representative stylized sub-projects from the feasibility study at appraisal, compared with actual projects' data at close. Under the financial intermediary mode followed by this project, the verification of the financial viability of the sub-projects within the feed-in tariff regime was the responsibility of the lending commercial banks which also bore the full credit risk of the sub-projects.

2.52 *Mini-hydropower plants.* Grid-connected mini- and micro-hydropower plants were the dominant investment in the "grid-tied" component. A mini hydro sub-project was used as a representative project for the economic and financial analyses. Post completion, the Economic Internal Rate of Return (EIRR) was 46 percent for a representative 2.5 MW mini hydro plant with an investment cost of US$1,445/kW, a plant factor[15] of 38 percent and an avoided cost of US$0.252/kWh based on Short-Run Marginal Cost (SRMC) of highest cost thermal plants offset by the mini hydro generation. The economic analysis at Appraisal for a 1.5 MW mini hydro plant showed an EIRR of 24 percent. The higher EIRR is attributed to the higher avoided cost even though plant factor was lower and investment cost higher than at appraisal.

2.53 *Solar Home Systems*. Households using a SHS save on kerosene for lighting and batteries and receive far superior and safer lighting services from electric lighting compared to kerosene lighting. Based on a 40 Wp SHS for a representative analysis, the ICR estimated the EIRR at 88 percent when consumer surplus (attributed to the far superior electric lighting) is considered and 13 percent if consumer surplus is disregarded. There was no EIRR calculated at appraisal for this component. However, since about 20,000 SHSs were not used by beneficiaries (which is about 18% of all SHSs), spreading the cost of these over the remainder of the SHSs should reduce the EIRR.

[15] The ratio of the average power load of a plant to its rated capacity

2.54 *Village hydro plants*. A village hydro plant saves kerosene for lighting and batteries as well as providing far superior and safer electric lighting services compared to kerosene lighting. Beyond meeting households' basic electricity needs, they have the potential to meet other electricity needs in the community such as ironing, water pumping, and power for small enterprises. The EIRR of a representative sub-project was calculated taking into account only savings due to avoided kerosene and battery use as well as consumer surplus gained from using superior electric lighting. The EIRR for a representative sub-project with a capacity of 8 kW and serving 30 households is 54 percent when consumer surplus is considered and 9 percent if consumer surplus was not considered. In comparison, the EIRR of a typical village hydro sub-project was reported as 12 percent at Appraisal.

2.55 The project cost increase of 10 percent (US$254 million vs. the original estimate of US$232 million) is in line with the significant upward revision and achievement of targets for grid-connected renewable energy, while noting the decrease in targets and achievements for SHS. The time overrun of three and a half years on top of the originally planned six and a half years implementation period was due to the increased targets and achievements, and the adjustments that were appropriately made in response to intervening political, financial and market conditions. As noted in the mid-term review, there were also delays in activities relating to overloaded substations on the part of the Ceylon Electricity Board and granting required approvals by the Sustainable Energy Authority that also contributed to the delay. Taking all these factors into consideration, efficiency is rated substantial.

Ratings

OUTCOMES

2.56 **Overall project development outcome is rated *Satisfactory***. Relevance of the project development objective is rated **high** because of Sri Lanka' priority and the Bank's supportive strategy to contribute to rural well-being through improved provision of electricity access and to reduce dependence on imported fossil fuels as a source of electricity. Relevance of the project's design is rated **high** because of its logical approach of leveraging renewable energy sources for both off-grid and grid-connected provision of electricity to improve access and therefore positively impact beneficiaries, especially in rural areas, while displacing the use of fossil fuels. The Efficacy of the first objective of improving the quality of rural life through off-grid renewable technologies is rated **substantial** due to significant outcomes from the spread of SHS in unserved rural areas, though this process was overtaken to some extent by the parallel advance of the electricity grid. The second objective of promoting private sector power generation from renewable energy resources is rated ***high*** from the higher greater than expected achievements from various renewable energy sources. Efficiency of the project is rated ***substantial*** (rather than *high*) mainly due to the avoidable causes that contributed to the significant time overrun, even though the economic rate of returns are very favorable. Overall Development Outcome of the project is rated **satisfactory** based on the ratings for relevance, efficacy and efficiency.

2.57 ***Global environment outcome***. CO2 emission reductions were greater than expected due the significant lowering of market barriers to renewable energy development and the overall achievement of renewable energy under the project being greater than originally planned.

RISK TO DEVELOPMENT OUTCOME

2.58 The risk to the improved quality of life from utilizing off-grid renewable energy technologies to bring electricity to remote communities is considered low. Also, the risk of communities no longer using the off-grid renewable energy technologies for reasons other than the arrival of the grid is low. Once the users have experienced the benefits of off-grid electrification they are seen to make considerable efforts to maintain this service. In many cases, the off-grid options may be maintained as a back-up or to reduce the grid electricity bill.

2.59 At Appraisal, the Governments' rural electrification policy envisaged that 20 percent of the population would remain reliant on off-grid electricity supply. At present, the Government expects to achieve full electrification by 2016, of which a relatively low number of 40,000 households would have to be served by off-grid means. The Government also targets a share in generation capacity for non-conventional renewable of 15 percent by 2015 and 20 percent by 2020. By 2013, the generation from non-conventional renewable energy sources had reached about 9.6 percent. Apart from the numerical targets, further addition of non-conventional renewable energy is critical for managing the peak load demand as well as replacing expensive oil-based power plants, thereby lowering the average costs of generation. Hence the sustainability of the project's outputs and outcomes are very important to the sector's developmental priorities.

Role and support of Ceylon Electricity Board

2.60 Stakeholders expressed mixed views to the mission about the Ceylon Electricity Board's active support for grid-connected renewable energy, mainly attributing this to a lack of consensus among its key constituents and management. However, there are signs that the Ceylon Electricity Board has emerged from its earlier reluctance towards grid-connected renewable energy. For instance, the Ceylon Electricity Board has acknowledged that power purchased from small renewable energy plants had saved the utility LKR 2 billion in electricity generation costs in 2010 through reduced expenditure on imported heavy fuel oil and other fossil fuels. Following the April 2013 tariff adjustments, the Ceylon Electricity Board estimates show that its average selling price could exceed the average purchase cost of energy from non-conventional renewable energy. Ceylon Electricity Board's projections indicate that non-conventional renewable energy would be a viable option to pursue in supply cost reduction. Please see Annex C for details. Project developers and the Ceylon Electricity Board both have a mutual interest in maximizing renewable energy production, particularly to minimize use of imported fossil fuel as the alternative for electricity generation.

Continuing financing for NCRE projects

2.61 One major criterion for measuring the impact of this project is the continued lending for renewable energy projects by commercial banks and the initial findings post project completion are very encouraging. As noted (in para 2.42) 73 new projects are in the pipeline and would add another 246 MW to non-conventional renewable energy capacity in the country.

2.62 Small hydro development is now considered a commercially viable activity by Participating Credit Institutions and developers. Sufficient technical expertise for this purpose exists within the country. All this is borne out by the large number of mini hydro projects in the pipeline. However, development of village hydro without the type of support provided by this project is unlikely while the need is also declining due to rapid grid expansion. Developers active in village hydro have moved to other areas and some are now providing consultancy services in India and Africa.

2.63 Biomass generation, and to a lesser extent wind and solar power generation, are still facing a number of barriers and support to overcome these barriers would be useful. These barriers include technical (integration with grid issues), regulatory (feed-in-tariffs) and financing (suitable terms) barriers. The Asian Development Bank is providing technical assistance support in this regard, and indicated its readiness to follow with financial support for investments.

2.64 The demand for SHS systems can be positively impacted by the net metering regulations introduced by the regulator (Public Utilities Commission of Sri Lanka) that allow individual SHS customers to offset their payments to the utility with electricity generated from their SHS systems at the retail tariffs. A few of these schemes (limited to 42 kWp per facility) are now in operation as residential tariffs have recently been increased to as much as LKR 50.4/kWh (including fuel adjustment surcharge for higher consumption category; currently about US$0.38/kWh). As the Ceylon Electricity Board and the Public Utilities Commission of Sri Lanka continue to fine tune the net-metering regulations, they need to ensure that the boost these have provided to the SHS industry is sustained.

2.65 In respect of SHS, only two vendors are currently active out of the fourteen at the peak of sales. Some of the technicians trained under the Energy Services Delivery and the RERED projects are providing independent after sales services in their areas and the remaining SHS vendors depend on their services to fulfill their obligations. One vendor (Wisdom Solar) has shown resilience by marketing solar street lamps to municipalities, and capturing business in some remote areas in the northern part of the country, and indicated that their firm is well placed to implement the SHSs and off-grid solutions to the 40,000 homes identified by the Ceylon Electricity Board.

Power plant operating risks

2.66 There is a risk that some of the grid-connected renewable energy sub-projects might stop operating (mainly for projects where power purchase agreements will be expiring and the tariff offered might be too low to sustain operations). For instance, a 1.8

MW mini hydropower plant[16] commissioned in 1989 was reported to have shut down from being unable to meet operating costs due to low tariffs. The Public Utilities Commission of Sri Lanka showed understanding in this situation and resolved this issue, after considering the impact it could have on the whole non-conventional renewable energy segment. The risk that the private sector ceases to seek and develop new projects is considered low unless tariffs decline substantially to the point where the economics become unviable. The Government has indicated its commitment to the participation of the private sector in electricity generation, especially from renewable resources. These projects are financially viable and commercial banks are continuing to lend, even without refinancing.

Role and support of the Government

2.67 Sub-projects refinanced by the project would continue to comply with the Government's environmental requirements, including the required monitoring. Some stakeholders from private sector and industry association however expressed reservations, but also the desire that the Sustainable Energy Authority needs to step up its efforts to meet the challenges, streamline bureaucratic requirements, and actually assist project developers to realize their projects and also contribute to national priorities of promoting non-conventional renewable energy. The Government's further endorsement of non-conventional renewable energy and support for its development should be sufficient incentives for the Sustainable Energy Authority, though its ability to attract skills remains an issue as market pay scales are far higher.

2.68 The activities supported by the project have transitioned from the AU to the Sustainable Energy Authority which will provide continuity for facilitating investments in the sector. Sustainable Energy Authority officials indicated to the mission that they are now maintaining documentation from the project, which includes a wealth of analysis, data and information on the subject of renewable energy and related initiatives in the developing country context.

2.69 Based on the overall assessment of the key issues, ***the risk to sustainability of overall project development outcome is rated Low.***

BANK PERFORMANCE

2.70 *The quality at entry for the project is rated Satisfactory*. The design of this project benefited from the Bank's experience with the earlier Energy Services Delivery project – which received a satisfactory outcome rating – as well as rural and renewable energy projects in South and East Asia and Sub-Saharan Africa. The guiding principles that emerged from the Energy Services Delivery project and other Bank projects were: (i) necessity of providing consumer choice; (ii) ensuring pricing which is cost-reflective; (iii) overcoming high start-up costs; (iv) encouraging local participation, tapping into private sector and civil society capabilities and potential; and (v) implementing sound sector policies.

[16] Daily Mirror, Sri Lanka, March 13, 2014, page A16 "Private Hydropower Plant Closed Without Notice"

2.71 Design features of the project that derived from the above lessons contributed to effective project implementation, including: third-party administration of the credit and grant facility and overall project management; involvement of industry associations and advocacy groups in guiding industry growth and directions; the adoption of a standardized power purchasing agreement and ensuring tariff certainty; a bankable legal framework that assured availability of long term financing; and the importance of participation and commitment of the entire community on off-grid village electrification schemes for ensuring long term sustainability of these schemes, as well as adequate after sales service.

2.72 In retrospect, the project design underestimated the pace at which the electricity grid would expand in the country. At the project preparation stage, the Bank in consultation with the Ceylon Electricity Board, estimated that existing technical and financial constraints would limit the coverage of the grid to 80 percent of the population leaving about 20 percent (or about 1 million households) reliant on off grid systems. Subsequently, the Government moved aggressively to increase generation (2,483 MW to 3,312 MW during 2003-12) and expand the grid, with the result that only 40,000 households remained to be covered through off-grid options by 2013. As the development of major hydro has remained stagnant at 1,207 MW since 2003, the growth in generation came mainly from an increase in thermal power (51%) as well as renewable energy (48%), the latter comprising small hydro, wind and biomass. The faster than anticipated growth of the grid, while a welcome development, necessitated changes in strategy and targets for off-grid electrification.

2.73 The overall risk rating for the project at appraisal was substantial. This is reasonable for the type and scale of interventions proposed under the project. The demand for refinancing of loans for grid-connected renewable energy projects depends on a number of macroeconomic factors that are beyond the control of the project. For example, when interest rates were substantially higher at certain periods during the implementation period – most notably at the height of the military conflict – the demand for refinancing loans reduced significantly. Demand grew once more when interest rates dropped again. On the other hand, the risk of an insufficient market for SHS was identified and considered moderate. The impact of a saturated market for SHS or accelerated grid expansion was not analyzed in sufficient detail, which could have anticipated some of the challenges faced during implementation. This is an important lesson for other countries that are undertaking or planning aggressive off-grid electrification schemes.

2.74 Again in retrospect, the inclusion of two relatively small components for energy efficiency/demand-side management and cross-sectoral energy applications did not fit well into the major thrust of the project. These components did not yield expected results, and may even have diverted some focus and effort from the larger project components.

2.75 *The Bank's quality of supervision during the project is rated Moderately Satisfactory*. The Bank's supervision was characterized by a strategic management role rather than day to day handholding of the implementing agency's activities. This was possible because of AU's capacity and competence, and contributed greatly to its sense of

ownership of the project for both AU and the Government. Feedback from the AU and the Government suggests that the Bank responded adequately and in a timely manner to requests for clearances and participated regularly in meetings with all project stakeholders. Both AU[17] and other stakeholders credited the participatory approach and its approach to the Bank and the project.

2.76 The role of the Bank was highly valued as indicated by the feedback survey conducted at the end of the project. This was confirmed by the mission from the feedback it received from the Government, AU, Participating Credit Institutions and other stakeholders. Most respondents recognize the Bank as a key catalyst for grid-connected and off-grid renewable energy and energy efficiency interventions. The Bank's involvement increased the confidence of the Participating Credit Institutions to continue to provide long-term loans to private developers of renewable energy projects. This was of particular importance because increasing the access to energy services from renewable energy was at the heart of the RERED design.

2.77 However, the Bank was less responsive in dealing with the implementation issues with solar PV, cross-sectoral energy applications and energy efficiency & demand side management components. Despite the early onset of problems from 2006 onwards, it was not until late-2010 when Bank revised output targets for solar PV component, and also it is unclear if the Bank proactively examined the implications of potential risks of non-payment by SHS customers on the vendors, creditors and the refinancing by the project. It is also unclear if the Bank enabled dialogue with Ceylon Electricity Board and the Government on these issues and possible coordination of grid expansion with off-grid options during this period. Similar lack of proactivity is apparent concerning the other two components, as also noted by the absence of such discussion in the additional financing documents.

2.78 The Bank could have done more to encourage and assist the AU in making active use of the technical assistance component rather than relying on requests from the industry, beneficiaries, or other stakeholders. The Bank could also have insisted on better transition arrangements from the AU to Sustainable Energy Authority including the digitizing and transfer of documentation.

2.79 Some stakeholders also pointed to the sometimes passive role of the Bank in critical issues (e.g. The Ceylon Electricity Board's least cost development plan and implications for non-conventional renewable energy); while most expressed that the Bank seemed to have exited the sector too soon since many policies formulated and adopted during the project period were showing signs of stress and the absence of the Bank's lead and convening forte was conspicuous. Interestingly, the Public Utilities Commission of Sri Lanka shared the view that local economic gains from non-conventional renewable energy projects could now be integrated into a broader theme of rural economic development, and that the Bank's presence could have facilitated this effectively.

2.80 Overall Bank Performance is rated ***Moderately Satisfactory***.

[17] The AU noted that despite the value-added of such an approach, other financiers like the European Investment Bank had not included technical assistance in their ongoing projects and financing.

BORROWER PERFORMANCE

2.81 *The government's performance is rated Satisfactory*. The Government showed consistent support to the project objectives throughout appraisal and implementation. During the project implementation period, in October 2007, the Government established the Sri Lanka Sustainable Energy Authority as an apex institution responsible promoting sustainability in energy generation and use through increasing the use of indigenous renewable energy resources and improving energy efficiency. This underlined the commitment of the Government to renewable energy and complemented the activities of the project.

2.82 The Government ensured continuity in the implementation arrangements from the earlier Energy Services Delivery project by working through the same AU located in the DFCC Bank. The Government also appropriately took a hands-off approach to the day-to-day implementation of the project and generally limited its own role to creating an enabling environment and providing counterpart funding. It facilitated the implementation of the project by providing the required policy and regulatory support, and approving investments by the utility for upgrading substations. The Government also provided considerable grant support for renewable energy through the Ceylon Electricity Board, directly to beneficiaries for SHS, and through provincial councils for village hydro schemes. It established attractive tariffs for selling renewable electricity to the national grid and ensured that the Standardized Power Purchase Agreement terms and conditions were adhered to by all parties. The Government was very responsive to the routine refinance-linked disbursement requests from the AU and was supportive in addressing problems that arose during the process. The mid-term review noted that there were delays in some cases in granting necessary approvals on the part of the Central Environmental Authority (CEA), and in dealing with overloaded substations on the part of the Ceylon Electricity Board. On balance, the Government's performance is rated Satisfactory.

2.83 *Implementing agency performance during the project is rated Highly Satisfactory*. The AU situated in the DFCC Bank was the implementing agency for the project. The AU was well placed to work with the Participating Credit Institutions and private developers and administer the refinancing mechanism due to its experience in commercial banking transactions.

2.84 The AU displayed strong commitment and professionalism to the objectives of the project, and coordinated well with all major stakeholder groups including Participating Credit Institutions, MFIs, developers, SHS vendors, village hydro developers, industry associations, village electricity consumer societies, the Ceylon Electricity Board and other Government organizations. In coordinating with stakeholders, the AU consolidated the consultative process that had been developed under the Energy Services Delivery project. Feedback to the mission from stakeholders suggests that they generally hold favorable views about the AU and its helpful role during their interactions. Some developers were very complimentary of the neutral role played by the AU; especially as it is also one among peer Banks and Participating Credit Institutions. Other Participating Credit Institutions indicated that the AU was professionally staffed and managed.

2.85 The AU was administratively separated from the lending arm of DFCC Bank to minimize conflict of interest in the eyes of the other Participating Credit Institutions that were competing with DFCC Bank for refinancing of their loans. Procedures were documented well in the AU, and detailed records of sub-projects were maintained well. In retrospect, the AU could have done better in identifying more opportunities for technical assistance activities to support the various components, and in planning for a smoother transition after project completion, especially in the development of Sustainable Energy Authority's readiness.

2.86 Overall, Borrower performance is rated ***Satisfactory***.

MONITORING AND EVALUATION

2.87 **Monitoring & Evaluation Design**. The M&E framework employed appropriate outcome and output indicators that were well-defined and largely measurable. The responsibility for collecting the M&E indicators lay mainly with the AU. The objective of improving the quality of rural life by utilizing off-grid renewable energy technologies was to be measured through: (i) increase in income generating activities in communities that gain access to electricity; and (ii) increased electricity connections to households, rural small/medium enterprises and public institutions. The number of households, small and medium enterprises and public institutions electrified was to be obtained from regular reporting under the project. The increase in income generating activities would be assessed through surveys, though it was noted that attribution to the use of renewable energy technologies might be difficult.

2.88 The objective of promoting private sector power generation from renewable energy resources for the main grid would be measured by additional MW of small-scale renewable grid-connected power generation capacity. The global environmental objective would be tracked through reduction of greenhouse gas emissions and the adoption of renewable energy and the trend in implementation cost as proxies for reducing market barriers. The indicators were adequate to assess achievement of this objective.

2.89 **M&E Implementation**. The AU contracted a consultant to monitor progress towards achieving objectives and meeting indicators. M&E reports were submitted initially every quarter and bi-annually from 2006 onwards. The AU collected the required information as part of its routine administration work and progress was monitored throughout the sub-project lifecycle. The task team reports that the information provided was current and reliable. The Bank also hired an expert consultant to help review the progress and issues with solar PV component, which was helpful in examining options to resuscitate this component.

2.90 **M&E Utilization**. The M&E process helped in proposing and pursuing the various corrective actions that emerged as described in the section on "Implementation Experience". The AU also conveyed that it had replicated the M&E processes for this project in other ongoing donor supported projects.

2.91 Overall, M&E is rated ***High***.

3. Lessons

- **Local participation and involvement, suitably incentivized, is crucial to promoting distributed power generation activities.** Active local participation drove the momentum and successful implementation of the 68 mini hydro projects and the 173 community-based micro hydro projects supported by the project. The participation came in the form of local political support and the newly-formed village level electricity consumer societies, which were incentivized by opportunities for selling a part of the generation to the grid through 'net metering'.

- **Involving the private sector effectively in a decentralized developmental effort requires flexibility in implementation arrangements and space for adapting to market conditions.** In spite of past lessons informing the design of the project, almost all major aspects – financing and disbursement parameters, procurement policies and approach, SHS business model – had to undergo modifications to keep up the pace of implementation. Without such adjustments, the project would likely have stalled /failed.

- **An appropriate feed-in-tariffs policy and its consistent and transparent application are crucial to spur growth of small scale and non-conventional renewable energy generation.** The low transaction costs enabled by attractive feed-in-tariffs crowded in project developers and investors, as well as commercial/investment banks to develop and invest in a variety of distributed generation projects. Market confidence was enhanced by consistent and transparent application of the policy by the regulator / government.

- **Investments in off-grid electrification could be underutilized or even abandoned in the event of a faster than expected arrival of the electricity grid. To mitigate this, the expansion of the grid should be coordinated with off-grid investments, and, where warranted, the off-grid facilities should be made grid-compatible to ensure their continued utility.** In Sri Lanka, as the electricity grid expanded faster than expected, the decreasing necessity and relevance of off-grid electrification was not foreseen early enough, resulting in some off-grid facilities falling into disuse or neglect. This experience points to the need for planning ahead for a coordinated access rollout, and making policy and technical provision for making the off-grid facilities grid-compatible and economically viable.

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Annex A. Basic Data Sheet

RENEWABLE ENERGY FOR RURAL ECONOMIC DEVELOPMENT PROJECT (IDA-36731 IDA-36730 TF-51248)

Key Project Data (amounts in US$ million)

	Appraisal estimate	Actual or current estimate	Actual as % of appraisal estimate
Total project costs	231.9	253.9	110%
Loan amount	115.0	127.4	118%
Co-financing	7.1	7.0	99%
Cancellation	-	-	-

Cumulative Estimated and Actual Disbursements (P076702)

	FY03	***FY04***	***FY05***	***FY06***	***FY07***	***FY08***	***FY09***	***FY10***	***FY11***	***FY12***
Appraisal estimate (US$M)	15.0	23.5	40.6	63.7	81.8	89.6	97.5	110.0	115.0	115.0
Actual (US$M)	15.0	23.5	40.6	63.7	81.8	82.4	95.5	103.4	122.3	127.4
Actual as % of appraisal	100	100	100	100	100	92	98	94	106	111
Date of last disbursement: December 31, 2011										

Cumulative Estimated and Actual Disbursements (P077761)

	FY03	***FY04***	***FY05***	***FY06***	***FY07***	***FY08***	***FY09***	***FY10***	***FY11***	***FY12***
Appraisal estimate (US$M)	1.6	3.5	5.2	5.3	6.1	6.4	6.6	6.9	7.1	7.1
Actual (US$M)	1.6	3.5	5.2	5.3	6.1	6.4	6.6	6.8	7.1	7.0
Actual as % of appraisal	100	100	100	100	100	100	99	98	100	99
Date of last disbursement: December 31, 2011										

Project Dates (P076702; P077761)

	Original	Actual
Appraisal	01/22/2002	01/22/2002
Board approval	06/20/2002	06/20/2002
Effectiveness	10/07/2002	10/07/2002
Closing date	06/20/2008	12/31/2011

Staff Time and Cost

Stage of Project Cycle	Staff Time and Cost (Bank Budget Only)	
	No. of staff weeks	USD Thousands (including travel and consultant costs)
Lending		
FY02	22.63	70,966
FY03	0.00	0
Total:	**22.63**	**70,966**
Supervision/ICR		
FY03	25.37	80,118
FY04	22.77	64,358
FY05	18.98	47,457
FY06	19.63	67,250
FY07	16.03	43,334
FY08	26.47	85,307
FY09	27.65	113,345
FY10	19.16	85,112
FY11	20.28	88,388
FY12	16.01	100,271
Total:	**212.35**	**845,906**

Task Team Members

Names	Title	Unit	Responsibility
Lending			
Subramanian V. Iyer	Team Leader		Team Lead
Supervision/ICR			
Abdulaziz Faghi	Energy Specialist	SASDE	Team Lead
Amali Rajapaksa	Senior Infrastructure Specialist	SASDT	Procurement
Boonsri Prasertwaree Kim	Program Assistant	SASDO	Energy Economist
Darshani De Silva	Environmental Specialist	SASDI	Financial Management
Deepal Fernando	Senior Procurement Specialist	ECSO2	Disbursement
Donna Thompson	Sr Financial Specialist	OPCFM	Resource Management
Gevorg Sargsyan	Program Coordinator	SEGEN	Financial Management
Hiran Heart	Consultant	SASDI	Procurement
Jiwanka B. Wickramasinghe	Sr Fin. Management Specialist	SARFM	Financial Management
Lashantha H. ayawardhana	Consultant	SASDI	Env. Safeguards
Luis Alejandro Lopez	Program Assistant	SASDO	
Md. Iqbal	Senior Energy Specialist	SASDE	
Mikul Bhatia	Senior Energy Specialist	SEGEN	ESCO Specialist
Miriam Witana	Procurement Specialist	EAPPR	Energy Specialist
Peter Johansen	Senior Energy Specialist	ECSS2	Energy Specialist
Raihan Elahi	Senior Energy Specialist	AFTEG	Energy Specialist
Ravindra Anil Cabraal	Consultant	AFTEG	
Peter Johansen	Senior Energy Specialist	ECSS2	Energy Specialist
Seenithamby Manoharan	Sr. Rural Dev. Specialist	SASDA	Rural Development
Shane Andrew Ferdinandus	Program Assistant	SASDO	
Shaukat Javed	Program Assistant	SASDO	
Sriyani De Alwis	Team Assistant	SACSL	
Sriyani M. Hulugalle	Senior Economist	SASFP	
Sumith Pilapitiya	Lead Environmental Specialist	SASDI	Environmental Specialist
Supul Chamikara Wijesinghe	Financial Specialist	SARFM	Financial Management

Annex B. List of WB Energy Projects in Sri Lanka

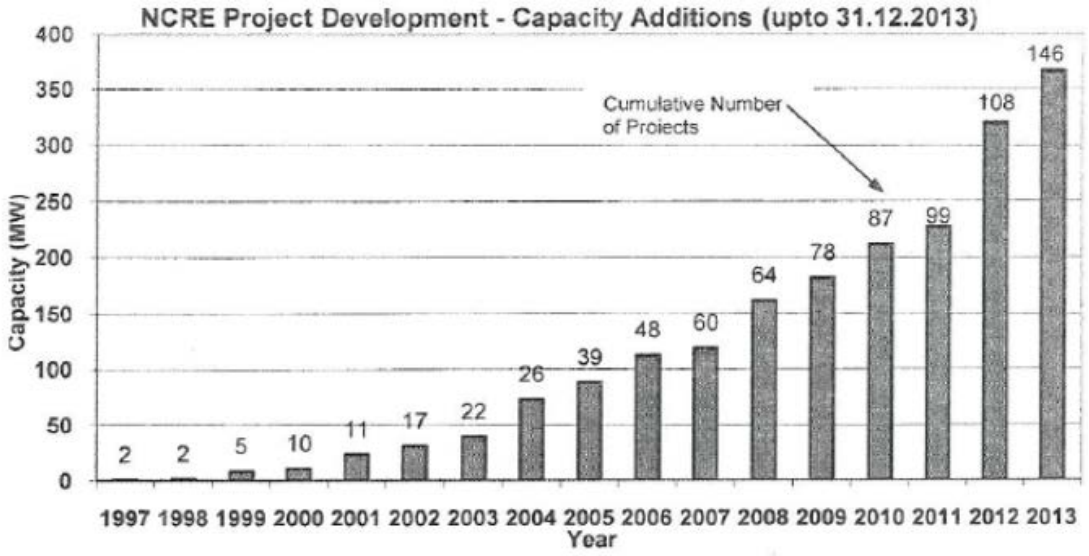
Table 1. World Bank Lending for the Energy Sector in Sri Lanka (1992-Present)

No.	Project ID	Name	Approval FY	Closing FY	Instrument	Project Cost (US$M)	WB Commitment (US$M)
1	P010386	Power Distribution	1992	1998	Specific Investment Loan	79	50
2	P010517	Private Sector Infrastructure Development	1996	2007	Financial Intermediary Loan	232	77
3	P039965	Energy Services Delivery	1997	2003	Specific Investment Loan	30	6
4	P010498	Energy Services Delivery	1997	2003	Specific Investment Loan	55	24
5	P076702	Renewable Energy For Rural Economic	2002	2012	Specific Investment Loan	166	115
6	P077586	Economic Reform Technical Assistance	2003	2008	Technical Assistance Loan	19	15

Annex C: Additional Data Tables and Figures

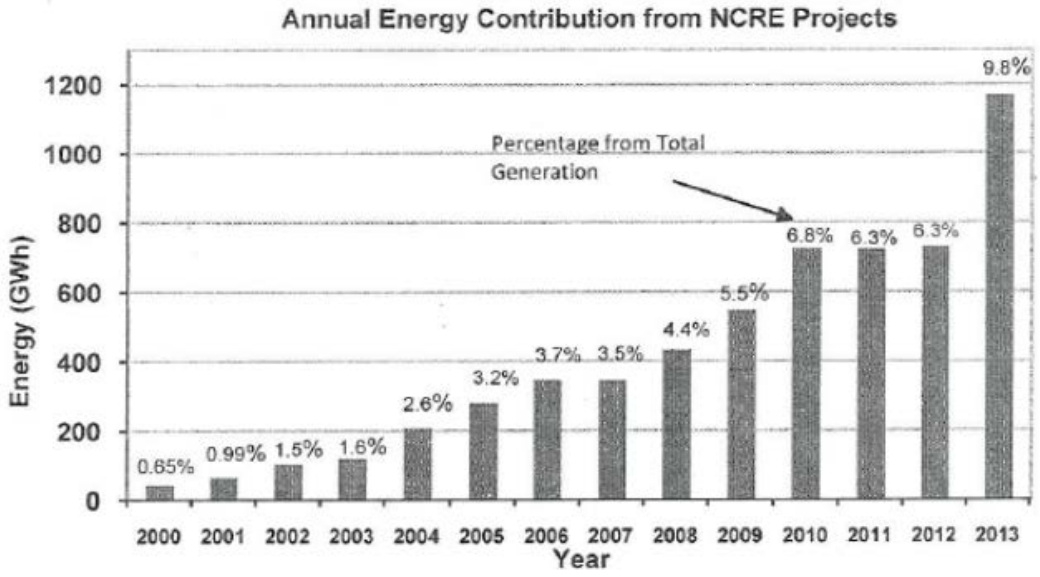
Non-Conventional Renewable Energy (NCRE) Development in Sri Lanka

Figure 1



Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Cap. (MW)	39	73	88	112	119	161	181	214	248	321	367

Figure 2



Year	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Energy (GWh)	120	206	280	346	344	435	546	727	722	730	1169

Table 1

Present Status of Non-Conventional Renewable Energy (NCRE) Sector as at 31st December 2013

No	Description	Project Type	No. of Projects	Capacity (MW)
1.	Commissioned Projects	Mini Hydro Power	128	270.932
		Biomass-Agricultural & Industrial Waste Power	2	11.000
		Biomass- Dendro Power	2	5.500
		Solar Power	4	1.378
		Wind Power	10	78.450
		Total - Commissioned	**146**	**367.260**
2.	Standardized Power Purchase Agreements (SPPA) Signed Projects	Mini Hydro Power	55	134.640
		Wind Power	5	41.100
		Biomass-Agricultural & Industrial Waste Power	2	4.000
		Biomass-Dendro Power	10	56.770
		Biomass-Municipal Waste	1	10.000
		Total - SPPA Signed	**73**	**246.510**

Source: Figures 1, 2, and Table 1: Ceylon Electricity Board

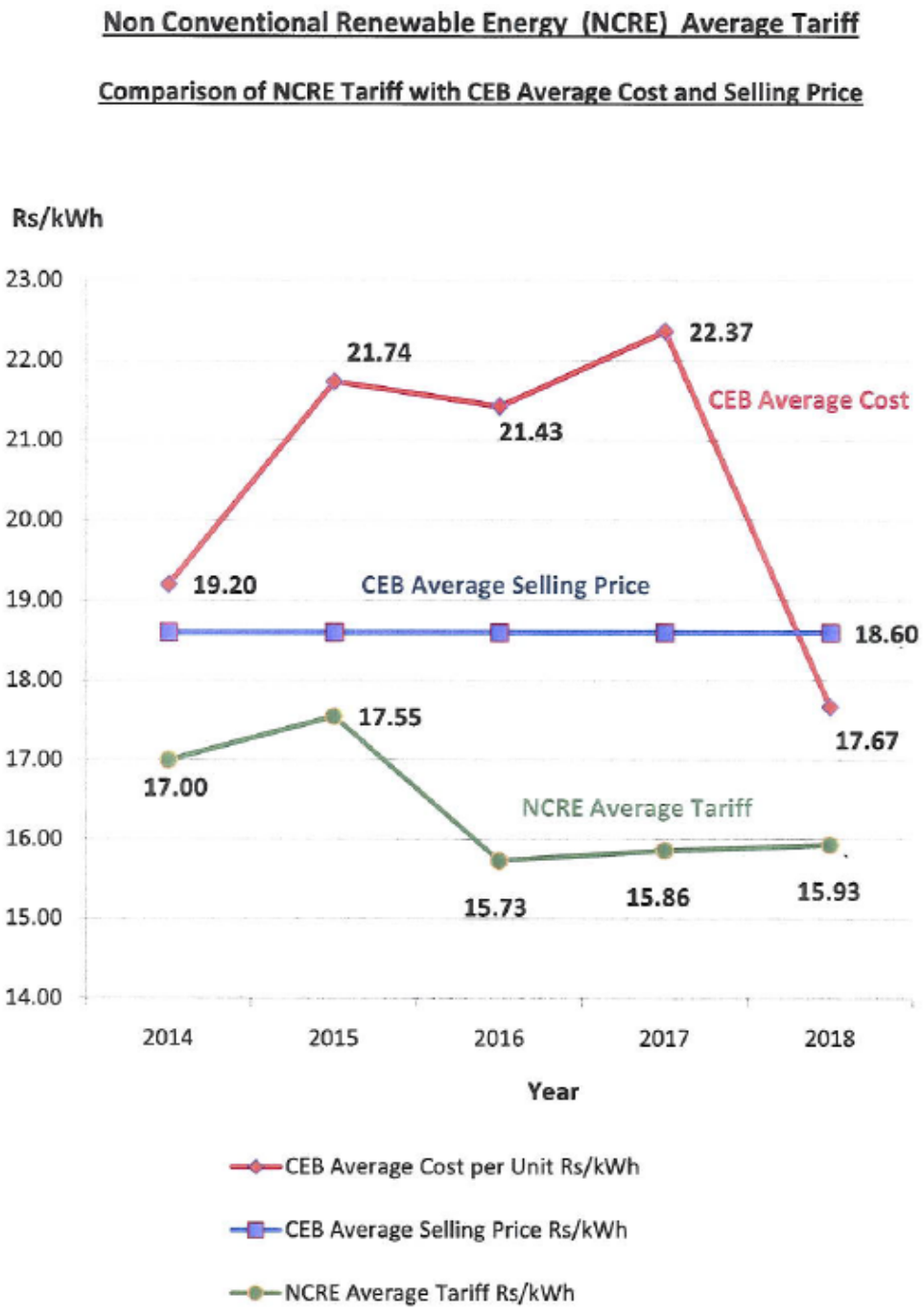
Table 2. Average Revenue, Total Generation and NCRE Contribution (2000-2013)

	2000	2005	2010	2011	2012	2013
Total Generation (GWh)	6629	8898	10801	11646	11896	12151 a/
of which: from NCRE (GWh)	Na	280	727	722	730	1169
as % of total	na	3.2	6.73	6.20	6.14	9.62
Ave. Rev. (LKR/kWh)	4.85	7.99	13.10	13.42	15.73	17.73-18.60
Ave.Rev. (US cents/kWh)	na	7.83	11.79	11.78	12.27	13.97-14.66

a/ extrapolated estimate

Source: Ceylon Electricity Board; and Sustainable Energy Agency Statistics, 2012

Figure 3



Source: Ceylon Electricity Board

Annex D. List of Persons Met

Government of Sri Lanka

Mr. Upali Daranagama , Additional Secretary, Ministry of Power and Energy,
Mr. B.M.U.D. Basnayake, Secretary, Ministry of Environment and Renewable Energy
Mr. Noel Priyantha, Chief Engineer (Renewable Energy), Ceylon Electricity Board
Mr. Thusitha Sugathapala, Director General, Sustainable Energy Authority
Mr. M.M.R. Pathmasiri, Deputy Director General, Sustainable Energy Authority
Mr. Damitha Kumarasinghe, Director General, Public Utilities Commission of Sri Lanka
Dr.B.M.S. Batagoda, Deputy Secretary to the Treasury, Ministry of Finance

DFCC Bank

Mr. Nalin Karunatileka Assistant Vice President, Project Management (AU)
Mr. Rohantha Seneviratne, Operations Manager

Commercial Banks / Participating Credit Institutions

Ms. Sushara Vidyasagara, Senior Manager, Corporate Finance, Commercial Bank of Ceylon
Mr. Kapila Subasinghe, Vice President, Corporate Banking
*Mr. Champal de Costa,*Vice President / Manager, Ratnapura Branch
Ms. Dulani Rodrigo, Relationship Manager, Corporate Banking, NDB Bank

Developers Associations / Advocacy Group / Think Tanks

Ms. Rekha S. Karunaratne, Small Hydropower Developers Association;
Mr. Shakila Wijewardena, Sarvodaya, Vice President, Microfinance and Guarantee Company
Mr. T.K. Weerawardhana, Sarvodaya, Microfinance and Guarantee Company
Mr. Asoka Abeygunawardhana, Executive Director, Energy Forum
Mr. Bandula Chandrasekara, Programs Coordinator, Energy Forum

Project Developers

Mr. Herath Dissanayake, Managing Director, Wisdom Solar Pvt. Ltd.
Ms. Rozanne Croos Moraes, Project Manager, Senok Wind Power (Pvt) Ltd
Ms. Praveena Sivamohan, Finance Manager, Senok Wind Power (Pvt) Ltd
Mr. Vishnu Vasanth, Managing Director, RenewGen Ventures
Ms. Rekha S. Karunaratne, Director, Integra International Pvt. Ltd.

World Bank / IFC / ADB

Ms. Francoise Clottes, Country Director, World Bank
Mr. Camilo Gomez Osorio, Country Economist, World Bank
Ms. Niluka Nirmalie Karunaratne, Team Assistant, World Bank
Mr. Abdulaziz Faghi, Senior Energy Specialist and Task Team Leader, World Bank
Mr. Kamal Dorabawila, Principal Investment Officer, IFC
Mr. Nishantha Jayasooriya, Associate Operations Officer, IFC
Mr. Milinda Wasalathantri, Investment Analyst, IFC
Mr. Ranishka Wimalasena, Project Officer (Energy), ADB

Note: During project site visits, several persons – traders / merchants, operators of power plants, SHS owners at homes and shops, energy consultants and specialists – were met. Conversations were facilitated through translators.