

RRP:SRI 25388

# ASIAN DEVELOPMENT BANK

REPORT AND RECOMMENDATION  
OF THE  
PRESIDENT  
TO THE  
BOARD OF DIRECTORS  
ON A  
PROPOSED LOAN  
TO THE  
DEMOCRATIC SOCIALIST REPUBLIC OF SRI LANKA  
FOR THE  
SECOND POWER SYSTEM EXPANSION (SECTOR) PROJECT

November 1995

## CURRENCY EQUIVALENTS

(as of 1 November 1995)

Currency Unit	-	Sri Lanka Rupee (SLRe)
SLRe 1.00	=	\$0.0195
\$1.00	=	SLRs 51.3

- (i) The Sri Lanka rupee is allowed to float against the currencies of the country's major trading partners.
- (ii) The exchange rate used in this report is SLRs 50 = \$1.00.

## ABBREVIATIONS

CEB	-	Ceylon Electricity Board
DSM	-	Demand Side Management
EIA	-	Environmental Impact Assessment
EIRR	-	Economic Internal Rate of Return
ES	-	Environmentally Sensitive
FIRR	-	Financial Internal Rate of Return
ICB	-	International Competitive Bidding
IEE	-	Initial Environmental Examination
JICA	-	Japan International Cooperation Agency
LCB	-	Local Competitive Bidding
LECO	-	Lanka Electricity Company (Private) Limited
LRMC	-	Long-Run Marginal Cost
LV	-	Low Voltage
OECS	-	Overseas Economic Cooperation Fund of Japan
PPA	-	Power Purchase Agreement
RE	-	Rural Electrification
ROR	-	Rate of Return
SEIA	-	Summary EIA
SIEE	-	Summary IEE
TA	-	Technical Assistance

## ELECTRICAL TERMS

V	(volt)	-	Unit of electrical voltage
kV	(kilovolt)	-	1,000 V
A	(ampere)	-	Unit of electric current
W	(watt)	-	Unit of active power = 1 VA
kW	(kilowatt)	-	1,000 W
MW	(megawatt)	-	1,000,000 W
kVA	(kilovolt-ampere)	-	1,000 VA
MVA	(megavolt-ampere)	-	1,000,000 VA
MVA <sub>r</sub>		-	1 MVA of reactive power
Wh	(watt-hour)	-	Unit of energy
kWh	(kilowatt-hour)	-	1,000 Wh
GWh	(gigawatt-hour)	-	1,000,000 kWh
MWh	(megawatt-hour)	-	1,000,000 Wh

## NOTES

- (i) The fiscal year (FY) of the Government, CEB and LECO ends on 31 December.
- (ii) In this Report, "\$" refers to US dollars.

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**SRI LANKA****SECOND POWER SYSTEM EXPANSION (SECTOR) PROJECT****LOAN AND PROJECT SUMMARY**

- Borrower** : Democratic Socialist Republic of Sri Lanka
- Project Description** : The Project will provide for rural electrification, and distribution and transmission system expansion by the two public power utilities in Sri Lanka: Ceylon Electricity Board (CEB) and Lanka Electricity Company (Private) Limited (LECO).
- Classification** : The primary objective is economic growth. The environmental classification of the Project is B.
- Rationale** : The Project supports the Government's efforts to establish basic infrastructure and promote economic development, particularly in the rural areas. At present only 44 percent of the population is connected to the power distribution networks, and the Government's long-term goal is to electrify the entire country. The transmission and distribution components of the Project will provide urgently required improvements for CEB's and LECO's power systems.
- Objectives and Scope** : About 38 percent of the Bank loan of \$80 million will be used to finance rural electrification, and the balance will be used for other distribution and transmission reinforcement and expansion. The rural electrification component will be the third to be financed by the Bank in Sri Lanka. The distribution component will finance strengthening of CEB's 33-kV and LECO's 11-kV and low-voltage distribution systems, primarily in rural areas. The transmission system component will finance the construction of new transmission substations, lines, and capacitors for the CEB system, which are required on a priority basis.
- Cost Estimates** : The Project is estimated to cost \$154 million, of which about \$66 million (43 percent) is in foreign exchange and \$88 million equivalent (57 percent) is in local currency.

**Financing Plan**

Source of Financing	Foreign Currency	Local Currency	Total	Percentage
	(\$ million equivalent)			
Bank Loan	66.4	13.6	80.0	51.9
CEB/LECO/Govt.	-	74.1	74.1	48.1
<b>Total</b>	<b>66.4</b>	<b>87.7</b>	<b>154.1</b>	<b>100.0</b>

(iii)

<b>Loan Amount and Terms</b>	:	The Bank will provide a loan in various currencies of SDR 53.528 million (\$80 million equivalent) from the Bank's Special Fund resources with a repayment period of 40 years including a grace period of 10 years. Principal and the service charge of one percent per annum will be paid semiannually.
<b>Allocation and Relending Terms</b>	:	\$30 million of the loan amount will be for rural electrification. These funds will be invested by the Government as equity in CEB. The balance will be used for transmission and distribution improvements (\$25 million for CEB's transmission, \$15 million for CEB's distribution, and \$10 million for LECO's distribution). These funds will be relented by the Government to CEB and LECO in local currency at 13 percent interest rate, with a repayment period of 20 years including a grace period of 5 years. The Government will bear the foreign exchange risk.
<b>Period of Utilization</b>	:	Until 31 December 2000
<b>Implementation Arrangements</b>	:	CEB's General Manager and Additional General Manager for Distribution and Customer Services will supervise project managers and teams who will implement CEB's rural electrification and 33-kV distribution components. CEB's General Manager and Additional General Managers for Planning and Transmission will supervise a project manager and team who will implement CEB's transmission component. LECO's General Manager will supervise a project manager and team who will implement LECO's distribution component. Prior to implementation, these groups from CEB and LECO will prepare appraisal reports for all proposed subprojects for the Bank's review and approval.
<b>Executing Agencies</b>	:	Ceylon Electricity Board and Lanka Electricity Company (Private) Ltd.
<b>Procurement</b>	:	Procurement of all goods and services to be financed under the proposed loan will be carried out in accordance with the Bank's <i>Guidelines for Procurement</i> . Bid packages will be structured to make them suitable for international competitive bidding whenever appropriate. Advance procurement action has been approved.
<b>Consulting Services</b>	:	A total of 26 person-months of international consulting services will be required for Project implementation to assist with training and design procedures for CEB's distribution and transmission facilities to be financed by the Bank, and to provide training on environmental assessment procedures. Consultants will be selected in accordance with the Bank's <i>Guidelines on the Use of Consultants</i> .

**Estimated Project  
Completion Date**

: 30 June 2000

**Project Benefits  
and Beneficiaries**

: The project will provide electricity to about 156,000 rural households and other consumers, with a population of about 750,000 throughout the country. This will improve standards of living and enhance economic development in rural areas. The transmission and distribution components will help CEB and LECO meet load growth, thus benefitting a broad spectrum of power consumers, and complement CEB's efforts to increase power generation capacities through public and private investment. The overall EIRR of the Project is 16.5 percent.

## I. THE PROPOSAL

1. I submit for your approval the following Report and Recommendation on a proposed loan to the Democratic Socialist Republic of Sri Lanka for the Second Power System Expansion (Sector) Project.

## II. INTRODUCTION

2. The Bank has financed rural electrification developments in Sri Lanka through two previous loans.<sup>1</sup> Concurrently with the second loan, a technical assistance (TA) grant was approved for a rural electrification study.<sup>2</sup> Based on the final report under that study submitted in March 1992, the Government of Sri Lanka (the Government) requested Bank assistance to finance the next phase of rural electrification. Initial fact-finding was undertaken in February 1993. However, further processing was suspended until satisfactory progress was made on tariff increases and on the contract award for the Sapugaskanda diesel power plant financed under Loan No. 1021-SRI. Tariffs were increased in July 1993 and February 1994 to a level sufficient to achieve a reasonably satisfactory financial performance in 1994 and 1995. The contract award for the power plant, as recommended by the CEB and its consultants, was approved by the Bank in October 1993, but the Cabinet did not endorse it. After the change in Government in 1994, the new Cabinet gave its concurrence in line with the original recommendation, and the contract was signed on 20 March 1995. This action allowed another fact-finding to be carried out between 21 March and 5 April 1995, during which the scope of the proposed sector loan was expanded to include other high priority power transmission and distribution components. Appraisal was subsequently undertaken from 22 August to 6 September 1995.<sup>3</sup> This report is based on the agreements reached with the Government during appraisal, and subsequently confirmed at loan negotiations held on 6-7 November 1995.

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<sup>1</sup> Loan No. 436 - SRI(SF): Rural Electrification Project, for \$11.3 million, approved on 10 December 1979 and Loan No. 1021 - SRI(SF): Power System Expansion (Sector Loan) Project, for \$74.3 million, approved on 31 May 1990.

<sup>2</sup> TA No. 1307 - SRI: Rural Electrification Development, for \$440,000, approved on 31 May 1990, and executed by Snowy Mountains Engineering Corp. of Australia. The objectives of this study were to (i) prepare a rural electrification master plan for the 1990s; (ii) provide support to the Ceylon Electricity Board (CEB) and recommend improvements in the selection and implementation of rural electrification schemes; and (iii) provide training to CEB staff in rural electrification planning, design, implementation, and benefit monitoring.

<sup>3</sup> The Appraisal Mission included J. Kuiper (Project Engineer and Mission Leader), J. Fyfe (Financial Analyst), M. Lewis (Consulting Engineer), P. Ghosh (Environmental Officer), and F. Mesch (Senior Counsel). The Mission was joined by V. Bohun, Manager of Energy Division West, as advisor from 31 August to 3 September 1995.

### III. BACKGROUND

#### A. The Power Sector

##### 1. Power Sector Organization

3. The CEB is the national power utility with responsibility for all generation and transmission and most distribution throughout the country. CEB supplies electricity directly to consumers and also sells electricity in bulk to a few distribution companies. Lanka Electricity Company (Private) Ltd. (LECO) is responsible for distribution in an area around Colombo and along the southwest coast. LECO is incorporated as a private company, but 99 percent of its shares are owned by the Government and CEB. Two small local authorities also distribute electricity in other areas. On a national basis in 1994, CEB was responsible for 83 percent of total retail energy sales, LECO for 13 percent, and the local authorities for 4 percent. The Ministry of Irrigation, Power and Energy is responsible for the supervision of CEB and LECO, while the Ministry of Finance, Planning, Ethnic Affairs and National Integration is also involved in the administration of the power sector through the approval of all major decisions affecting CEB's budget, capital expenditures, contract awards and tariffs.

4. Established in 1969 as a statutory corporation the CEB was the successor to the Department of Government Electrical Undertakings, which had been founded in 1927 to supply electricity, initially to Colombo, and later to other areas. CEB undertook the construction of power stations, development of the national transmission system, and supply of bulk power to local authorities. Until 1983 responsibility for the development and operation of the distribution systems in most parts of the country outside Colombo was vested with local government authorities, of which more than 200 were involved in electricity distribution. Initially these local authorities also generated much of their required power supply with their own small thermal power plants, but over time they came to increasingly rely on CEB for bulk power supply. As the demand for services grew and associated costs escalated these small entities found it difficult to operate efficiently and encountered major technical, financial, and managerial problems. Many also accumulated large overdue accounts owed to CEB for bulk power purchases. LECO was established in 1983 to take over the distribution systems of the local authorities in the southwestern coastal region and since 1987 CEB has gradually taken over those in the rest of the country, with the exception of two local authorities that continue to operate.

##### 2. Electricity Consumption

5. Per capita electricity consumption (i.e., sales) in Sri Lanka was only 196 kilowatt-hours (kWh) per annum in 1994, which is relatively low by regional standards.<sup>1</sup> The extent of electrification is also low by regional standards: only 44 percent of the population currently has electricity supply.<sup>2</sup> In urban areas, which contain 21 percent of the national population, all residents have access to electricity supply, and about 84 percent are connected. In rural areas and plantation estates, which contain 79 percent of the national population, it is estimated that only 52 percent have access to electricity service within 100 meters of their household location,

<sup>1</sup> In 1992, average per capita consumption in other comparable Asian countries was 188 kWh in Indonesia, 281 kWh in India, 284 kWh in Pakistan, 337 kWh in the Philippines, and 854 kWh in Thailand.

<sup>2</sup> By comparison, the proportion of households electrified in other countries is currently 38 percent in Indonesia (Java and Bali), 48 percent in Pakistan, 61 percent in the Philippines, 87 percent in Thailand, and 98 percent in Malaysia.



and 64 percent of households with access are actually connected. The remainder cannot afford to pay for the costs of connection, house wiring, and monthly electricity bills. On a national basis, it is thus estimated that about 62 percent of the population has access to electricity service and 44 percent is actually connected.

6. Total electricity consumption in Sri Lanka increased at an average annual rate of 8.6 percent from 1978 to 1986, and then at an average annual rate of 6.0 percent over the last eight years from 1986 to 1994. Total electricity consumption is forecast by CEB to grow at 10 percent annually over the next ten years, which may be optimistic in light of historical growth rates. A preliminary load forecast prepared recently by consultants for a power system planning study in Sri Lanka indicates an expected average annual growth rate in total electricity sales of about 8.1 percent for the next 15 years. This assumes continuing rapid expansion of electrification in the country.

7. In 1994 total retail energy sales were 3,565 gigawatt-hours (GWh). These sales were made to 1,415,000 CEB consumers and 238,000 LECO consumers. The breakdown of final energy sales in 1994 was 44 percent industrial, 20 percent commercial, 35 percent residential, and 1 percent miscellaneous. In recent years the share of residential sales has increased. The changing sales mix, and other significant statistics on power consumption and supply, are summarized in Table 1 for selected years at intervals from 1981 to 1994. The sales mix shown in Table 1 is for CEB sales only, while the final sales mix including local authority and LECO sales includes higher proportions for all end-user categories.

**Table 1 : Past Electricity Consumption and Supply in Sri Lanka**

Item	1981	1985	1990	1994
Total CEB Sales (GWh)	1,504	2,061	2,608	3,565
CEB Sales Mix (%)				
Residential	14	17	20	26
Commercial	15	14	16	16
Industrial	45	41	35	40
Local Authorities	25	23	13	4
LECO	-	2	12	13
Street Lighting	1	1	1	1
Hotels	-	3	3	-
Losses (GWh)	369	422	542	800
(% of generation)	19.7	16.4	17.2	18.3
Generation (GWh)	1,872	2,464	3,150	4,365
Hydro	1,571	2,395	3,145	4,089
Thermal	300	69	5	275
Peak Demand (megawatts[MW])	413	515	640	911
Installed Capacity (MW)	522	949	1,290	1,410
Hydro	372	679	1,017	1,137
Thermal	150	270	272	272
Reserve Margin (% of inst. cap.)	21	46	50	35
System Load Factor (%)	51.7	54.6	56.2	54.7

### 3. Electricity Supply

8. CEB's total installed generating capacity increased from 522 MW in 1981 to 1,410 MW in 1994, and now includes 1137 MW of hydro power and 272 MW of thermal power. In 1994, the peak load on the power system was 911 MW, resulting in a reserve capacity margin of 35 percent. CEB currently has adequate peak generating capacity in its system, but most of its generating capacity is hydro with restricted firm energy capability in the dry season. Consequently, new power plants will be required to bridge the energy gap. CEB's total energy generation was 4,365 GWh in 1994, of which 94 percent was hydro generation. The proportion of thermal generation is expected to increase in future years. Only one new hydro power plant, the 70-MW Kukule project, is committed for construction, with a planned commissioning date of 2001. Financing for the Kukule project has been arranged, but the engineering consultant has not yet been selected, and no contracts have been awarded. Some other hydro projects are planned but remain uncertain and are unlikely to be commissioned before 2003. Most new power plants will be thermal, and many of those are expected to be developed by independent power producers (see paras. 15 and 33). The only committed thermal power plant now under development by CEB is the Bank-financed 40-MW Sapugaskanda diesel project, to be commissioned in early 1997. A brief description of other planned power plants and their status is given in Appendix 1.

9. The major power plants and load centers are interconnected by CEB's transmission system of 132 and 220-kilovolt (kV) lines. The transmission system is generally sound, but is becoming overloaded in several areas. The physical condition of the subtransmission and distribution networks was generally unsatisfactory in the mid-1980s as a result of high load growth, insufficient investment, and inadequate maintenance. Some of these problems were the legacy of the local authorities, who had previously operated many of the local distribution systems. To address these problems, the Bank provided LECO with two loans for the Secondary Towns Distribution Project in 1985 and 1987 for rehabilitation and expansion of distribution systems. The World Bank provided similar loans to CEB for the Distribution Expansion and Rehabilitation Project in 1988, and the Second Power Distribution and Transmission Project in 1991. These loans helped LECO to take over and rehabilitate the distribution systems of 32 local authorities starting in 1985, and CEB to do so for 180 local authorities starting in 1987. Additional investments in expansion of transmission and distribution systems are now required. CEB's 33-kV distribution system is becoming overloaded in many areas, with high losses. Development of the transmission system is also becoming urgent.

10. CEB's system losses increased from only 10 percent of gross generation in 1975 to 20 percent by 1981, largely as a result of over emphasis of investment in generation and high-voltage transmission, and relative underinvestment in subtransmission and distribution. System losses decreased to 16.4 percent by 1985 as a result of corrective measures, but since then losses crept up again to 17.2 percent in 1990 and 18.3 percent in 1994. Most of these losses occur in the subtransmission and distribution systems, and only a small portion is estimated to be nontechnical losses. One reason for the increase in losses is the takeover of the distribution systems operated by former local authorities in the late 1980s. Their distribution losses, which were very high (in the range of 20-30 percent), were not included in statistics on CEB's overall losses before the takeover. LECO managed to bring the losses in its distribution system down to 10.7 percent in 1994. CEB does not keep separate records of its distribution losses, but it has managed to reduce losses in the former local authority distribution systems substantially through rehabilitation and improved maintenance. CEB's goal is to reduce total system losses to 12

percent, which will require substantial investments in the distribution and transmission systems, as well as careful operation and maintenance of those systems.

11. CEB has also undertaken several rural electrification projects to expand distribution service in rural areas, with financial support from the Government and from the Bank. In the early years, the Government provided annual grants for rural electrification on a modest scale. In 1979, the Bank approved a loan to CEB (Loan No. 436-SRI(SF)) to supplement these efforts, and the last Bank loan (Loan No. 1021-SRI(SF)) also included a component for rural electrification. In 1979, only about 10 percent of villages in the country were electrified, which increased to 17 percent by 1986. By 1990, 29 percent of all households in the country were connected, and the extent of electrification has progressed more rapidly in recent years to 44 percent by 1995.

12. To proceed with development of the distribution and transmission systems in the country, as well as further expansion of rural electrification, CEB and LECO need assistance for financing these programs. The investment programs of CEB and LECO are well conceived and meet priority needs, and CEB and LECO are competent executing agencies. The policies for management of the power sector and financial performance are also reasonably satisfactory, and the Government has agreed to undertake further reforms in tariff restructuring and various other matters under loan covenants for this Project. A sector loan approach is therefore considered appropriate to finance a portion of CEB's and LECO's investment programs in distribution and transmission over the next five years. The sector loan approach will enable flexibility in choosing subprojects that meet the technical, economic, and environmental criteria for support from the Bank.

13. Electricity tariffs, the history of tariff adjustments, and an analysis of tariff structure are described in detail in paras. 25 to 32 of this report. The financial performance of CEB and LECO is analyzed in paras. 64 to 74.

## **B. Government Policies and Plans**

14. The Government has declared its commitment to rural electrification, which has become a high national priority because of its potential to improve living standards and to accelerate economic growth, particularly in less developed rural areas. The previous administration had declared that its goal was to provide electrification throughout the entire country by the year 2000, but this is clearly not feasible, given that only 44 percent of the population currently has electricity supply, and the rate of expansion of the power grid will be constrained by financing available and institutional capability to plan and construct new projects. To provide access to electricity service to all population, another 18 rural electrification projects comparable in size to the rural electrification component planned under this loan would have to be constructed. The Bank-financed rural electrification study, completed in 1992, recommended that in view of these constraints, a more realistic objective would be to plan for an electrification ratio of 70 percent by the year 2000. Even this target is unlikely to be achieved, however, considering the delay in starting the proposed Project and continuing funding constraints. Nevertheless, continued development of rural electrification remains a high Government priority.

15. The Government recognizes that public sector resources for financing power system expansion are limited and not adequate to fully meet the projected load growth. The Government has therefore invited proposals for financing and development of new power projects by the private sector. Negotiations for such projects have been in progress for about two years and have reached an advanced stage for a few of them, but no power purchase agreements

(PPAs) have been signed yet. The emphasis for private development is on new thermal power plants, but some hydropower projects are also being considered. At the request of the Government, the Bank has agreed to use funds available for consulting services under Loan No. 1021-SRI(SF) to advise the Government and CEB on legal and financial issues related to negotiation of PPAs.

16. The Government has decided recently to proceed quickly with the sale to private investors of a major part of LECO's shares, which are currently held by the Government and CEB. Ten percent of LECO's shares will also be allocated to LECO employees. This privatization is being managed by the Public Enterprise Reform Commission in Sri Lanka, with advice from the World Bank and its staff consultants, who are also assisting in the privatization of other public sector enterprises in Sri Lanka. Advertisements to sell LECO's shares were made in October 1995 inviting potential investors to submit statements of interest and qualifications. The Government intends to short list qualified investors by December 1995. At present, the exact plans for divestment have not yet been finalized, nor has the Government decided how much of LECO's total shares will be sold. Also, the procedures for regulation, including requirements to provide services, job security for LECO employees, and allowed tariffs, profit margins, and performance incentives, still have to be developed. These issues will be decided after negotiations with potential investors to establish an acceptable and common framework for competitive proposals. The selected qualified investors will then submit final proposals with firm financial offers in the first half of 1996, and a final agreement for sale of shares should be made shortly thereafter. This will be an important step towards privatizing a part of power sector operations in Sri Lanka.

17. The Government has not yet made any decisions about privatizing part or all of CEB's operations, and there is opposition to such proposals from the CEB trade unions. However, CEB's distribution operations will be restructured to allow distribution districts to operate on a more independent and commercial basis. If the privatization of LECO proceeds successfully, then it would be possible to consider privatization of other distribution operations at a later date.

### **C. External Assistance to the Power Sector**

18. In the past two decades Sri Lanka has received substantial foreign aid for power sector development, much of it for constructing multipurpose hydro projects in the Mahaweli basin. More recently, the Overseas Economic Cooperation Fund of Japan (OECF), the Bank, and the World Bank have been the most active aid agencies in the power sector. Appendix 2 summarizes the amounts of foreign aid to the power sector since 1987 from various sources.

19. OECF has by far the largest foreign aid program in Sri Lanka, with annual lending of about \$360 million for all sectors, compared with about \$140 million for the Bank, and about \$100 million for the World Bank. OECF has financed several power generation projects, including the 120-MW Samanalawewa hydropower project, completed in 1992 with cofinancing from the Overseas Development Administration of the UK, and the 70-MW Kukule hydropower project which will start soon. OECF has indicated willingness to continue to finance power generation projects in Sri Lanka, including possibly a coal-fired thermal power plant, to meet the projected growth in demand. Further details are described in Appendix 1. OECF has also agreed to consider financing future transmission projects, and in this regard the Japan International Cooperation Agency (JICA) has agreed to prepare a transmission system master plan for Sri Lanka, which should be completed by the end of 1996. During appraisal these plans were discussed with the JICA and OECF offices in Colombo to ensure coordination with the proposed

Bank Project. The United Kingdom and Germany have also been active in financing power sector projects in Sri Lanka, as shown in Appendix 2. Germany may also finance the Sapugaskanda Stage III project soon (see Appendix 1).

20. The World Bank has provided assistance through International Development Association credits to CEB in 1987, 1989, and 1991 for transmission and distribution developments intended to reduce high system losses and to address serious deficiencies in local authority power distribution. The World Bank is not planning any new loans for public sector power projects in Sri Lanka at this time, but it is currently processing a loan for a private infrastructure development fund in Sri Lanka which will support the financing of new independent power projects, as well as other private infrastructure projects. The International Finance Corporation is also planning to finance one of the private power projects which is currently being negotiated for development in Sri Lanka.

21. The Bank has played a very active role in the development of the power sector in Sri Lanka. Since 1972 the Bank has provided eight loans to the power sector totalling \$168 million and ten TA grants (see Appendix 3). To address urgent problems in power distribution, such as high system losses and the serious deficiencies in areas which were under the responsibility of local authorities, the Bank supported the creation of LECO with two loans in 1985 and 1987. The Bank has also been a major source of finance and TA for rural electrification. The second loan for this purpose, for the Power System Expansion Project approved in May 1990, was the Bank's most recent power sector loan to Sri Lanka.

#### **D. Lessons Learned**

22. Previous projects financed by the Bank have been generally successful, particularly the development of LECO as an independent and efficient distribution utility. Both CEB and LECO have competent engineering staff, but they have been constrained by lack of autonomy and the requirement for Government review and approval of all important decisions. Progress on project implementation has often been delayed, mainly due to procurement issues. Similar problems have been experienced with power projects financed by other donors. A positive step was taken to expedite procurement when the Cabinet agreed in June 1994 to allow executing agencies of projects financed by the Bank and the World Bank to approve contract awards of up to SLRs50 million (\$1.0 million) without its further review and approval. Compliance with loan covenants has lagged in some cases. Electricity tariffs were too low for many years, resulting in poor financial performance of CEB in those years. The Government approved tariff increases in 1993 and early 1994, and this has resulted in reasonably satisfactory financial performance in 1994 and 1995.

23. In addition to the rural electrification TA completed in March 1992, which provided recommendations on how to improve rural electrification planning, design, and implementation procedures, the Bank also provided a TA for institutional review and development of CEB.<sup>1</sup> This study, completed in January 1994, recommended a number of measures to strengthen CEB's management and operations, including a recommendation that CEB delegate more accountability to its provincial offices and make them separate profit centers. The institutional strengthening of CEB will facilitate the Government's efforts to reduce its involvement in the power sector through increasing the autonomy of CEB and introducing area distribution units, which could be privatized

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<sup>1</sup> TA No. 1309-SRI for \$700,000, approved on 31 May 1990 and executed by Energy Resources International of USA.

at a later stage. However, progress in implementing the recommendations of these two TA studies has been slow.

## **E. The Bank's Sectoral Strategy**

24. The Bank's country operational strategy in Sri Lanka is to support projects that will accelerate economic growth to reduce poverty and increase employment opportunities. Development of economic and widely available electric power supply is an important infrastructure service required to improve living standards and support balanced regional economic growth. The Bank's specific objectives in the power sector are to (i) support formulation of well conceived least-cost power system development plans; (ii) promote balanced power generation, transmission, and distribution system development; (iii) improve operational efficiency through decentralized management; (iv) promote increased private sector participation in the power sector, particularly in new power generation projects; and (v) ensure financial viability and economic efficiency through adequate pricing policies and tariff structure. Increased electrification is seen as a catalyst for growth and as a means to improve living standards of the rural population, which comprises four fifths of the national population. With improved prospects for private sector participation in power generation, the Bank will in the future focus its assistance to the power sector on public utility transmission and distribution system development, and will support Sri Lanka's efforts to efficiently and effectively utilize private funding for power generation projects.

## **F. Policy Dialogue**

### **1. Tariff Structure and Cross-Subsidies**

25. Adequate average electricity tariff levels are essential to enable CEB and LECO to achieve satisfactory financial performance, which is necessary to (i) pay for all debt-service costs and also achieve a reasonable rate of return on capital investments; (ii) provide net earnings, which can be used to finance a significant proportion of capital costs for system expansion; (iii) operate CEB and LECO as financially sound companies that can borrow funds for expansion on their own account; and (iv) improve the creditworthiness of CEB as a party to PPAs with independent power producers. Adequate tariff levels combined with an appropriate tariff structure are also necessary to send price signals to consumers on the real economic costs of power supply in order to encourage more efficient power consumption and voluntary demand side management (DSM) practices. After several years of inadequate tariff levels two substantial tariff increases were implemented in July 1993 and February 1994 (18.4 percent and 18.6 percent, respectively), which enabled CEB to achieve a reasonably satisfactory financial performance in 1994 and 1995. The Cabinet agreed in October 1995, as a condition for completing processing of this Bank loan, to increase tariffs by about 11 percent on average in January 1996 to the levels shown in Appendix 4. This will enable CEB and LECO to comply with their financial covenants in 1996, particularly the 8 percent rate of return (ROR) on fixed assets.

26. The tariff structure, however, requires further review and revisions. The current tariff structure results in substantial cross-subsidies in favor of low-usage residential consumers. Residential tariffs for the initial blocks of consumption have been very low (see Figure 1 of Appendix 5). The average residential tariff in 1995 for the first 50 kWh of monthly consumption has been only \$0.027/kWh. With the new tariff schedule for 1996, this will increase to \$0.040/kWh. Residential tariffs are significantly below CEB's long-run marginal cost of power supply for residential consumers, which ranges from about \$0.10/kWh in urban areas to about \$0.24/kWh

in rural areas. The average residential tariff is also low compared with both the average overall total tariff in Sri Lanka and the average residential tariff in most other Asian countries, with the exception of India, as shown in Table 2.

**Table 2: Comparison of Electricity Tariffs in Some Asian DMCs (US¢/kWh)**

Country	Utility	Lifeline Rate for Small Residential Consumers with Total Monthly Consumption of		Average Residential Tariff	Average Overall Tariff	Ratio of Average Residential to Overall Tariff
		25 kWh	50 kWh			
Malaysia	TNB			10.4	8.8	118%
Singapore	PUB			9.5	8.1	117%
Philippines	Meralco	6.9	6.9	12.4	11.4	109%
Bangladesh	PBS	4.0	4.0	4.6	4.7	98%
Indonesia	PLN	6.2	6.2	7.1	7.4	96%
Thailand	PEA	3.4	4.5	6.7	7.7	87%
India	Various			2.5	3.6	69%
Sri Lanka	CEB - 1995	3.0	2.7	4.7	7.5	62%
	CEB - 1996	3.6	4.0	5.7	8.3	68%

27. The low residential tariffs result in a requirement for substantial cross-subsidies to residential consumers from commercial and industrial consumers (see Figure 2 of Appendix 5). They also result in financial losses on rural electrification sales because residential consumers, many of them with very low usage, account for 87 percent of such sales. In 1995, the average residential tariff for rural consumers has been only \$0.031/kWh, and the average overall tariff for rural areas only \$0.040/kWh. This will increase in 1996 to \$0.040/kWh and \$0.048/kWh respectively, which, however, is still much lower than average rural power tariffs in other low-income Asian countries.<sup>1</sup> CEB's 1995 tariffs have covered only 22 percent of the financial costs of power supply for rural electrification. Substantial increases in residential tariffs are therefore required, particularly for low levels of consumption up to 90 kWh/month.

28. The residential tariff is much lower than the alternative costs of lighting with kerosene that rural consumers have to pay when they are not connected to the grid. CEB has conducted surveys on rural household expenditures for kerosene for lighting and batteries, which indicate that such households on average spend about SLRs100-200/month for these purposes. The equivalent power consumption for lighting would require only about 7 kWh/month for a medium size house, but the total electricity consumption for such a house is typically about 40-50 kWh/month. The total cost of consuming 50 kWh/month has been only SLRs67 in 1995, and will be SLRs99 in 1996, which is less than the alternative average expenditure on kerosene that would provide much lower lighting levels. The Mission conducted a field trip to inspect some typical

<sup>1</sup> By comparison, average tariffs for rural electrification sales in other comparable Asian countries in 1990, converted to 1993 price levels, were: \$0.064/kWh in Thailand; \$0.060/kWh in Indonesia; \$0.067/kWh in Malaysia; \$0.075/kWh in Bangladesh; and \$0.079/kWh in the Philippines. See the "Report on Rural Electrification Experience in Asia: A Review of World Bank Experience" by the World Bank, Report No. 13295, June 30, 1994, for more discussion of this subject.

rural electrification schemes in North West Province, which confirmed that most prospective customers could pay, and would be willing to pay, more for power supply than the current low tariff levels.

29. For many years there were no significant increases in CEB's residential tariffs for low levels of consumption, and these tariffs in real terms after adjustment for inflation have declined substantially since 1988, as shown in Figure 3 of Appendix 5. The Government did increase residential tariff levels briefly in February 1994, but this increase was revoked again three months later, prior to elections held later that year. The Government has recognized the deficiencies of this tariff structure, partly as a result of discussions with the Mission during appraisal. The new tariff schedule to take effect on 1 January 1996 will increase residential tariffs by about 21 percent compared with an average overall tariff increase of 11 percent. Tariffs for the first 50 kWh/month of residential use will increase even more steeply, as shown in Table 2.

30. Indirect subsidies and cross-subsidies are required to support rural electrification. The Government provides no direct operating subsidies for rural electrification, although it does provide an investment subsidy in the form of equity contributions (including proceeds of the Bank loans) to CEB to finance the full capital costs of rural electrification projects, with no requirement for dividend payments to date. The full cost of rural electrification projects is included in total fixed assets, however, and overall tariffs must be adequate to earn a ROR of 8 percent on total net fixed assets in service. Since rural electrification projects are not financially viable investments with the low residential tariffs, losses on rural electrification are subsidized by charging higher tariffs to other consumer categories, primarily commercial and industrial. The uniform tariff policy also results in a cross-subsidy from urban to rural areas. However, these policies in some ways have been counterproductive to the welfare of the rural population. Because residential tariffs have been so low, it has not been profitable and there has been no incentive for CEB to serve these rural consumers. The result is that investments in rural electrification from the resources of CEB and the Government have been restrained, and Sri Lanka still has a relatively low level of rural electrification. With higher residential tariff levels, it would be possible for CEB to finance such investments from its own resources and to accelerate the development of rural electrification.

31. The current tariff structure requires a thorough review and revision. To assist CEB in this endeavor, the Bank agreed to finance international consulting services for a tariff study from Loan No. 1021-SRI(SF). CEB invited proposals for this study in October 1995; the study is expected to commence in February 1996; and the draft final report should be completed six months later. The Government, CEB, LECO, and the Bank will meet to discuss and agree upon the major recommendations of this study after the draft final report is prepared. The Government, CEB, and LECO will then implement the agreed upon recommendations on tariff restructuring according to a mutually acceptable schedule. The tariff restructuring will include a simplification of the current residential tariff structure, a further reduction of cross-subsidies to residential consumers, and establishing a clear basis for the bulk supply tariff from CEB to distributors. To reduce the large cross-subsidies to residential consumers, which are inherent in the current tariff structure, it has been agreed that average tariffs for residential consumers will be raised progressively over the next five years, or such other period of time as the Government and the Bank may agree upon, in such a manner that the average residential tariff will equal or exceed the average overall retail tariff thereafter.



32. Another feature of the tariff structure that requires review concerns adjustments to reflect changes in the cost of fuel. Such a fuel cost adjustment clause existed for many years, but was dropped in February 1994, when provision for fuel costs was incorporated into the basic tariff. CEB will incur substantial fuel costs for thermal generation in the next few years, but the required quantities and costs of such generation are unknown because of the uncertainty of future hydrologic conditions and load growth. The scope of the tariff study will include a review of options for a fuel cost adjustment clause. The final decision on whether to reinstate a fuel cost adjustment clause or to provide for a fuel cost reserve fund will be made after the tariff study is completed.

## **2. Privatization in the Power Sector**

33. The continued development of the power sector in Sri Lanka will require substantial investments as well as institutional reform and efficiency improvements. The Government has realized that the investment program cannot be fully financed by the public sector, and has invited the private sector to develop new power generation projects on a build-operate-own/transfer basis. This is an important step towards commercialization and privatization of the power sector. The Bank has agreed to finance consultants to assist CEB in negotiation of PPAs for such projects (see para. 15).

34. The Mission discussed with the Government its policy regarding the privatization of LECO. The Government confirmed that it has decided in principle to privatize LECO as soon as possible by selling a major part of its shareholding to private sector investors (see para. 16). Detailed plans for such divestment have not yet been developed. In view of the Bank's involvement with LECO through two previous loans and the additional lending through the proposed loan, it has been agreed that the plans for divestment of LECO's shares will be discussed further with the Bank. The Bank also plans to prepare a TA in 1996 to assist the Government in developing and implementing the regulatory framework for the regulation of LECO and other distribution utilities, and in exercising regulatory supervision.

## **3. CEB Management and Operations**

35. Two Bank-sponsored TA studies need to be followed up through full implementation of their recommendations by CEB. One is the rural electrification study (TA No. 1307-SRI), completed in March 1992, which contains recommendations on how to improve rural electrification planning, design, and implementation procedures. The other is the institutional review of CEB (TA No. 1309-SRI), completed in January 1994, which contains recommendations on how to strengthen CEB's management and operations (e.g., by delegating more accountability to CEB's provincial offices and making them separate profit centers). To ensure that these TAs have been effective, it has been agreed that CEB will prepare brief reports for each of these TA studies within six months of loan effectiveness that summarize the principal recommendations, CEB's acceptance or otherwise of each recommendation, progress to date in implementing each accepted recommendation, the benefits achieved or difficulties encountered, and an action plan to complete implementation.

#### **4. Energy Conservation and Demand Side Management**

36. CEB will examine options for including a DSM component in the Project and submit a corresponding proposal to the Bank for review. As a large part of the Project consists of rural electrification expansion, which adds peak load due to residential lighting in the evening, CEB has agreed to prepare a DSM project for lighting. This will provide fluorescent lights to residential consumers, and also replace incandescent street lights. Alternative residential lighting options will be evaluated, as well as various options for financing and cost recovery of more efficient lights. CEB will conduct surveys to determine (i) the extent of incandescent lighting and fluorescent lighting in households connected in the last five years; and (ii) consumer willingness to pay for the higher installation costs of fluorescent lamps of various types, considering both the current tariffs and the proposed tariff increases. Based on these surveys, CEB will evaluate options for subsidies or short-term loans to pay for these costs. CEB will also prepare a pilot program to provide such DSM services on a practical scale, to be financed under the Project.

### **IV. THE PROJECT**

#### **A. Rationale**

37. Rural electrification has been given a high national priority in Sri Lanka because of its potential to improve standards of living and economic development in less developed rural areas. At present only 62 percent of households in the country have access to electricity, and only about 44 percent are actually connected to public power supply. The proposed Project will provide electricity supply to about 156,000 additional households and other consumers, an increase of almost 10 percent in total connections in the country. Bank support for rural electrification development is important, since alternative sources of financing are very limited. The Project will also provide financing for transmission and distribution system developments by both CEB and LECO. These developments are required to supply adequate, economical, and reliable power to support continuing economic growth in urban and rural areas in Sri Lanka and to reduce power system losses.

38. A sector loan is proposed for the Project, which will finance a time-slice of CEB's and LECO's investment programs. The Mission has reviewed the power sector in detail and is satisfied that the Government's power sector policies are generally sound and merit support. CEB and LECO are suitable agencies for a sector loan, as the relevant criteria for providing a sector loan are met. The investment programs of CEB and LECO are well conceived and appropriately formulated to meet priority needs in distribution and transmission system expansion, while relying on the private sector to finance an increasing share of generation expansion. CEB and LECO are competent agencies capable of implementing the investment program by using the sector lending modality. The last Bank loan to CEB (Loan No. 1021-SRI(SF)), also a sector loan, is being implemented successfully, and the last Bank loan to LECO (Loan No. 870-SRI(SF)) had many features comparable to those of a sector loan. The sector loan approach is also much more practical for this Project, in view of the small size of most distribution and transmission subprojects, the corresponding large number of such subprojects to be financed under this loan, and the lack of detailed preparation and appraisal of most of these subprojects at this time. The Government, CEB, and LECO have also agreed, under loan covenants for this Project, to undertake reforms in tariff structure and other measures to improve performance and operations in the power sector.

## **B. Objectives and Scope**

39. The Project has been formulated with the objectives to (i) continue the Government's rural electrification program through CEB, (ii) provide financing for urgent transmission system developments required by CEB, and (iii) continue expansion and reinforcement of CEB's and LECO's distribution systems. The Project will consist of the following four groups of subprojects:

- A. CEB Rural Electrification
- B. CEB 33-kV Distribution
- C. CEB Transmission
- D. LECO Distribution

40. Part A will consist of many rural electrification subprojects that will provide or expand electricity supply in about 1,100 villages located in rural areas that are under CEB's responsibility. Part A has been formulated taking into account the findings of the Bank-financed rural electrification study and will include about:

- (i) 1,700 kilometers (km) of 33-kV overhead lines;
- (ii) 4,280 km of 400-volt (V) overhead lines;
- (iii) 575 distribution transformers with a total capacity of 50 megavolt-amperes (MVA);
- (iv) service connections and meters for about 110,000 new consumers;
- (v) 11 personmonths of consulting services for training in rural electrification project planning, design, and management; and
- (vi) pilot program to promote residential use of fluorescent lights for DSM, with a budget of \$500,000.

41. Part B will consist of CEB 33-kV distribution substations to serve LECO (Part B1), and 33-kV distribution lines in rural areas to strengthen CEB's existing distribution networks which are becoming overloaded in many areas, and to reduce losses on those lines (Part B2). Part B will include about:

- (i) five new primary 33/11-kV substations, required to supply 11-kV power to the LECO system at Kolonnawa, Nugegoda, Maharagama, Dulugama, and Seenigoda, and the associated 33-kV transmission lines required to connect these substations to the CEB system (Part B1);
- (ii) 750 km of 33-kV and 11-kV pole lines;
- (iii) 75 km of 33-kV tower lines;
- (iv) 100 MVar of capacitors; and
- (v) other related distribution equipment.

42. Part C will provide for the construction of a new transmission substation, transformers, transmission lines, and capacitors for the CEB system, which are required on an urgent basis to meet the load growth of the system. The emphasis of the Bank loan will be on transmission requirements up to 1998, since it is expected that OECF will provide financing for construction of new transmission projects to be commissioned after 1998. Part C will consist of:

- (i) construction of one new 132/33-kV grid substation at Veyangoda plus associated 132-kV transmission lines;
- (ii) additional transformer capacity totalling about 126 MVA, and transformer replacements totalling another 126 MVA, at six existing grid substations of 132/33 kV;
- (iii) 33-kV capacitor additions at seven substations, totalling about 75 MVAR;
- (iv) reconductoring and upgrading of the 132-kV transmission line, 38 km long, from the Kotugoda substation to the Kolonnawa substation;
- (v) 12 personmonths of consulting services for training in transmission project design and implementation; and
- (vi) three personmonths of consulting services for training in environmental impact analysis.

43. Part D is designed to strengthen and expand LECO's distribution system, including about:

- (i) 177 km of 11-kV with 400-V overhead lines;
- (ii) 470 km of 400-V overhead lines;
- (iii) 250 distribution transformers with a total capacity of 40 MVA; and
- (iv) service connections and meters for about 46,000 new consumers.

### **C. Cost Estimates**

44. The total Project cost is estimated at \$154 million equivalent, of which \$66 million (43 percent) is in foreign exchange and \$88 million equivalent (57 percent) is in local currency (see Table 3). Detailed cost estimates are given in Appendix 6. The cost estimates are based on 1995 price levels for base costs, an exchange rate of SLRs50 = \$1.00, taxes and duties at 45 percent of the price of imported supplies and equipment, no physical contingencies since these are already included in base costs, and total price contingencies of 6.6 percent based on three years of inflation at 2.2 percent per annum for equivalent costs in US\$.

**Table 3: Summary Cost Estimate**  
(\$ million)

Component	Foreign Exchange Cost	Local Currency Cost	Total Cost	Percent
A. CEB Rural Electrification	16.4	43.6	60.0	38.9
B. CEB 33-kV Distribution	15.0	14.5	29.5	19.1
C. CEB Transmission	25.0	16.7	41.7	27.1
D. LECO Distribution	<u>10.0</u>	<u>12.9</u>	<u>22.9</u>	<u>14.9</u>
<b>Total</b>	<b>66.4</b>	<b>87.7</b>	<b>154.1</b>	<b>100.0</b>

#### **D. Financing Plan**

45. The financing plan for the Project is shown in Table 4. The proposed Bank loan of \$80 million will finance about 52 percent of the total Project cost. The entire foreign exchange cost of \$66.4 million will be financed from the Bank loan. Local costs for Part A, except duties and taxes, the local manufacture of transformers, and consumer connection costs, will also be eligible for partial financing under the Bank loan up to \$13.6 million, or about 31 percent of the total local costs of Part A and 16 percent of the entire local costs of the Project. About 13 percent of the local costs for Part A will be financed by consumer contributions for service connections.<sup>1</sup> The Government will meet the balance of the local cost for Part A through reimbursement of duties and taxes, estimated at \$7.1 million equivalent, and through an allocation from its development budget of \$17.1 million equivalent, spread over three years. The interest that the Government will earn on the balance of the loan funds re-lent to CEB and LECO for Parts B, C, and D will pay for most of this allocation.

46. Bank financing of a portion of the local costs for Part A is considered to be justified on the following grounds: (i) the Government's development budget is very restricted; (ii) CEB's capacity to finance rural electrification development is also restricted; (iii) under the last Bank Loan No. 1021-SRI, the Bank financed 80 percent of the total costs for the rural electrification component, including most of the local costs; and (iv) under the proposed Project, the Bank will finance only 50 percent of the total cost for Part A, including about 31 percent of the local costs.

47. The Government's contribution (including Bank loan funds) for Part A will be passed on to CEB as equity. This arrangement was also followed under Bank Loan No. 1021-SRI for the last rural electrification project, and is in line with the Government's policy of financing rural electrification by providing equity to CEB (para. 30). This arrangement is considered appropriate because, while economically justified, rural electrification is not financially viable for CEB (para. 27); and while CEB is implementing the country's rural electrification program on behalf of the Government, it is also being encouraged to operate on a commercial basis and in a financially viable manner. In principle, CEB should not be required to finance a financially

<sup>1</sup> CEB's policy is to charge all consumers the full cost of distribution service connections. For residential consumers the average connection cost is about SLRs4,400 (\$88) per household. Local bank loans are available to consumers, with a CEB guarantee, to finance the full cost of this service connection with a five-year repayment period.

nonviable project, either through borrowings or its own resources. However, investments in rural electrification are added to CEB's rate base and the Government's tariff policy allows CEB to earn a satisfactory ROR on the overall rate base, removing the need for direct subsidies to the electric power subsector. Future tariff levels for rural electrification will be reviewed in the forthcoming tariff study, and the Government has agreed to increase these over the next five years (see para. 31), thus improving the cost recovery on rural electrification projects.

**Table 4: Proposed Financing Plan**  
(\$ million)

Component	Foreign Exchange Cost	Local Currency Cost	Total Cost	Percent
<b>A. CEB Rural Electrification</b>				
Bank	16.4	13.6	30.0	50.0
Government	-	24.2	24.2	40.3
Consumers	-	<u>5.8</u>	<u>5.8</u>	<u>9.7</u>
Subtotal	16.4	43.6	60.0	100.0
<b>B. CEB 33-kV Distribution System</b>				
Bank	15.0	-	15.0	50.8
CEB	-	<u>14.5</u>	<u>14.5</u>	<u>49.2</u>
Subtotal	15.0	14.5	29.5	100.0
<b>C. CEB Transmission</b>				
Bank	25.0	-	25.0	60.0
CEB	-	<u>16.7</u>	<u>16.7</u>	<u>40.0</u>
Subtotal	25.0	16.7	41.7	100.0
<b>D. LECO Distribution</b>				
Bank	10.0	-	10.0	43.7
LECO	-	10.3	10.3	45.0
Consumers	-	<u>2.6</u>	<u>2.6</u>	<u>11.3</u>
Subtotal	10.0	12.9	22.9	100.0
<b>Total Project Cost</b>	<b>66.4</b>	<b>87.7</b>	<b>154.1</b>	
Bank Loan	66.4	13.6	80.0	
Bank Loan (%)	100.0	15.5	51.9	

48. Local costs under Parts B, C, and D, will be financed from retained earnings of CEB and LECO (about 27 percent of the total Project cost) and by consumer contributions for connection costs.

49. The proposed loan from the Bank's Special Funds resources of \$80 million will have a repayment period of 40 years, including a grace period of 10 years. The Democratic Socialist Republic of Sri Lanka will be the Borrower. The proceeds relating to Part A will be

passed on by the Government as equity to CEB, while the proceeds relating to Parts B, C, and D will be relent to CEB and LECO in local currency at an interest rate of 13 percent per annum with a repayment period of 20 years, including a grace period of 5 years.<sup>1</sup> The Government will bear the foreign exchange risk. As a condition of loan effectiveness, the Government will enter into a Financing Agreement with CEB for provision of equity and loan and a Subsidiary Loan Agreement with LECO, in form and substance satisfactory to the Bank.

## **E. Implementation Arrangements**

### **1. Executing Agencies**

50. The Executing Agency for Parts A and B2 will be CEB, whose General Manager and Additional General Manager (Distribution and Customer Services) will be responsible for overall management of implementation, which will be carried out by two separate teams headed by Project Managers under the supervision of the Deputy General Manager (Distribution Development). The teams will be supported by CEB's provincial offices.

51. LECO will be in charge of implementation of the five 33/11-kV primary substations required under Part B1 to supply power to LECO. These will be implemented by LECO on behalf of CEB. LECO will design the substations according to specifications provided by CEB, and LECO will manage procurement and construction supervision. Upon the commissioning of these substations, LECO will turn them over to CEB, who will own and operate them.

52. The Executing Agency for Part C will be CEB, whose General Manager will be responsible for overall management of Part C. A team headed by a Project Manager shall be responsible for the planning of transmission subprojects under the supervision of the Additional General Manager (Planning), and for the contract awards and construction management of such subprojects under the supervision of the Additional General Manager (Transmission).

53. The Executing Agency for Part D will be LECO, whose General Manager will supervise implementation by a team headed by a Project Manager.

### **2. Implementation Schedule**

54. The proposed implementation schedule is shown in Appendix 7. Parts A, B, and D are estimated to require an implementation period of about four years, with procurement commencing in early 1996 and construction in early 1997. Construction work for Part C should start in mid-1997. All construction should be completed by late 1999. To expedite implementation and avoid some of the front-end delays that have occurred under past loans, it has been agreed that (i) all subprojects will be prepared to a satisfactory standard (including subproject appraisal reports with adequate justification) and submitted to the Bank for approval within two years of the date of loan effectiveness; and (ii) all contracts will be awarded within three years.

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<sup>1</sup> The Bank's last power sector Loan No. 1021-SRI(SF), approved on 31 May 1990, had a relending rate of 10 percent, and the World Bank's last power sector loan to Sri Lanka, Loan No. 2297-CE, approved in December 1991, had a relending rate of 12.5 percent. Recent OECF loans to the Government for power sector projects have had a relending rate of 13 percent.

### 3. Appraisal of Subprojects

55. CEB will prepare and submit subproject appraisal reports for Parts A, B2, and C, to the Bank for review and approval, while LECO will have this responsibility for Parts B1 and D. The procedures for subproject selection, appraisal, and approval are described in detail in Appendix 8. For Part A, subproject appraisals will follow similar procedures to those used for the rural electrification schemes under the ongoing Loan No. 1021-SRI(SF), incorporating recommendations made under the Bank-financed rural electrification study. The revised economic evaluation model developed in that study for evaluation of rural electrification subprojects will be used, with some further modifications as described in Appendix 8.

56. For each subproject an appraisal report, with an initial environmental examination (IEE) if necessary, will be prepared. Subprojects under Parts B, C, and D should have an economic internal rate of return (EIRR) of at least 12 percent. For rural electrification subprojects under Part A, the minimum EIRR will be 10 percent in view of the unquantified indirect and social benefits associated with such projects. However, for rural electrification subprojects in very poor areas, where at least 40 percent of expected connected households are below the poverty line (SLRs1,500 per family per month or \$360 per family per year), the EIRR threshold will be reduced to 8 percent to enable more participation of the poor under Part A. It is expected that less than 10 percent of rural electrification subprojects would qualify for this special provision as poverty-oriented subprojects. CEB has agreed to ensure that the average EIRR for all subprojects under Part A will be at least 10 percent.

### 4. Distribution Planning by CEB

57. Until recently CEB had no systematic process for conducting periodic distribution planning studies at the provincial level or for coordinating such distribution planning studies with transmission planning carried out at its headquarters. To rectify this deficiency, computer hardware, software, and training necessary to carry out all planning up to the 33-kV level have been provided to CEB under Loan No. 1021-SRI(SF). Consequently, CEB's provincial offices should now be able to prepare and update a distribution master plan for each province on an annual basis. This will include a detailed analysis, justification, and recommendations for development of various rural distribution schemes and the 33-kV distribution systems, and preliminary recommendations for augmentation and construction of 132/33-kV grid substations. These plans will then be reviewed and approved by CEB headquarters, and new grid substation construction and expansion will be coordinated with the Transmission Planning Branch. CEB will also take care to design distribution projects in the most economic manner, and consulting services have been provided under Part A to train CEB staff in more advanced techniques for distribution planning and design (see para. 61).

### 5. Procurement

58. Procurement of all items financed by the Bank will be carried out in accordance with the Bank's *Guidelines for Procurement*. As noted previously, the Bank will finance the entire foreign exchange cost of contracts for imported materials and equipment required for the Project, and also a portion of the local costs under Part A.



59. Under Part A, CEB's Distribution Development Branch will coordinate procurement through CEB's Procurement Branch. All imported materials and equipment required to construct rural electrification schemes under Part A, such as aluminum redraw rods, transformer components, etc., will be procured through international competitive bidding (ICB)<sup>1</sup> for contracts costing \$500,000 or more, while imported equipment and materials costing less than that will be procured through international shopping. CEB's standard local competitive bidding (LCB) procedures will be used for the manufacture of aluminum conductors and for the procurement of concrete poles, line hardware, and accessories.<sup>2</sup> The construction of the distribution lines and the installation of related equipment will be carried out by CEB and local contractors engaged by CEB at the village and provincial levels under its standard procedures. CEB may use either its own construction work force or local contractors for this work, depending on the availability of qualified local contractors to undertake such work, and also on the availability of CEB's own construction forces. Under Loan No. 1021-SRI(SF), about 60 percent of construction work was carried out by local contractors. CEB uses distribution transformers of 1 MVA and below manufactured by its subsidiary company, Lanka Transformers Limited. The imported materials required for the manufacture of transformers for Part A will be procured through ICB and financed from the Bank loan, while the Government will finance the local manufacture of these transformers by Lanka Transformers Limited from its own resources.<sup>3</sup> The Mission considers the above arrangements cost-effective and satisfactory to help achieve economy and efficiency in procurement. The Bank's Project Completion Report for Loan No. 436-SRI(SF) commended CEB on the introduction of private local contractors into distribution construction work, as this was considered beneficial for the project as well as for the development of local industry. Based on estimated quantities required, standard distribution equipment and materials will be procured in bulk. Prior to the preparation and submission of subproject proposals to the Bank, half the total equipment and materials required will be procured, as well as all tools required for construction. The second half will be procured when required, about two years later, depending on progress in implementation of subprojects under Part A. An imprest account will be established to facilitate the disbursement of the local costs financed under the Bank loan. The Bank approved advance procurement action in September 1995 for supply of equipment and materials related to Parts A and B. This includes review and approval of tender documents, and advertisement of invitations to bid.

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<sup>1</sup> Local suppliers, if any, participating in ICB bidding under the Project will, in the course of bid evaluation, be accorded the domestic preference margin allowed under the Bank's domestic preference scheme.

<sup>2</sup> CEB's standard local procurement procedures have been reviewed by the Mission and found satisfactory. These procedures were successfully used under the Bank's two previous loans to CEB for rural electrification projects (Loan Nos. 1021-SRI(SF) and 436-SRI(SF)), as well as under the two LECO projects (Loan Nos. 732-SRI(SF) and 870-SRI(SF)). Aluminum redraw rods will be procured through ICB. They will be used for the local manufacture of aluminum conductors. The cost of manufacture amounts to only about 10 percent of the total cost of conductors. With regard to concrete poles, line hardware, and accessories, the capability of local manufacturers and the scattered location of the rural electrification schemes render these relatively small contracts unattractive to foreign suppliers.

<sup>3</sup> These arrangements are considered cost-effective and satisfactory. Lanka Transformers Limited manufactured all the distribution transformers for the second rural electrification project financed by Bank Loan No. 1021-SRI(SF) under the same arrangements, and the transformers are technically satisfactory. The same company was awarded a contract in 1989 by LECO for the supply of similar transformers, after ICB procurement under the Loan No. 870-SRI(SF): Secondary Towns Power Distribution Project II.

60. Under Parts B, C, and D, all equipment and materials costing \$500,000 or more to be financed by the Bank will be procured through ICB, while equipment and materials costing less than that will be procured through international shopping. CEB's Distribution Development Branch will coordinate procurement through CEB's Procurement Branch under Part B2 for the 33-kV distribution line subprojects, while LECO will be responsible for preparation of tender documents and procurement under Part B1 for the five primary substations to supply power to LECO. Under Part C, CEB's Transmission Development Branch will coordinate the procurement of equipment and materials. Construction of lines and substations and installation of the related equipment will be carried out partly by local contractors engaged by CEB under its standard LCB procedures and/or by CEB on a force account basis. Under Part D, LECO will be responsible for all procurement. Construction of lines and installation of equipment will be carried out by local contractors engaged by LECO under its standard LCB procedures and/or by LECO on a force account basis.

## 6. Consulting Services and Training

61. Design work for Parts A and B will be done by CEB staff incorporating findings and recommendations of the Bank-financed rural electrification study. International consultants will be financed under Part A of the loan to (i) assist CEB in preparing a Code of Practice and Design for rural electrification projects, as recommended in the Bank-financed rural electrification study; and (ii) conduct a training seminar in Colombo to train CEB and LECO distribution engineers in the planning and design of distribution and rural electrification subprojects. The staff in provincial offices responsible for distribution planning will also attend the seminar, and a study tour of a successful Asian power distribution utility will be provided for some of the staff who complete the seminar. Terms of reference for the consulting services are given in Appendix 9. Consultants for this work will be engaged in accordance with the Bank's *Guidelines on the Use of Consultants*. It is estimated that about 11 person-months will be needed.

62. Several transmission subprojects will be constructed under Part C. A national transmission system planning study was recently completed for CEB,<sup>1</sup> but detailed designs for the recommended projects in this plan have not yet been prepared. The Bank will finance, under Part C, consulting services to train CEB engineers in the planning, design, and implementation of transmission projects (see the terms of reference in Appendix 10). An international consulting firm with the requisite qualifications and experience will be engaged in accordance with the Bank's *Guidelines on the Use of Consultants* to provide about 12 personmonths of services. CEB will ensure that the consultants for the above assignments are appointed within six months of loan effectiveness. A provision has also been made under Part C to finance about 3 person-months of consulting services to train CEB staff on the environmental impact assessment of projects (see terms of reference in Appendix 11).

63. Under Part D, standardized designs developed during the two previous Bank-financed projects will be applied and, consequently, no consulting services are required. For management and institution building, LECO intends to retain the consultants engaged under the

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<sup>1</sup> Power System Study, completed in December 1994 by Lahmeyer International of Germany.

previous projects<sup>1</sup> in an advisory capacity as the need arises, and to finance their services from its own resources.

## F. The Executing Agencies

### 1. Past Financial Performance

#### a. CEB

64. CEB's performance over the last three years is summarized in Table 5. Data for 1992 and 1993 are from CEB's audited financial statements, and for 1994 from unaudited financial statements. Detailed financial statements are given in Appendix 12.

**Table 5: Selected Performance Indicators for CEB**

Indicator	FY1992	FY1993	FY1994
ROR on revalued assets (%)	4.3	4.8	7.8
Debt-service coverage ratio	1.9	2.2	2.9
Debt: equity ratio	28:72	25:75	23:77
Sales increase (%)	6.4	12.1	9.0
Average tariff (SLRs/kWh)	2.64	3.13	3.71
Average tariff increase (%)	10.0	18.4	18.6
Accounts receivable (months)	2.5	2.8	2.4
Fuel cost (SLRs million)	1,645	349	912
Cash balance (SLRs million)	-2,084	1,067	5,685

65. Since 1986, CEB has experienced average annual growth rates of 6.0 percent in energy sales and 18.7 percent in sales revenue. Despite this growth, CEB has not always been able to comply with its main financial covenants under previous Bank loans. CEB's ROR on net revalued fixed assets in service was only 4.3 percent in 1992 and 4.8 percent in 1993, against the covenanted target of 8 percent. However, the ROR improved to 7.8 percent in 1994 because of substantial tariff increases in July 1993 and February 1994. CEB's debt-service coverage was 2.2 times in 1993 and 2.9 times in 1994, which satisfied the minimum requirement of 1.5. Accounts receivable have been below the covenanted three months since 1991.

66. CEB's capital expenditures over the last five years (1990-1994) have totalled SLRs30,161 million (approximately \$600 million at the current exchange rate). Funding for this program has been provided as shown in Table 6. The foreign aid has been provided primarily from the Bank, the World Bank, and OECF, usually through loans to the Government for onlending to CEB. Despite its very conservative gearing ratio (presently only 23:77 debt:equity ratio), CEB has not borrowed long-term funds directly from the capital markets either in Sri Lanka or overseas. Short-term borrowings have been arranged with local banks, usually to cover temporary liquidity problems caused by delays in Government approvals for tariff changes.

<sup>1</sup>

**Table 6: Sources of Investment Funds for CEB, 1990-1994**

Item	SLRs million	%
Government equity contributions	2,573	8.5
Consumer contributions	3,744	12.4
Foreign aid	12,910	42.8
Retained earnings	<u>10,161</u>	<u>36.3</u>
<b>Total</b>	<b>30,161</b>	<b>100.0</b>

**b. LECO**

67. Selected performance indicators for LECO for the last three years are shown in Table 7, and detailed financial statements are shown in Appendix 13. Data for 1992 and 1993 are from LECO's audited accounts, and for 1994 from its unaudited accounts.

**Table 7: Selected Performance Indicators for LECO**

Indicator	FY 1992	FY1993	FY1994
ROR on revalued assets (%)	8.7	10.4	10.6
Debt-service coverage ratio (times)	2.7	3.5	4.5
Self-financing ratio (%)	78	68	90
Debt: equity ratio	44:56	35:65	29:71
Sales increase (%)	12.6	9.5	11.8
Average tariff (SLRs/kWh)	2.82	3.26	3.84
Average tariff increase (%)	16.9	15.7	17.7
Accounts receivable (months)	2.5	2.6	2.1
Cash balance (SLRs million)	615	580	893

68. LECO was unable to meet its financial covenants during its early years of operation because of the dilapidated systems it took over from local authorities, and its poor consumer mix, which had a large proportion of small, unprofitable residential consumers. LECO incurred financial losses until 1990, when it made its first profit. Profitability has steadily improved since then, and LECO has exceeded the covenanted 8 percent ROR since 1992. LECO has also met its debt-to-equity and debt-service coverage covenants of 60:40 and 1.5 times, respectively, for the last three years. Now that it is operating a larger, more modern system, and in the absence of major capital projects, its self-financing ratio on a three-year average basis has been over 60 percent for the last three years. At the end of 1994 LECO's accounts receivable represented 2.1 months' revenue.

**2. Projected Financial Performance****a. CEB**

69. The Government announced a change in policy in 1992 whereby CEB's investment program for new thermal power generation would be taken over by private sector developers to the maximum possible extent. As of November 1995, no firm contracts for new private power generation projects have been awarded, however, CEB's investment plan and the financial projections described in this section assume that CEB will undertake only hydropower

development. While the new policy will ease CEB's funding requirements, the cost of purchased power from the private sector in the medium term will be slightly higher than if produced by CEB because of the higher cost of commercial financing and a shorter capital recovery period.

70. CEB's plans for development and financing of new power plants and transmission and distribution expansion are summarized in Appendix 1. This shows that several new thermal power plants are proposed for development by CEB, but the financing for these projects is not yet assured. Although CEB's investment program over the next five years will be substantially reduced as a result of the proposed private sector participation in generation, CEB's planned annual investments are still high, totalling SLRs66 billion, or \$1,320 million, during the period 1996-2000. This projection is based upon the assumption that all new thermal power plants after 1997 will be developed by the private sector, and that CEB will be responsible for development of all transmission and distribution, the completion of the Sapugaskanda diesel project now under construction, and the construction of two new hydro projects. If CEB also develops new thermal power plants, then CEB's investment program will increase accordingly. The Bank's contribution to financing this development program under the proposed Project will be \$70 million, which is only about 5 percent of CEB's total investment requirements for the next five years. Appendix 1 indicates that assured sources of financing from other agencies and sources are still rather limited at present, and CEB will therefore require additional financing for its development program.

71. The projected performance indicators for CEB are summarized in Table 8, and forecasts of detailed financial statements are shown in Appendix 12. These projections are based on the development program described above. If CEB does undertake construction of new thermal power plants as well, the self-financing ratios shown in Table 8 will be reduced.

**Table 8: Projected Performance Indicators for CEB**

Indicator	FY1995	FY1996	FY1997	FY1998	FY1999	FY2000
Sales increase (%)	11.0	10.0	10.0	10.0	10.0	10.0
Average tariff (SLRs/kWh)	3.74	4.14	4.60	5.20	5.86	6.10
Required tariff increase (%)	-	10.7	11.1	13.0	12.7	4.1
ROR on revalued assets (%)	7.5	8.2	8.0	8.0	8.0	8.0
Debt-service coverage ratio	2.9	2.9	2.2	2.9	3.0	2.7
Self-financing ratio (%)	50	69	31	52	58	55
Debt: equity ratio	21:79	20:80	19:81	19:81	18:82	17:83
Cash balance (SLRs million)	4,093	6,244	6,244	6,244	6,244	6,244

72. CEB's future financial performance will depend on a number of factors, the foremost being adequate tariffs. The Cabinet in October 1995 approved a tariff increase of about 11 percent to an average rate of SLRs4.14/kWh, to take effect on 1 January 1996, which will enable CEB to earn 8 percent ROR in 1996. Further tariff increases in subsequent years will also be required, as shown in Table 8. Another important factor is the need for timely implementation of the required capital expenditure program to ensure that capacity is available to meet the forecast load growth of 10 percent per annum. The development of new private thermal power projects will also have to proceed quickly if CEB is to satisfy all forecast load growth. Continued and concerted action to reduce both technical and nontechnical system losses, which are currently about 18 percent, is also required. The above projections assume that losses will be reduced by 0.6 percent annually for the next ten years.

73. Annual tariff increases are projected to average 10.3 percent over the next five years, in part because of the initial higher costs of private power generation. This is higher than the forecast domestic inflation rate of 7.5 percent annually. As a result of these increases in tariffs and reduced annual investment in generation by CEB, it is projected that CEB's self-financing ratio will significantly improve. However, a substantial cash balance, estimated at about SLRs6.0 billion, will have to be retained in CEB to cover a reasonable level of current expenditures and, in the absence of a fuel adjustment surcharge mechanism, as a reserve for fuel costs in the event that water resources are inadequate to provide sufficient hydro generation to meet demand.

#### **b. LECO**

74. The projected performance indicators for LECO are summarized in Table 9, and detailed financial information is shown in Appendix 13. These projections assume that the bulk supply tariff for LECO's power purchases from CEB will increase at the same average rate as CEB's retail tariff, and that LECO's retail tariff will increase sufficiently to ensure an 8 percent ROR on revalued fixed assets. This results in lower LECO retail tariff increases than those needed by CEB. LECO is now entering a period of slower growth and investment after having consolidated its position by completing the acquisition and rehabilitation of distribution systems taken over from local authorities. LECO will have high self-financing ratios in future years, even though it has been assumed that 50 percent of net profits after tax are paid out as dividends, and income tax is paid commencing in 1999. LECO will be in a position to finance a substantial proportion of future expansion from retained earnings, and with a reasonable level of profitability thus established, it is now ready to be privatized. It is not expected that privatization will have any significant impact on LECO's financial performance. As a prerequisite for privatization and in the absence of a regulatory framework, the Government will need to assure potential purchasers that the mechanisms for establishing the bulk power supply tariff for LECO's purchases from CEB and for setting LECO's retail tariffs will be fixed in a satisfactory manner and for a reasonable period if optimum proceeds are to be realized from privatization.

**Table 9: Projected Performance Indicators for LECO**

<b>Indicator</b>	<b>FY1995</b>	<b>FY1996</b>	<b>FY1997</b>	<b>FY1998</b>	<b>FY1999</b>	<b>FY2000</b>
Sales Increase (%)	9.6	8.1	7.8	7.7	7.5	7.2
Average tariff (SLRs/kWh)	3.78	3.97	4.18	4.51	4.90	5.07
Required tariff increase (%)	-	5.0	5.1	8.1	8.6	3.4
ROR on revalued assets (%)	9.1	8.6	8.0	8.5	8.3	8.4
Debt-service coverage ratio	2.1	4.0	3.0	3.0	2.9	3.1
Self-financing ratio (%)	132	46	89	50	48	33
Debt: equity ratio	24:76	22:78	22:78	22:78	21:79	19:81
Cash balance (SLRs million)	1,146	955	994	823	559	323

#### **G. Environmental Considerations**

75. The environmental regulations in Sri Lanka were reviewed by Bank staff, and the environmental management capabilities of the agencies involved in the Project were assessed. The question of ensuring consistency between the Bank's requirements for environmental analysis of projects and the existing regulatory system of Sri Lanka was discussed with the relevant authorities, and a procedure for such analysis under the Project has been agreed upon. Details of the procedure are described in Appendix 14.

76. The existing environmental regulatory procedures of Sri Lanka are basically sound, and therefore they will be relied upon to the maximum extent to ensure that the environmental concerns are properly addressed. Under the agreed upon procedure, each subproject will be screened for environmental impact. All subprojects that are currently required to undergo environmental evaluation under Sri Lanka's regulations will continue to be subject to these requirements. The procedures will identify subprojects that are environmentally sensitive, and these will be evaluated by the designated national environmental authorities. Of these, subprojects with a capital cost exceeding \$5.0 million will be further reviewed by the Bank for their environmental impact.

77. CEB and LECO staff are reasonably aware of environmental issues and experienced in the environmental review of projects. Nevertheless, further training in this subject would be beneficial, and it has been agreed that CEB will engage consultants, to be financed under Part C of the loan, to conduct a training program in Colombo on the preparation of IEE and environmental impact assessment (EIA) studies. Such a program will also facilitate the use of the agreed upon environmental procedures. Terms of reference for this training program are described in Appendix 11.

## **V. PROJECT JUSTIFICATION**

### **A. Economic and Financial Analyses**

#### **1. Part A: CEB Rural Electrification**

78. Rural electrification to be undertaken under Part A will serve about 110,000 rural households and other consumers with a total population of about 530,000 people. About 87 percent of the energy sales from Part A will be to residential consumers, and the balance will be to commercial and small industrial consumers. Part A is estimated to cost \$60 million for distribution and consumer connection costs, which corresponds to an average cost of \$545 per consumer. The financial and economic analyses of Part A are described in detail in Appendix 15 and summarized below.

79. The economic benefits of electricity consumption by residential consumers are based on (i) the alternative economic costs of kerosene that would be used for lighting in the absence of electricity supply; and (ii) valuing additional energy consumption at the estimated average willingness to pay for electricity based on a weighted average of alternative kerosene costs for lighting and the current residential tariff. For industrial users, electricity is used mainly for motors, and the cost of alternative small diesel motors is therefore considered to determine the economic benefits of power supply. The resulting EIRR for Part A as proposed by CEB is estimated to be 10.9 percent for the base case. Sensitivity analysis has been conducted for several scenarios, which are described in Appendix 15. To be eligible for financing from the proposed sector loan, each rural electrification subproject must have an EIRR of at least 10 percent, or 8 percent if more than 40 percent of project beneficiaries are below the poverty line. This screening will eliminate the relatively less economic subprojects.

80. The financial analysis of Part A is based on the total financial costs to CEB of rural electrification and the additional tariff revenues generated by it. Part A is not profitable because of the low tariffs, which in 1995 have averaged in rural areas only SLRs1.60/kWh for residential

consumers, SLRs5.75/kWh for commercial consumers and SLRs4.40/kWh for industrial consumers. In 1996 this will increase to SLRs2.04/kWh for residential consumers, with moderately higher tariffs for commercial and industrial consumers. The average incremental cost of service to rural consumers is about SLRs11.8/kWh, which is almost six times the 1996 average residential tariff, and more than twice the average commercial and industrial tariff. The net annual financial cash flows of Part A are therefore negative, and it is not possible to calculate the financial internal rate of return (FIRR). A more meaningful measure of project performance in this case is the financial benefit-cost ratio, which will be 0.23 with the 1996 tariffs. This indicates that only 23 percent of the total financial costs of rural electrification are recovered through the tariffs, and the balance has to be cross-subsidized by other consumer groups. With the tariff restructuring agreed to under the Project, average residential tariffs will increase in real terms over the next five years so that they are at least equal to average overall retail tariffs. The financial cost recovery for the rural electrification under Part A will then increase to about 38 percent by the year 2001.

81. Although the financial performance of the rural electrification in Part A is disappointing, its size is small compared with CEB's overall operations, and its impact on CEB's average tariff level is moderate. Even though a large number of rural consumers will benefit from Part A, average consumption rates for these consumers are relatively low, and total energy sales under Part A will amount to only 0.7 percent of CEB's overall energy sales. The financial losses on rural electrification operations will be recovered by cross-subsidies from other consumer groups, and by increases in CEB's overall average tariff level. The average tariff will have to increase about 1.0 percent to pay for the costs incurred under Part A. The total impact of the entire rural electrification program in the country, including rural electrification projects already constructed and those planned for the future, will be to increase CEB's average overall tariff level by about 8-10 percent.

## **2. Parts B and C: CEB Distribution and Transmission**

82. Part B of the Project will strengthen CEB's existing 33-kV distribution system in rural and provincial areas for loss reduction and improved security of supply, and will also include five new 33/11-kV primary substations required to supply power to LECO. Part C will include new transmission substations, transmission lines, and capacitors for the CEB system, which are required during the period 1996-1998 to meet continuing load growth. A recently completed national transmission system planning study demonstrates that these subprojects under Part C are required technically and are part of the least-cost plan for CEB's transmission development.

83. These distribution and transmission subprojects cannot be readily evaluated for economic and financial performance on a stand-alone basis, but must be considered as part of CEB's integrated power system expansion program. An economic evaluation of this program for additional power supply over a ten-year period was conducted, resulting in an EIRR of 21 percent (for details see Appendix 15). The FIRR for CEB's integrated power system expansion program should be close to 8 percent, since CEB is obliged under its loan covenants to earn an 8 percent ROR on revalued net fixed assets in service.

## **3. Part D: LECO Distribution**

84. LECO's distribution system development under Part D will serve about 46,000 households and other consumers, with a total population of about 220,000 people. The average



connection cost under Part D will be about \$500 per customer, which is lower than for CEB's rural electrification under Part A because population densities are higher in LECO's service area. Economic development and average income levels are also higher, resulting in higher average consumption rates for LECO customers. The resulting EIRR for Part D is estimated to be 16.3 percent.

#### 4. Consolidated Economic Performance of the Project

85. The economic performance of each major part of the Project, and the weighted or consolidated performance of the overall project, is summarized in Table 10.

**Table 10: Summary of Economic and Financial Performance**

<b>Project Component</b>	<b>Total Cost (\$ million)</b>	<b>EIRR</b>	<b>FIRR</b>
A - Rural Electrification	60	10.9%	-
B - CEB 33-kV Distribution	29	21%	8%
C - CEB Transmission	42	21%	8%
D - LECO Distribution	23	16.3%	8%
<b>Total Project</b>	<b>154</b>	<b>16.5%</b>	

#### B. Social Dimensions

##### 1. Socioeconomic Impact

86. Parts A and D of the Project will provide electricity service and improve standards of living and the quality of life for about 750,000 people living in rural areas. The improvements created by public electricity supply will include greatly improved lighting that will allow more active use of time in the evening for work at home or in local shops and cottage industries, leisure activities, television viewing, study, and reading. Electricity supply will also enable small commercial establishments and rural industries to become viable or more profitable. This will increase employment opportunities and economic development in rural areas. However, the employment impacts of rural electrification should not be overestimated. Surveys of 53 rural electrification schemes implemented under Loan No. 436-SRI(SF) indicate that 87.1 percent of electricity sales are for residential use, 8.3 percent are for commercial use (retail shops, schools, offices, etc.), and only 4.6 percent are for industrial use. The average number of industrial consumers using electricity (rice mills, carpentry shops, welding shops, etc.), is about five per scheme, employing a total of about 12 persons per scheme. This compares with an average number of 198 consumers per scheme, and an average population of about 1,300 people resident in the area served by each scheme. Thus, the direct industrial employment impacts of rural electrification are moderate. However, this analysis does not include increased employment in commercial establishments or home-based cottage industries which may be more significant. The introduction of electricity also enables longer working hours and increased production and efficiency at many existing occupations. Evidence from other countries such as Thailand suggests that these other employment enhancement benefits are important.

87. Many of the beneficiaries of rural electrification are from very low income families. The Ministry of Finance, Planning, Ethnic Affairs and National Integration estimates that 25 percent of the total rural population, or 20 percent of the total national population, has an income below the Government's official poverty line of SLRs1,500 per family per month (or \$360 per family per year). The Ministry has conducted follow-up surveys of the first Bank-financed rural electrification project, constructed between 1980 and 1988, which indicate that 20 percent of its total connected consumers were below the poverty line in 1994. The income distribution of rural consumers connected under this project is shown in Appendix 16. The median annual income level, i.e., the level reached by 50 percent of rural consumers, was \$640 per family in 1994, and the average annual income level, was \$790 per family. By international standards, these are relatively low figures. Considering that the average family size is about 4.8 persons, this corresponds to per capita income levels of only \$133 and \$165, respectively. It is expected that the income distribution of beneficiaries under Part A will be even more skewed towards low incomes, because of the reduced threshold EIRR of 8 percent for schemes with at least 40 percent of households below the poverty line.

## **2. Benefit Monitoring and Evaluation**

88. CEB will conduct follow-up surveys of the benefits of the rural electrification under Part A to enable post-evaluation of the Project, and also to improve the planning for future rural electrification projects. CEB will compile records of the total numbers of consumers who are connected in each scheme under Part A at several dates after its commissioning. These surveys, which can be based on consumer billing records, will include statistics on (i) size of each scheme and date of commissioning; (ii) original forecasts of numbers of consumers in various categories, average consumption rates, and total sales for each scheme after one, three, and five years; and (iii) actual figures for the above items after one, three, and five years. CEB will also carry out more comprehensive field surveys, in scope and format acceptable to the Bank, in a representative selection of about 10 percent of the rural electrification schemes implemented under Part A, at time intervals of one, three and five years, to determine (i) actual numbers of connected consumers in various categories, numbers of total potential consumers in those categories resident in the service area, and the connection ratios for those categories at various dates after commissioning; (ii) average consumption rates for consumers in each category; (iii) description (quantitative wherever possible) of new economic activities induced by the introduction of electricity; (iv) description (quantitative wherever possible) of existing economic activities that have switched to using electricity and thereby become more efficient and productive; (v) estimated total value of economic activities induced by the rural electrification; (vi) estimates of average income levels; and (vii) surveys of the perceived importance of various types of benefits created by electricity supply, such as improved employment opportunities, increased income levels, improved quality of life and leisure activities, opportunities for television viewing and reading, improved health standards and more varied and enjoyable food due to refrigerators. CEB will also carry out concurrent surveys of average income levels in some representative and comparable communities that are not electrified in order to determine the incremental impact of rural electrification on income levels and economic activities.

## VI. ASSURANCES

### A. CEB

89. The financial covenants under the previous Bank loans are appropriate in most cases and will be repeated under the proposed loan, with one addition. The Government and CEB have given the following assurances, in addition to the standard assurances, which have been incorporated in the legal documents:

- (i) The Government and CEB will take all necessary actions, including tariff adjustments, to ensure that CEB annually achieves, at the minimum:
  - (a) an after-tax ROR of 8 percent on its revalued net fixed assets in operation;
  - (b) a debt-service coverage ratio of at least 1.5 times;
  - (c) a ratio of current assets to current liabilities of at least 1.2 (this is a new covenant).
- (ii) CEB's accounts receivable will not exceed three months of equivalent electricity sales.
- (iii) The Government will make available funds provided for Part A to CEB as equity under a Financing Agreement.
- (iv) CEB will furnish to the Bank:
  - (a) unaudited financial statements on its operations not later than five months after the end of each fiscal year, and audited financial statements not later than ten months after the end of each fiscal year;
  - (b) financial projections of its operations (including income statements, balance sheets, and sources and applications of funds statements) for the ensuing ten years at the end of each fiscal year; and
  - (c) results of tariff investigations carried out jointly with LECO by 1 July each year.

90. The Government and CEB will proceed as quickly as possible to appoint international consultants to conduct the tariff study, to be financed by the Bank under Loan No. 1021-SRI(SF). The Bank and LECO will be invited to participate in the review of progress under this study when interim reports are completed. The Government, CEB, LECO, and the Bank will meet to discuss and agree upon the major recommendations of this study after the draft final report is prepared and before it is finalized. The Government, CEB, and LECO will then implement the agreed upon recommendations on tariff restructuring according to an agreed upon schedule. The tariff restructuring will include a simplification of the current residential tariff structure, the reduction of cross-subsidies to residential consumers, and setting a bulk supply tariff from CEB to distributors. To reduce the large cross-subsidies to residential consumers that are inherent in

the current tariff structure, average tariffs for residential consumers will be raised progressively over the next five years, or such other period of time as the Government and the Bank may agree upon, in such a manner that, thereafter, the average residential tariff will equal or exceed the average overall retail tariff.

91. The following assurances related to CEB's management and project preparation have also been incorporated in the legal documents:

- (i) CEB's regional distribution district offices will prepare on an annual basis plans for distribution system development in each district, including an analysis of feasibility and justification for each new subproject. These plans will then be reviewed and finalized by CEB's headquarters office.
- (ii) CEB will ensure that an adequate number of qualified engineers and other professional staff are assigned to implement the transmission and distribution subprojects funded under the Bank loan.
- (iii) CEB will prepare a Code of Practice for design of distribution projects and systems, with the assistance of consultants, which will incorporate the recommendations made in the report on Rural Electrification Development prepared under the Bank's TA No. 1307-SRI. CEB will also ensure that these recommended practices are followed.
- (iv) CEB will prepare a status report for each of the two Bank-financed TA studies (i) Rural Electrification Development in Sri Lanka (TA No. 1307-SRI), completed in March 1992; and (ii) the Institutional Review and Development of CEB (TA No. 1309-SRI), completed in January 1994. These status reports, to be completed within six months of loan effectiveness, will summarize the principal recommendations of these studies concerned with CEB's management and operational practices, CEB's acceptance or otherwise of each recommendation, progress to date in implementing each accepted recommendation, the benefits achieved or difficulties encountered, and an action plan to complete implementation of these recommendations.
- (v) CEB will complete the preparation of appraisal reports for all its subprojects and submit these to the Bank for approval within two years of the date of loan effectiveness; and CEB will complete the award of all contracts for its subprojects under this loan within three years of the date of loan effectiveness.
- (vi) CEB will conduct follow-up surveys of the benefits of the rural electrification under Part A, in order to enable a post-evaluation of this project and to improve the planning for future rural electrification projects.
- (vii) CEB will engage international consultants to provide assistance on the three consulting assignments to be financed under this loan according to agreed upon terms of reference for (i) training in distribution system planning and design procedures, (ii) training in transmission design management, and (iii) training in environmental evaluation of subprojects.

- (viii) CEB will prepare a feasibility study for a pilot program on DSM, to be funded from Part A of the Project. This DSM proposal will concentrate on promoting the use of fluorescent lights by residential consumers.

## **B. LECO**

92. The financial covenants under the previous Bank loans are appropriate in most cases and will be repeated under the proposed loan, with one modification and one addition. The Government and LECO have given the following assurances, in addition to the standard assurances, which have been incorporated in the legal documents:

- (i) The Government and LECO will ensure that tariffs for the sale and purchase of electricity are established and maintained at a level adequate to enable LECO to achieve annually:
  - (a) an after-tax ROR of at least 8 percent on its revalued net fixed assets in operation;
  - (b) a self-financing ratio of at least 30 percent, based on a three-year moving average (this is a modification of the previous covenant under Loan No. 1021-SRI(SF), which requires LECO to achieve a self-financing ratio of at least 20 percent);
  - (c) a debt-service coverage ratio of at least 1.5 times; and
  - (d) a ratio of current assets to current liabilities of at least 1.2 (this is a new covenant).
- (ii) LECO's accounts receivable will not exceed two months equivalent of electricity sales.
- (iii) LECO will maintain a ratio of debt to equity not higher than 60:40.
- (iv) LECO will not declare any dividend if its ROR is less than 8 percent. LECO's target dividend distribution rate will be 50 percent of net annual earnings after tax.
- (v) LECO will furnish to the Bank:
  - (a) unaudited financial statements on its operations not later than four months after the end of each fiscal year, and audited financial statements not later than ten months after the end of each fiscal year;
  - (b) financial projections of its operations (including income statements, balance sheets, and sources and applications of funds statement) for the ensuing five years at the end of each fiscal year; and
  - (c) the results of tariff reviews carried out jointly with CEB by 1 July each year.

- (vi) As a condition of loan effectiveness of the Loan Agreement, the Government will issue to LECO, pursuant to the Electricity Act, a license to supply electricity at voltages up to 33-kV for at least ten years, and otherwise substantially similar to the license issued to LECO dated 12 June 1989.
- (vii) In view of the Bank's involvement with LECO through two previous loans and the proposed additional lending through this loan, the Government will discuss further with the Bank its proposed plans for divestment of LECO's shares.

## VII. RECOMMENDATION

93. I am satisfied that the proposed loan would comply with the Articles of Agreement of the Bank and recommend that the Board approve the loan in various currencies equivalent to Special Drawing Rights 53.528 million to the Democratic Socialist Republic of Sri Lanka for the Second Power System Expansion (Sector) Project, with a service charge at the rate of 1 percent per annum and with an amortization period of 40 years, including a grace period of ten years, and such other terms and conditions as are substantially in accordance with those set forth in the draft Loan Agreement and Project Agreements presented to the Board.

MITSUO SATO  
President

16 November 1995

## APPENDIXES

<b>Number</b>	<b>Title</b>	<b>Page</b>	<b>Cited On (page, para.)</b>
1	Planned Power Development Projects	34	4,8
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5	Tariff Analysis	39	8,26
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9	Terms of Reference for Consulting Services for Distribution System Planning and Design Procedures	49	20,61
10	Terms of Reference for Consulting Services for Transmission Design Management	52	20,62
11	Terms of Reference for Consulting Services for Training on Environmental Assessment	54	20,62
12	Financial Statements for CEB	55	21,64
13	Financial Information for LECO	60	22,67
14	Environmental Review and Approval of Subprojects	61	24,75
15	Economic and Financial Analysis	65	25,78
16	Income Distribution of Rural Electrification Customers	74	28,87

## SUPPLEMENTARY APPENDIX

(available on request)

- A. SIEEs for Sample Subprojects

# **PLANNED POWER DEVELOPMENT PROJECTS**

**Table 1 : New Power Plants**

<b><u>Powerplant</u></b>	<b><u>Capacity</u></b> <b><u>MW</u></b>	<b><u>Total</u></b> <b><u>Cost</u></b> <b><u>Mil.\$</u></b>	<b><u>Status and Financing</u></b>
Sapugaskanda Diesel Stage II	40	64	Under construction, to be commissioned in January 1997. ADB has provided \$42 million in financing through Loan No. 1021-SRI(SF).
Sapugaskanda Diesel Stage III	40	64	Project is planned, but financing not yet completed. KfW has indicated interest in financing DM 47 million (about \$33 million).
Kukule Hydro	70	230	Financing secured from OECF. Detailed engineering and construction not yet started.
Upper Kotmale Hydro	150		Environmental feasibility is very uncertain. Financing secured from OECF, subject to environmental clearance.
Combined Cycle	150	150	Appraisal by OECF in progress. Candidate for OECF finance in 1996.
West Coast Coal Power Plant	300		Feasibility study by JICA in progress. Candidate for OECF finance in 1997.
<b><u>Various BOO/BOT Projects:</u></b>			
KHD Diesel Project	51		Discussions in progress with Ministry of Finance and Planning to finalize the power purchase agreement. IFC plans to finance part of this project.
Trincomalee Coal Power Plant	300		Discussions with original sponsors have failed. Government recently advertised for new proposals.
Combined Cycle Project	150		Proposals have been invited.
Barge Mounted Diesel Project	100		Proposals have been invited.



## PLANNED POWER DEVELOPMENT PROJECTS

**Table 2: CEB's Transmission and Distribution  
System Expansion, 1996-2000**

<u>Amount</u> (\$ millions)		<u>Comments</u>
415	<b><u>Total Investments</u></b>	Load growth in next five years (1995-2000) is forecast to be 394 MW. Average investment in transmission and distribution will be about 1,053 \$/kW of incremental peak load.
	<b><u>Sources of Funds</u></b>	
48	World Bank Loan 2297	This loan for the World Bank's Second Power Transmission and Distribution Project was approved in December 1991 for an amount of \$56 million, of which about \$8 million has been spent to date. Loan will close in June 1998.
25	NORAD Project	Soft loan for transmission development; approval expected in late 1995.
12	Korean Loan	Soft loan for transmission development, approved 1995, due to close in 1998.
40	Proposed ADB Loan	A major part of the proposed Bank loan is allocated to CEB's transmission and distribution system development.
80	Planned OECF Loan	An OECF loan for transmission system development is under consideration, and expected to be approved in 1997. First contract awards would be late 1998.
22	CEB Allocation to date	CEB has recently allocated \$22 million from its own budget for urgent refurbishment of the transmission system over the next three years.
188	Financing Gap	Additional financing to be arranged, from CEB's own funds and other sources.

**EXTERNAL ASSISTANCE FOR POWER SECTOR, 1987–1994**  
**(\$ million)**

Source	Loan	Grant	Total
<b>MULTILATERAL</b>			
ADB	109	2	111
World Bank	122	—	122
<b>Subtotal</b>	<b>231</b>	<b>2</b>	<b>233</b>
<b>BILATERAL</b>			
Germany	55	—	55
Japan	200	—	200
Netherlands	—	1	1
United Kingdom	—	45	45
<b>Subtotal</b>	<b>255</b>	<b>46</b>	<b>301</b>
<b>TOTAL</b>	<b>486</b>	<b>48</b>	<b>534</b>

Sources: UNDP Development Cooperation: Sri Lanka 1993 Report, March 1995 and  
ADB Document No. 95/09, Loan, Technical Assistance and Private Sector Operations  
Approvals, September 1995.

**BANK LOANS AND TECHNICAL ASSISTANCE  
TO THE ENERGY SECTOR IN SRI LANKA**

**A. LOANS**

Loan No.	Amount (\$ million)	Date of Approval	Project
118-SRI(SF)	8.00	19 Dec 1972	Bowatena Hydroelectric Project <sup>1/</sup>
299-SRI(SF)	17.50	26 Jul 1977	Canyon Hydropower Project <sup>1/</sup>
436-SRI(SF)	11.30	10 Dec 1979	Rural Electrification Project <sup>1/</sup>
654-SRI(SF)	3.45	17 Nov 1983	Trincomalee Thermal Power Project <sup>1/</sup>
732-SRI(SF)	12.40	13 Feb 1985	Secondary Towns Power Distribution <sup>2/</sup>
634-SRI(SF)	3.80	16 Aug 1983	Special Assistance <sup>3/</sup>
870-SRI(SF)	34.80	3 Dec 1987	Secondary Towns Power Dist. Project II <sup>1/ 2/</sup>
1021-SRI(SF)	74.30	31 May 1990	Power System Expansion (Sector Loan) <sup>1/</sup>

**B. TECHNICAL ASSISTANCE**

Loan No.	Amount (\$ million)	Date of Approval	Project
83-SRI	46,000	11 Apr 1973	Preparation of Samanala Wewa Power
219-SRI	190,000	9 Dec 1977	Rural Electrification
523-SRI	80,000	16 Jun 1983	Energy Planning Support
551-SRI	150,000	17 Nov 1983	Trincomalee Thermal Power
578-SRI	250,000	29 Dec 1983	Secondary District Towns Power
660-SRI	50,000	26 Dec 1984	Energy Planning Support (Phase II)
930-SRI	230,000	3 Dec 1987	Institutional Strategy Study of LECO
1307-SRI	445,000	31 May 1990	Rural Electrification Development
1308-SRI	690,000	31 May 1990	Preparation of CEB's New Thermal Power Station
1309-SRI	700,000	31 May 1990	Institutional Review and Development of CEB

<sup>1/</sup> Executing Agency was Ceylon Electricity Board (CEB).

<sup>2/</sup> Executing Agency was Lanka Electricity Company (Private) Ltd. (LECO).

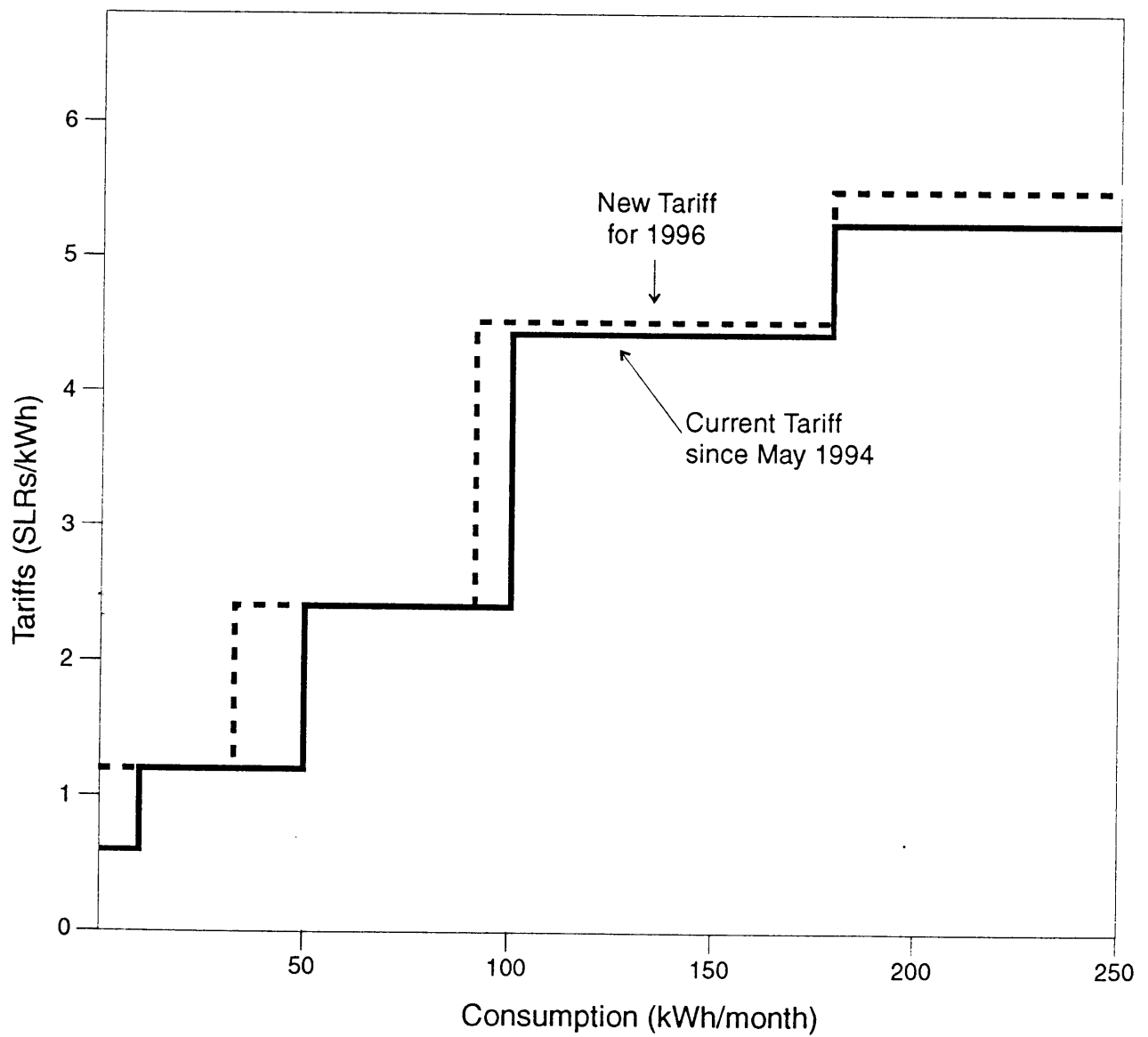
<sup>3/</sup> The Special Assistance Loan totalling \$14.7 million was given to selected Bank-financed Projects for local cost financing. The Rural Electrification Project (Loan No. 436-SRI(SF)) was allocated \$3.8 million of the total amount.

**CEYLON ELECTRICITY BOARD  
1996 TARIFF**

<b>Domestic</b>			
Block 1: First 30 units		@ SLRs1.20 per unit	
Block 2: 31 - 90 units		@ SLRs2.40 per unit	
Block 3: 91 - 180 units		@SLRs4.50 per unit	
Block 4: Above 180 units		@SLRs5.60 per unit	
Monthly Fixed Charge		SLRs15.00	
<b>Religious Purpose</b>			
Block 1: First 90 units		@SLRs1.20 per unit	
Block 2: 91 - 150 units		@SLRs2.40 per unit	
Block 3: Above 150 units		@SLRs4.50 per unit	
Monthly Fixed Charge		SLRs15.00	
	<b>General Purpose</b>	<b>Industrial</b>	<b>Industrial (Time of Day)</b>
<b>Supply at 400/230V</b> Contract Demand < 50kVA Unit Charge (SLRs/unit)	5.60	4.30	8.90 (peak) 3.20 (offpeak)
Fixed Charge (SLRs/month) up to 10kVA above 10kVA	15.0 205.0	15.00 205.00	15.00 205.00
<b>Supply at 400/230V</b> <b>Contract Demand ≥ 50kVA</b> Unit Charge (SLRs/unit)	5.50	4.10	9.00 (peak) 3.80 (offpeak)
Demand Charge (SLRs/kVA) Fixed Charge (SLRs/kVA)	270.00 435.00	235.00 435.00	110.00 435.00
<b>Supply at 11/33/132/kV</b> Unit Charge (SLRs/unit)	5.40	3.90	8.60 (peak) 3.60 (offpeak)
Demand Charge (SLRs/kVA) Fixed Charge (SLRs/month)	250.00 435.00	210.00 435.00	100.00 435.00
<b>Bulk Supplies to LECO/LA</b>			
	Unit charge SLRs/unit	Demand charge SLRs/kVA	
L1 - Supply at 400/230V	2.60	65.00	
L2 - Supply at 11kV and above	2.25	47.50	
Street Lighting		@SLRs4.30 per unit	

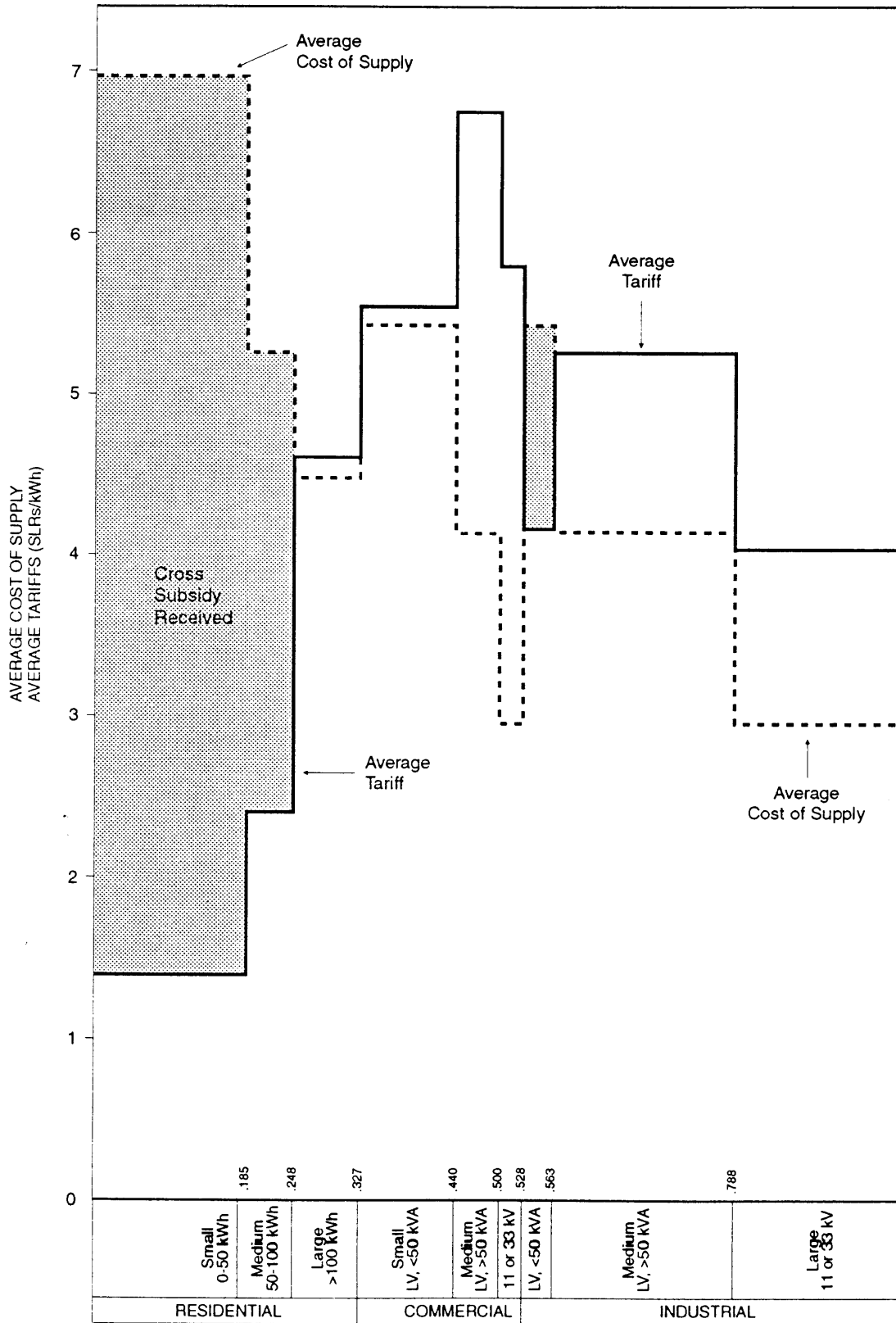
## Tariff Analysis

### CEB's Residential Electricity Tariffs



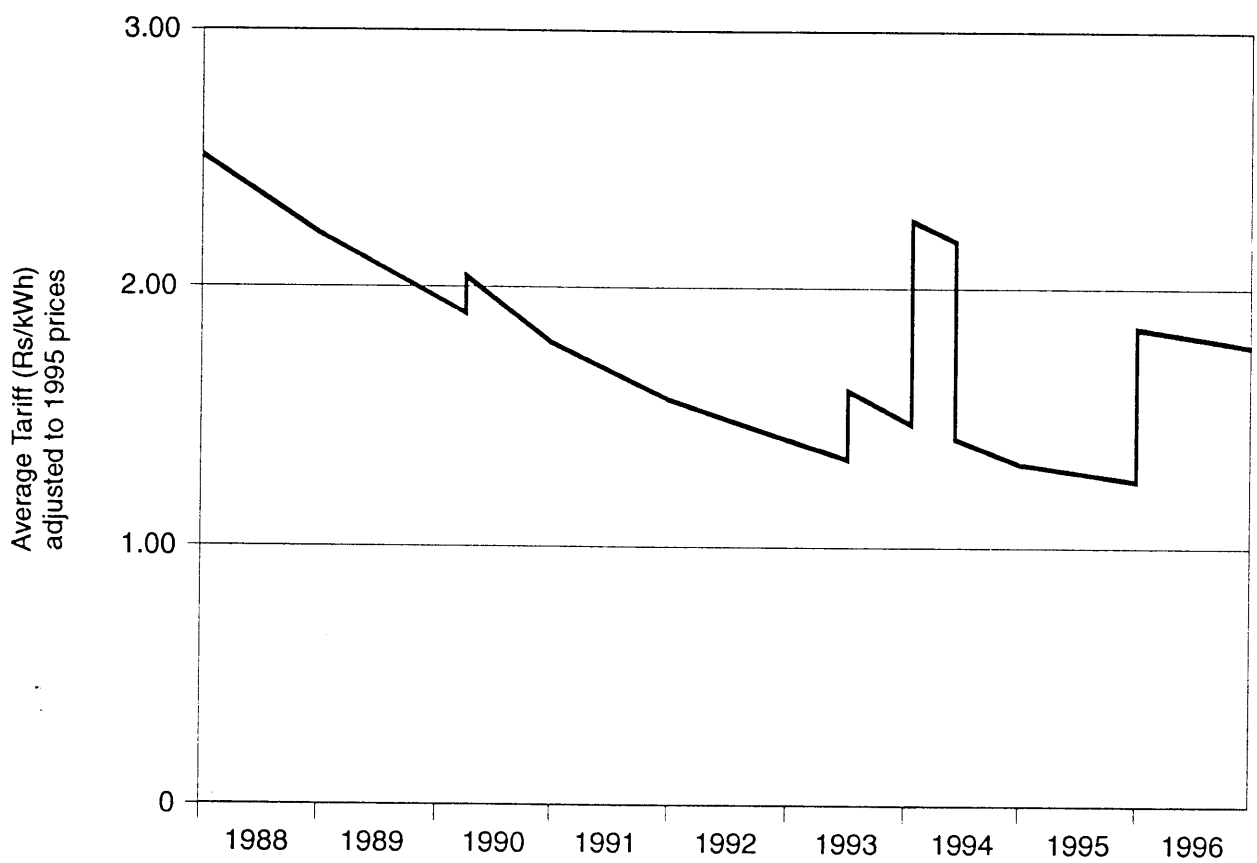
Tariffs shown above exclude fixed charges.

**CEB's Average Electricity Tariffs, Costs of Supply  
and Cross Subsidies in 1995**



CONSUMER GROUPS AND PROPORTION OF TOTAL CEB SALES

**Average Residential Tariff in Sri Lanka**  
for first 50 kWh/month of electricity consumption



NOTE: Average tariff includes fixed charges.

**PROJECT COST ESTIMATES**  
(\$ million)

Component	Foreign Exchange Cost	Local Currency Cost	Total Cost
<b>A: Rural Electrification</b>			
Materials and equipment	14.0	15.7	29.7
Local erection and fabrication	0.0	13.1	13.1
Service connections	0.0	5.5	5.5
Consulting services and training	0.4	0.0	0.4
DSM Pilot Program	0.4	0.1	0.5
<b>B: CEB 33 kV Distribution</b>			
Distribution lines	8.8	4.8	13.6
Other equipment	1.2	0.2	1.4
Five new substations	3.8	1.0	4.8
<b>C: CEB Transmission</b>			
Transformers	7.1	0.7	7.9
Capacitors	6.6	0.7	7.3
New substation	6.7	1.1	7.8
Transmission lines	2.2	0.7	3.0
Consulting services and training	0.3		0.3
<b>D: LECO Distribution</b>			
11 kV and 400 V lines	5.3	3.9	9.3
Other equipment	3.6	0.3	3.8
Service connections		2.8	2.8
Consulting services	0.3	0.2	0.5
<b>Total Basic Cost, 1995 prices</b>	60.8	50.8	111.5
Taxes and duties		<u>26.9</u>	<u>26.9</u>
Total before contingencies	60.8	77.7	138.5
Price contingencies	4.0	5.1	9.1
Service charge and interest during construction	1.6	4.9	6.5
<b>Total Project Cost</b>	66.4	87.7	154.1



Component/ Activity	1995	1996	1997	1998	1999
<b>Funding Arrangements</b>	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
<u>Part A: CEB Rural Electrification</u>					
Feasibility Studies and Designs	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Procurement	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Manufacture and Delivery	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Construction	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Service Connections	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
<u>Part B: CEB 33 kV Dist.</u>					
Feasibility Studies and Designs	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Procurement	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Manufacture and Delivery	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Construction	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
<u>Part D: LECO Distribution</u>					
Feasibility Studies and Designs	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Procurement	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Manufacture and Delivery	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Construction	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
<u>Part C: CEB Transmission</u>					
Detailed Design	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Procurement	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Manufacture & Delivery	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D
Construction	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D	J F M A M J J J A S O N D

## **PROCEDURES FOR SUBPROJECT APPRAISAL AND APPROVAL**

### **A. General Procedure**

1. Under the sector loan approach, the Ceylon Electricity Board (CEB) or Lanka Electricity Company (Private) Limited (LECO) will submit to the Bank for review and approval the proposals for all subprojects, in the form of subproject appraisal reports. The Bank will review all proposals prior to their implementation to ensure that the subprojects are properly formulated and that the agreed upon assumptions, criteria, and procedures have been applied. All subproject planning and appraisals must be completed to a satisfactory standard by CEB or LECO and approved by the Bank within two years of the date of loan effectiveness. CEB or LECO will document all subprojects using the agreed upon format to facilitate their review, project supervision by Bank missions, the preparation of a project completion report and benefit monitoring.

2. Each subproject proposed for financing under the Bank loan will be appraised by CEB or LECO, taking into account economic and technical factors relevant to the subproject. Specifically, such appraisal will be based upon the pertinent criteria that have been agreed upon between the Bank and CEB or LECO for this purpose, as set forth in this appendix. The appraisal procedures appropriate to subprojects in each Part of the Project are described in the following sections.

### **B. Part A**

3. Part A comprises many new rural electrification (RE) schemes. CEB will be responsible for identifying, prioritizing, formulating, appraising, proposing for approval, and implementing subprojects under Part A. The total scope of work in each RE scheme, whether new or an extension to existing one, will be considered to comprise one subproject. Responsibility for carrying out these subproject appraisals will rest with CEB's Rural Electrification Project Office, under the supervision of the Deputy General Manager (Distribution Development). The Rural Electrification Project Office staff will work closely with other CEB departments and field offices concerned with the activities to which the subprojects relate. The results of the appraisal of each proposed subproject that is recommended for approval will be recorded in a subproject appraisal report, which take the form described below.

4. The subproject appraisals will be undertaken in a phased manner, depending upon when the subprojects are expected to be implemented, but in any event all subproject appraisals and approvals will be completed within two years of loan approval. CEB will submit the subprojects for Bank review and approval in batches comprising 50-100 schemes each. Therefore, while the appraisal of each subproject will follow the procedures and criteria outlined below, one submission will cover a large number of subprojects. Subproject appraisal will be undertaken using the following procedure, except as the Bank may otherwise agree:

- (i) CEB will evaluate the economic feasibility of proposed rural electrification schemes with the computer spreadsheet model developed by CEB for "Rural Electrification Substation Scheme Evaluation" (the RE Model). This RE Model, which was developed originally for the evaluation of rural electrification schemes for CEB's second rural electrification (RE2) project, will incorporate the improvements and revisions recommended in the report on Rural Electrification Development in Sri Lanka by Snowy Mountains Engineering Corporation Limited (SMEC), March 1992

(the RE Report). In addition, this RE Model will also incorporate the other revisions and improvements described in the following clauses,

- (ii) For the purposes of this Project, an RE scheme is defined as an electricity distribution project designed to serve a community in a rural area, not under the jurisdiction of a Municipal or Urban Council, which either includes the construction of a new distribution substation and low voltage (LV) line for local service to at least 50 new consumers, or includes an extension of at least 500 meters of LV distribution line to an existing RE scheme in a rural area,
- (iii) The load forecast for each RE scheme will be prepared in accordance with the forecast model described in the RE Report. CEB will update the RE Model to incorporate the results of CEB's 1993 survey of RE schemes undertaken under the First Rural Electrification (RE1) project. The updated component forecasts of average connection rates, average consumption rates, and growth rates for households of different sizes, at various dates after commissioning of an rural electrification scheme, should be reviewed by the Bank after these have been updated and applied to a few sample RE schemes,
- (iv) The estimated numbers of consumers of various types for specific RE schemes will be determined through field surveys. If major single consumers are identified, they may be included, and specific justification for their estimated load will be given. Although household mixes for specific RE schemes will vary, CEB will take care to ensure that the average mix of households types (i.e., large, medium, and small) for a large batch of RE schemes is reasonably consistent with the survey results described in the RE Report. These averages will be calculated and reported for each batch of subprojects sent to the Bank for approval,
- (v) The economic cost of capital investments in RE schemes should be based on cost, insurance, and freight (CIF) prices of imported equipment and supplies, without duties and taxes, and a standard conversion factor of 0.80 on all local costs. This will result in an average economic cost for capital expenditures equal to about 75 percent of the total financial cost. The long-run marginal economic costs (LRMCs) of bulk power supply at 33 kilovolts (kV) should be updated when the forthcoming tariff study is completed,
- (vi) Average tariff levels in the RE Model should be based on current tariff levels, not assumed future tariffs. The standard conversion factor of 0.80 for local prices should also be applied to calculate the economic benefit of induced (or additional) energy consumption in the RE Model. The willingness-to-pay factor (in the RE Model) should be 0.4 (i.e., the average willingness to pay should be estimated as 40 percent of the alternative cost of kerosene lighting and 60 percent of the current tariff level),
- (vii) The short-run energy costs in the RE Model should be deleted because they are misleading. The summary of financial cash flows in the RE Model should be based on LRMCs of bulk power supply, not on short-run costs,
- (viii) The RE Model calculates distribution losses but does not summarize them. Total losses each year should be summarized and also expressed as a percentage of total bulk power supply delivered at 33 kV. If the losses for a proposed scheme are

greater than 15 percent after ten years, a warning should appear in the summary. If the losses are greater than 20 percent after ten years, the scheme design should be rejected as inadequate, and an alternative design with lower losses should be prepared. When an RE extension scheme is appraised, incremental distribution losses on the existing RE scheme as well as the extension to that scheme should be evaluated. Limits on minimum allowable voltages should also be established,

- (ix) The one-page summary printout in the RE Model for each scheme should be expanded, in a format satisfactory to the Bank. This summary should also include statements on (i) average losses in years 5 and 10; (ii) average consumption rates in kilowatt-hours (kWh) per month per household in years 5 and 10; and (iii) the average economic value of electricity consumption in SLRs/kWh. Copies of this one-page summary for each scheme will be included with the subproject applications sent to the Bank for approval,
- (x) Alternatives in design and installation will be evaluated to establish that the proposed RE scheme is the most economic design. Project cost estimates will be prepared on the basis of CEB's standard rates. A breakdown into foreign exchange costs, local costs, and taxes and duties will be made,
- (xi) Each RE scheme proposed for implementation must yield a minimum economic internal rate of return (EIRR) of 10 percent. For those RE schemes where CEB is confident that at least 40 percent of the new consumers will be below the poverty line of SLRs1,500/month/family, the required minimum EIRR will be only 8 percent. For such cases, CEB should describe in detail the consumer surveys, with associated estimates of household incomes, that support the load forecast. In addition to the economic evaluation of each scheme, CEB may also provide, whenever it is considered appropriate, a qualitative evaluation of the other benefits of the scheme, including its possible connection to other rural development activities in the area. CEB will generally endeavor to avoid proposing isolated schemes with only the minimum EIRR. CEB will also take care to ensure that the overall average EIRR for all subprojects under Part A will be at least 10 percent,
- (xii) Each RE scheme proposed for implementation will be evaluated to establish its environmental acceptability. This assessment will take into account critical environmental considerations such as encroachment into precious ecological areas/valuable lands, loss of irreplaceable resources, etc. This environmental assessment will be conducted according to the procedures described in Appendix 14. Under those procedures, only a simple one-page checklist needs to be prepared for an RE scheme with a total capital cost of less than \$100,000 if it has no significant environmental impact,
- (xiii) CEB will submit to the Bank for its review and approval the summaries of appraisals of batches of 50-100 RE schemes. Each summary will include a description for each RE scheme of its name, district, EIRR, lengths of medium voltage line, transformer size, lengths of LV line, estimated numbers of consumers of various types, environmental ranking, and cost estimate. A one-page summary of the appraisal of each RE scheme, as generated by the RE Model (see item [ix] above), will also be sent to the Bank with the submission of these RE batches. The Bank reserves the right to ask for more detailed description of the appraisal of any particular RE

scheme, to review with CEB such detailed appraisals, and to propose future refinements in the RE Model if appropriate.

### **C. Parts B and C**

5. Part B comprises 33-kV distribution subprojects by CEB, including five 33/11-kV substations to serve LECO (Part B1), and 33-kV distribution lines in rural areas to strengthen the existing CEB distribution system and reduce losses (Part B2). New 33-kV distribution lines whose main purpose is to serve new RE schemes should be evaluated under Part A, rather than as subprojects under Part B2. Part C comprises various CEB transmission subprojects. The five distribution substations in Part B1 have already been identified, and in consultation with CEB will prepare appraisal reports for these subprojects, and then LECO will manage their implementation. CEB will be responsible for identifying, prioritizing, formulating, appraising and implementing all other subprojects under Parts B2 and C. The appraisal of each proposed subproject that is recommended for approval will be described in a subproject appraisal report, that will include the following:

- (i) description of the subproject, including its objectives, scope and size, and location including a map;
- (ii) description of the technical justification for the subproject, and the method used to verify this; load flow studies for the local distribution or transmission system the subproject will serve, with and without the subproject; and the annual loss reduction, increased system capacity, and other benefits due to the subproject;
- (iii) demonstration that the subproject constitutes the most economic method of meeting system requirements, by describing the design options considered and by showing that the selected option is the most economic, considering both capital costs and operating costs;
- (iv) cost estimates showing local and foreign currency components for equipment, supplies, and erection with separate taxes and duties, and using agreed upon escalation factors; for subprojects with an estimated cost of more than \$1 million, the cost estimate should be set out in the following format;

<b>Foreign Exchange Costs</b>	<b>Local Currency Costs</b>	<b>Total Costs</b>
---------------------------------------	-------------------------------------	------------------------

Major Components:

Item 1

Item 2

etc.

Total Base Cost

Physical Contingencies

Price Contingencies

Interest during Construction

Total Cost

- (v) financing plan, including cumulative commitments to date under this part of the Bank Loan;
- (vi) identification of contract packages for Bank financing, indicating mode of procurement, (if the equipment has not already been procured), and planned schedule for contract award and disbursements;
- (vii) implementation schedule for the subproject;
- (viii) economic analysis of subproject costs, benefits and net annual benefits, and an EIRR analysis to demonstrate the viability of the subproject wherever possible; in the case of 33-kV distribution line reinforcement subprojects in Part B2, economic benefits will be based on cost savings due to loss reduction, and the benefits of improved reliability; all assumptions used in the analysis should be described; economic feasibility requires that the subproject EIRR should be greater than 12 percent, and for a subproject with a variable in-service date, the annual benefits must exceed the annual costs, calculated with a 12 percent interest rate, in the first full year of operation; for some subprojects under Parts B1 and C, economic benefits due to a particular subproject may be difficult to measure and separate from the integrated power system that subproject serves, and in such cases the subproject may be justified on the basis of commonly accepted and practiced technical criteria for power system design; and
- (ix) initial environmental examination (IEE), and, if necessary, an environmental impact assessment (EIA) and summary environmental impact assessment (SEIA) which will be prepared in accordance with the procedures described in Appendix 14. In case a subproject is environmentally sensitive, the IEE should describe the alternatives considered and the reasons for selection of the recommended design.

#### **D. Part D**

6. Part D will comprise numerous subprojects to strengthen and expand LECO's ongoing distribution system development. LECO will be responsible for preparing and appraising all subprojects under Part D. If a subproject in Part D involves an extension of LECO's distribution system to serve a new local area, it will be evaluated in the same manner as the RE schemes under Part A. However, LECO will prepare its own version of the RE Model for this purpose, with a load forecast and consumer load characteristics based on experience with similar distribution schemes in LECO's own service area. All subprojects under Part D should have at least a 12 percent EIRR to be economically feasible. LECO should be able to achieve this higher minimum EIRR because of the higher population densities and higher average income levels and consumption rates in LECO's service area.

7. Subprojects under Part D that are intended for distribution system reinforcement and strengthening, rather than expansion, will be evaluated according to the procedures described above for subprojects under Parts B and C.

## **TERMS OF REFERENCE FOR CONSULTING SERVICES FOR DISTRIBUTION SYSTEM PLANNING AND DESIGN PROCEDURES**

1. The Ceylon Electricity Board (CEB) is responsible for the generation, transmission, and most of the distribution of electric power and energy in Sri Lanka. CEB has, since the early 1980s, pursued the electrification of the rural areas of Sri Lanka with the ultimate goal of providing all inhabitants with access to electrical service. This effort has been funded in part by three loans from the Asian Development Bank and by funds of the Government of Sri Lanka. As of 1995, about 52 percent of the rural population has access to electricity within 100 meters of their households. CEB has already completed the first two Bank-financed rural electrification (RE) projects, and has recently received funding for a third RE project from the Bank. CEB now requires expert consulting services to further develop its capabilities in the subjects of electric distribution system design, engineering economic analysis, project management, and for the preparation of a Code of Practice and appropriate technical standards for RE development. The consultants will provide services to include the formal training of CEB and LECO personnel at Colombo, according to the following tasks:

### **A. Code of Practice and Technical Standards for CEB**

2. A set of Specifications and Standards for the procurement of material for distribution projects has been prepared by CEB covering most items. These appear to be satisfactory. In addition, CEB is also in the process of preparing Construction Standards and other Technical Standards for the Distribution Division. Several of these Standards have been prepared by the Distribution Development Branch and are being adopted.

3. The consultants will review all CEB's existing relevant Standard Specifications, Construction Standards, and Technical Standards and assist CEB in further developing and improving the Standards. Further, they will assist in the preparation of the Standards for the subjects not already covered.

4. The consultants will assist CEB in acquiring the facilities needed to prepare complete sets of the Standards and arrange them to be completed at the end of the consultancy period. All drawings required are preferred to be in AutoCad format. CEB will provide the computer software, hardware and the operators needed for this work.

5. The consultants will recommend, wherever relevant, new practices in design and construction in distribution that will enable better quality and cost reductions.

6. The consultants will work with CEB to develop a Code of Practice for distribution system design, to include all aspects of overall system design and identification of alternative designs within prudent utility practice.

### **B. Seminar in Planning and Design of Rural Electrification**

7. The consultants will prepare and present a 2-3 week course of instruction to include the following areas of electrical engineering analysis as related to international rural electric practices.

## **1. System Design**

- System voltage selection (33 kV and below)
- System configurations to include 3-phase, 4-wire and 3-wire, grounded and ungrounded systems, and single-phase uses
- Transformer types and selection techniques
- LV (480 V and below) services
- Economic conductor selection
- Reactive compensation
- Sag and tension calculation and uses
- System BIL and insulation coordination
- Distribution substation design
- Grounding and lightning protection methods
- Metering techniques

8. The objective is to acquaint CEB and LECO distribution engineers and managers with methods of selection of alternative designs for RE based upon lowest cost and reliability. Seminars will include a balance of theory, demonstration of practical application, and problems to be completed by the participants and critiqued by the consultants. The consultants will furnish all instructional materials including bound notes for the participants of the seminars.

## **2. Operation and Maintenance**

9. The consultants will give instruction on proper operation and maintenance practices for RE systems. Topics and subject matter will include, but not be limited to:

- Systems loss and outage monitoring
- System data analysis
- Preventive maintenance programs

## **3. Economic Analysis**

10. The consultants will explain techniques of economic analysis of engineering projects. This instruction should prepare the CEB personnel to perform economic analysis of alternative designs and to use the appropriate economic criteria for project optimization. Topics presented will include:

- Least-cost planning
- Annual cash flow analysis
- Economic analysis including:
  - Net present value calculations
  - Simple pay-back
  - Internal rate of return

## **4. Project Management**

11. The consultants will present an overview of current practices and techniques in the management of construction and implementation of projects. They will demonstrate the use of project management software, including aspects of critical path calculation, resource allocation, and time management techniques.



**C. Study Tour**

12. At the conclusion of the seminar, the consultants will organize a study tour for six to ten CEB and LECO distribution engineers to observe design and implementation techniques, planning, maintenance, and management practices for RE systems at a utility in a Southeast Asian country with an exemplary RE program. The specific utility and participants will be selected by CEB based on the consultants' guidance. The tour will be aimed at three areas; planning and appraisal procedures for RE projects, cost-effective designs, and project management procedures. Half of the participants in this tour will be selected based upon their performance during the seminar described above. CEB will select the other tour participants based on responsibility for similar work. The study tour will be for two weeks.

**D. Consulting Services Required**

13. The consulting assignment will require about eight personmonths to assist CEB in preparing a Code of Practice and various standards, and about three personmonths to conduct the training seminar and study tour. One or two consultants will be required, with experience in this work. All the work should be carried out in Colombo.

## **TERMS OF REFERENCE FOR CONSULTING SERVICES FOR TRANSMISSION DESIGN MANAGEMENT**

### **A. Background**

1. The Transmission Design Unit of the Ceylon Electricity Board (CEB) is responsible for the design of all transmission lines and substations above 33 kilovolts (kV). Recently, it has also been assigned the design of 33-kV lattice support lines and 33-kV/11-kV circuit breaker-controlled substations. The Unit is headed by a Chief Engineer, who is presently assisted by one electrical engineer and one civil engineer. The Chief Engineer has about 15 years experience, though not in design. The two assistant engineers are junior engineers without any previous experience in design. Action is under way to increase the staff of the branch by the addition of another three electrical engineers. The assistance of an experienced international consultant is required to improve the capability of the Unit.

2. The Unit is expected to carry out the following work: design and technical specification of 220-kV, 132-kV and 33-kV lattice support lines and 220/132, 220/33, 132/33, 132/11, and 33/11-kV substations on the basis of the planning parameters provided by the Transmission Planning Unit. The Unit will also provide assistance to the Transmission Division during the implementation stage. For transmission lines, the Unit is expected to carry out: electrical design of the line including conductor selection, insulation design, earthing design, route survey, profile plotting, support location, support design, and foundation design. In the case of substation design, work will include: layout, earthing, insulation coordination, protection, and control. In respect of both transmission lines and substations, the Unit will have to be able to prepare detailed technical specifications for transformers, circuit breakers, etc.

### **B. Terms of Reference**

3. The terms of reference of the consultant are described below.
- (i) Identify all the tasks that need to be carried out by the Unit.
  - (ii) Develop an organizational structure for the Unit including staff levels.
  - (iii) Identify other resource needs such as drawing office facilities, instruments, etc.
  - (iv) Identify the training needs and prepare a training plan.
  - (v) Recommend suitable software (and hardware) for use by the Unit.
  - (vi) Guide CEB staff through the design of a 132/33-kV substation.
  - (vii) Guide CEB staff through the design of a 132-kV transmission line.
  - (viii) Provide outline technical specifications for transformers, circuit breakers, supports, and foundations.
  - (ix) Provide assistance in actual design of various transmission subprojects to be implemented under the Bank loan, to the extent possible within the remaining available time.

**C. Consulting Services Required**

4. The assignment is expected to take about 12 personmonths, all of which will be at CEB headquarters in Colombo. One qualified expert is preferred, who should have extensive experience in the above subjects.

**D. Deliverables**

5. The consultant will prepare the following reports and documents:
- (i) report on the recommended organization of the Unit, with staffing, responsibilities etc. and resource requirements;
  - (ii) report on procedures for eventual compliance with ISO 9000 series standards;
  - (iii) report on recommended computer software;
  - (iv) typical substation design;
  - (v) typical 132-kV transmission line design including route selection; and
  - (vi) outline specifications for transformers, circuit breakers, line supports, and foundations.

## **TERMS OF REFERENCE FOR CONSULTING SERVICES FOR TRAINING ON ENVIRONMENTAL ASSESSMENT**

### **A. Background**

1. The Project will include a training program for preparation and review of Initial Environment Examination (IEE) and Environmental Impact Assessment (EIA) for technical staff of the Ceylon Electricity Board (CEB) and Lanka Electricity Company (Private) Limited (LECO) (and perhaps the Project Approving Agency of the Ministry of Irrigation and Power) entrusted with specified functions in the environmental review and clearance of subprojects (see Appendix 14). An international consultant will be recruited for this purpose and will be financed from Part C of the Bank loan. The consultant will prepare background material and conduct a two-week interactive training course for technical personnel (with a university degree) in IEE/EIA preparation and review. The training program will focus on:

- (i) identification and quantification/enumeration of all perceived adverse environmental impacts of transmission lines, distribution lines, and distribution substations, in the context of Sri Lanka conditions;
- (ii) discussion of feasible and economical measures for mitigation of all unavoidable environmental impacts;
- (iii) principles of imputing economic costs to adverse environmental impacts, and costing of mitigation measures;
- (iv) development of criteria for identification of environmentally sensitive subprojects through interaction with the participants;
- (v) development of models of public participation in Sri Lanka in the selection of routing of transmission and distribution lines and the location of substations through interaction with the participants; and
- (vi) step-by-step details of preparation of IEEs/EIAs of transmission and distribution line subprojects, in accordance with guidelines and format of the Bank and the Central Environmental Authority of Sri Lanka.

2. The consulting services required will be three person-months, inclusive of time in the field.

**FINANCIAL STATEMENTS FOR CEB**  
**Ceylon Electricity Board**  
**Income Statement**  
**Years Ending December 31**  
**(SLRs million)**

Item	1986	1987	1988	1989	Actual	1990	1991	1992	1993	Unaudited	1994	1995	1996	1997	1998	Projected	1999	2000	2001	2002
<b>Operating Data</b>																				
Gross Energy Generation (GWh)	2,653	2,701	2,799	2,858	3,145	3,376	3,540	3,979	4,365	4,779	5,218	5,700	6,225	6,799	7,427	8,113	8,862			
System Loss (%)	15.9	16.4	15.3	17.6	17.1	18.8	17.6	17.8	18.3	17.2	16.6	16.0	15.4	14.8	14.2	13.6	13.0			
Energy Sales (GWh)	2,232	2,258	2,370	2,354	2,608	2,742	2,916	3,271	3,565	3,957	4,352	4,788	5,266	5,793	6,372	7,010	7,710			
Sales Growth (%)	8.3	1.2	5.0	-0.7	10.8	5.1	6.4	12.1	9.0	11.0	10.0	10.0	10.0	10.0	10.0	10.0	10.0			
Average Tariff (Rs/kWh)	1.48	1.47	1.70	1.66	2.16	2.40	2.64	3.13	3.71	3.74	4.14	4.60	5.20	5.86	6.10	6.69	7.39			
Increase in Average Tariff (%)	8.9	-0.8	15.3	-1.9	29.8	11.1	10.0	18.4	18.6	0.9	10.7	11.1	13.0	12.7	4.1	9.7	10.5			
<b>Operating Revenue</b>																				
Electricity Sales	3,306	3,319	4,018	3,917	5,633	6,174	8,381	8,762	13,214	14,799	18,017	22,025	27,383	33,947	38,869	46,897	56,977			
Fuel Surcharge	18	1,259	236	62	0	472	0	0	0	0	0	0	0	0	0	0	0			
Other Operating Revenues	117	127	141	263	631	1,072	691	1,218	859	946	993	1,043	1,095	1,150	1,207	1,268	1,331			
<b>Total</b>	<b>3,441</b>	<b>4,705</b>	<b>4,395</b>	<b>4,242</b>	<b>6,264</b>	<b>7,718</b>	<b>9,071</b>	<b>9,980</b>	<b>14,073</b>	<b>15,745</b>	<b>19,010</b>	<b>23,068</b>	<b>28,478</b>	<b>35,097</b>	<b>40,076</b>	<b>48,165</b>	<b>58,308</b>			
<b>Operating Expenses</b>																				
Purchased Power	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Fuel Cost	17	1,223	229	60	24	479	1,645	349	912	1,277	2,631	5,022	7,149	10,179	12,158	18,365	24,878			
Operation and Maintenance	481	528	724	825	1,275	1,698	1,831	1,882	1,989	3,091	3,091	2,922	3,303	3,701	4,104	4,723	5,374			
Turnover Tax	116	137	128	119	169	199	368	438	661	728	0	0	0	0	0	0	0			
Administration	166	351	345	508	546	428	518	615	843	875	963	1,059	1,165	1,281	1,409	1,550	1,705			
Depreciation	922	802	1,038	1,307	1,397	2,064	2,134	2,875	3,362	3,341	3,802	4,274	4,856	5,467	6,098	6,726	8,033			
<b>Total</b>	<b>1,702</b>	<b>3,041</b>	<b>2,464</b>	<b>2,819</b>	<b>3,410</b>	<b>4,868</b>	<b>6,496</b>	<b>6,159</b>	<b>7,767</b>	<b>9,412</b>	<b>10,991</b>	<b>14,351</b>	<b>18,643</b>	<b>24,207</b>	<b>28,197</b>	<b>34,353</b>	<b>42,671</b>			
<b>Operating Income</b>	<b>1,739</b>	<b>1,664</b>	<b>1,931</b>	<b>1,423</b>	<b>2,854</b>	<b>2,851</b>	<b>2,576</b>	<b>3,821</b>	<b>6,306</b>	<b>6,333</b>	<b>8,020</b>	<b>8,717</b>	<b>9,835</b>	<b>10,890</b>	<b>11,879</b>	<b>13,812</b>	<b>15,637</b>			
<b>Other Income/Expense</b>																				
Interest Income	366	364	229	143	0	0	0	0	549	846	620	749	749	749	749	789	934			
Interest Expense	515	813	979	640	1,200	2,457	2,300	2,472	2,741	2,727	2,957	3,407	3,952	4,460	4,428	4,902	5,344			
Cost of Studies	0	0	45	18	0	0	0	85	305	198	1,100	779	260	254	213	0	0			
<b>Total</b>	<b>881</b>	<b>1,177</b>	<b>1,253</b>	<b>801</b>	<b>1,200</b>	<b>2,457</b>	<b>2,300</b>	<b>2,557</b>	<b>3,595</b>	<b>3,771</b>	<b>4,677</b>	<b>4,935</b>	<b>4,961</b>	<b>5,463</b>	<b>5,390</b>	<b>5,691</b>	<b>6,278</b>			
<b>Net Income Before Tax</b>	<b>1,590</b>	<b>1,215</b>	<b>1,136</b>	<b>908</b>	<b>1,654</b>	<b>394</b>	<b>275</b>	<b>1,264</b>	<b>3,809</b>	<b>4,254</b>	<b>4,583</b>	<b>5,280</b>	<b>6,372</b>	<b>6,925</b>	<b>7,987</b>	<b>9,699</b>	<b>11,227</b>			
Prior Years' Adjustment	0	0	0	0	0	0	2	(469)	0	0	0	0	0	0	0	0	0			
Income Tax	360	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0			
Proposed Dividend	0	0	0	0	0	0	0	0	0	0	0	4,126	1,940	739	3,049	5,885	6,978			
<b>Retained Earnings</b>	<b>1,230</b>	<b>1,215</b>	<b>1,136</b>	<b>908</b>	<b>1,654</b>	<b>394</b>	<b>277</b>	<b>796</b>	<b>3,809</b>	<b>4,254</b>	<b>4,583</b>	<b>1,154</b>	<b>4,432</b>	<b>6,186</b>	<b>4,938</b>	<b>3,814</b>	<b>4,249</b>			
<b>Ratios</b>																				
Return on Net Fixed Assets (%)	8.5	8.7	7.9	5.1	7.6	6.4	4.3	4.8	7.8	7.5	8.2	8.0	8.0	8.0	8.0	8.0	8.0			
Covenanted Return on Assets (%)	8.0	8.0	8.0	8.0	8.0	8.0	7.0	7.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0			
Return on Equity (%)	5.4	4.5	3.4	2.4	3.2	0.7	0.4	1.1	4.5	4.3	4.1	4.2	4.4	4.1	4.2	4.6	4.8			
Return on Equity without Revaluation Surplus (%)	8.5	7.6	6.3	4.6	7.7	1.7	1.1	2.9	11.6	10.9	10.1	10.7	11.0	10.0	10.2	11.4	12.1			

**Ceylon Electricity Board**  
**Balance Sheet**  
**As on December 31**  
**(SLRs million)**

	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
ASSETS																	
<b>Fixed Assets</b>																	
Gross Fixed Assets in Use	30,901	35,884	43,220	49,028	65,516	72,670	106,556	122,449	133,637	152,076	170,975	194,258	218,675	243,921	269,054	321,309	350,381
Less: Depreciation	7,248	8,789	11,367	13,789	19,312	22,737	26,645	31,622	36,950	43,432	50,491	58,552	67,800	78,352	90,326	103,827	119,647
Net Fixed Assets in Use	23,653	27,095	31,853	35,239	46,205	49,934	79,911	90,827	96,687	108,644	120,484	135,706	150,875	165,569	178,728	217,482	230,734
Construction In Progress	2,593	4,996	9,534	16,021	23,134	27,773	6,110	3,832	4,919	5,478	7,352	5,871	11,634	20,296	28,483	9,646	19,410
Investment in Subsidiaries	194	219	295	324	340	340	347	485	635	645	655	665	675	685	695	705	715
Insurance Escrow Account	105	147	181	188	218	272	332	435	553	705	876	1,070	1,289	1,533	1,802	2,123	2,474
<b>Total</b>	3,869	2,518	1,396	841	428	644	(2,084)	1,067	5,685	4,093	6,244	6,244	6,244	6,244	6,244	6,907	8,659
<b>Current Assets</b>	1,000	1,178	1,651	2,184	2,370	2,516	2,869	2,711	3,048	3,802	3,420	3,885	4,373	4,878	5,381	6,426	7,008
Cash	916	1,093	1,678	1,498	1,600	1,416	1,919	2,300	2,766	3,358	3,754	4,589	5,705	7,073	8,097	9,770	11,871
Accounts Receivable	641	2,621	3,435	1,590	2,043	2,147	2,943	1,138	2,236	3,922	4,314	4,746	5,220	5,742	6,316	6,948	7,643
Other Receivables	6,426	7,410	8,160	6,113	6,441	6,723	5,647	7,216	13,735	15,175	17,732	19,464	21,542	23,937	26,038	30,051	35,181
<b>Total</b>	32,971	39,867	50,023	57,885	76,337	85,041	92,347	102,796	116,528	130,648	147,099	162,776	186,017	212,017	235,746	260,005	288,511
<b>EQUITY AND LIABILITIES</b>																	
<b>Equity</b>																	
Government Equity	7,251	7,333	8,036	8,047	8,048	8,468	9,155	9,907	10,620	10,985	11,673	13,396	16,374	19,597	22,121	23,621	25,121
Consumer Contribution	1,980	2,125	2,284	3,080	3,412	4,102	4,561	5,851	6,824	8,274	9,381	10,599	11,938	13,411	15,032	16,815	18,776
Revaluation Surplus	8,249	10,777	15,641	18,843	29,403	33,074	37,642	44,829	51,171	59,389	67,538	76,574	86,752	98,068	110,485	123,890	140,201
Retained Earnings	5,262	6,472	7,623	8,513	10,154	10,534	10,811	11,606	15,382	19,636	24,219	25,373	29,805	35,991	40,929	44,743	48,992
<b>Total</b>	22,742	26,707	33,584	38,483	51,017	56,178	62,169	72,193	83,996	98,284	112,811	125,942	144,870	167,067	188,567	209,069	233,090
<b>Liabilities</b>																	
<b>Non-current Liabilities</b>																	
Long-term Debt (LTD)	8,141	10,471	13,263	16,005	20,836	24,049	23,075	22,087	23,590	23,700	26,508	28,182	31,186	33,127	33,441	35,451	38,286
<b>Current Liabilities</b>																	
Other Liabilities	302	745	876	876	0	0	731	1,426	1,648	1,517	1,490	1,490	1,490	1,490	1,490	1,490	1,490
Current Maturities (LTD)	396	364	373	612	0	0	1,678	1,720	1,719	2,042	2,036	2,042	2,312	2,977	3,840	3,913	3,875
Deferred Interest	0	0	0	0	0	0	0	0	1,883	0	0	0	0	0	0	0	0
Other Current Liabilities	1,692	2,023	2,058	1,909	4,484	4,814	4,693	5,369	3,692	5,105	4,254	5,120	6,159	7,356	8,408	10,082	11,770
<b>Total</b>	2,088	2,689	3,176	3,397	4,484	4,814	7,102	8,515	8,942	8,664	7,780	8,652	9,961	11,823	13,738	15,485	17,135
<b>Total Equity and Liabilities</b>	32,971	39,867	50,023	57,885	76,337	85,041	92,347	102,796	116,528	130,648	147,099	162,776	186,017	212,017	235,746	260,005	288,511
<b>Ratios</b>																	
Current Ratio	3.1	2.8	2.6	1.8	1.4	1.4	0.8	0.8	1.5	1.8	2.3	2.2	2.2	2.0	1.9	1.9	2.1
Long Term Debt : Equity	27.73	29.71	29.71	30.70	29.71	30.70	28.72	25.75	23.77	21.79	20.80	19.81	19.81	18.82	17.83	16.84	15.85
Accounts Receivable (months)	3.2	2.8	4.6	4.2	3.1	2.2	2.5	2.8	2.4	2.6	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Accounts Receivable Covenant (months)	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	2.5	2.5	2.5	2.5	2.5	2.5	2.5

**Ceylon Electricity Board**  
**Sources and Applications of Funds**  
**Years Ending December 31**  
**(SLRs million)**

Item	Actual										Unaudited					Projected				
	1986	1987	1988	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002			
SOURCES OF FUNDS																				
Internal Cash Generation																				
Net Income	1,230	1,215	1,136	908	1,654	394	277	796	3,809	4,254	4,583	1,154	4,432	6,186	4,938	3,814	4,249			
Interest Expense	515	813	979	640	1,200	2,457	2,300	2,472	2,741	2,727	2,957	3,407	3,952	4,460	4,428	4,902	5,344			
Depreciation	922	802	1,038	1,307	1,397	2,064	2,134	2,875	3,362	3,341	3,802	4,274	4,856	5,467	6,098	6,726	8,033			
Total	2,667	2,830	3,153	2,855	4,251	4,914	4,711	6,142	9,912	10,322	11,342	8,835	13,240	16,113	15,464	15,442	17,626			
Equity Contributions																				
Government Equity	216	82	703	11	1	420	688	751	713	365	688	1,723	2,978	3,223	2,524	1,500	1,500			
Consumer Contribution	204	145	159	796	332	690	459	1,290	973	1,450	1,107	1,218	1,339	1,473	1,621	1,783	1,961			
Total	420	227	862	807	333	1,110	1,147	2,041	1,686	1,815	1,795	2,941	4,317	4,696	4,145	3,283	3,461			
Loan Drawdowns																				
Loans - Foreign	4,033	2,693	3,165	3,354	4,597	3,921	2,144	528	1,720	2,152	4,884	3,722	5,366	4,920	4,152	5,924	6,708			
Total Funds Available	7,120	5,750	7,180	7,016	9,181	9,945	8,002	8,711	13,318	14,289	18,021	15,498	22,923	25,729	23,761	24,649	27,795			
APPLICATIONS OF FUNDS																				
Capital Investment Program																				
Construction Program	5,359	4,119	5,470	7,978	8,916	6,760	5,880	4,326	3,967	7,638	9,408	8,984	15,661	17,508	15,026	13,239	14,738			
Investment in Subsidiaries	111	25	76	29	16	0	8	138	150	10	10	10	10	10	10	10	10			
Total	5,470	4,144	5,546	8,007	8,931	6,760	5,888	4,464	4,117	7,648	9,418	8,994	15,671	17,518	15,036	13,249	14,748			
Debt Service																				
Principal Repayments	405	396	364	373	378	708	1,440	1,474	1,642	1,719	2,042	2,036	2,042	2,312	2,977	3,840	3,913			
Interest Payments	515	813	979	640	1,200	2,457	2,300	2,472	2,741	2,727	2,957	3,407	3,952	4,460	4,428	4,902	5,344			
Deposits to Escrow	105	42	34	7	30	54	60	103	117	152	171	194	219	244	269	321	350			
Total	1,025	1,251	1,377	1,020	1,608	3,219	3,800	4,050	4,500	4,598	5,170	5,637	6,213	7,016	7,674	9,063	9,607			
Change in Working Capital																				
Cash Increase/(Decrease)	275	(1,351)	(1,122)	(555)	(413)	216	(2,728)	3,150	4,618	(1,592)	2,151	0	0	0	0	663	1,752			
Other Increase/(Decrease)	865	1,702	1,394	(1,474)	(956)	(263)	1,041	(2,953)	83	3,633	1,284	866	1,039	1,198	1,050	1,676	1,690			
Total	1,140	351	272	(2,029)	(1,371)	(47)	(1,686)	198	4,701	2,041	3,435	866	1,039	1,198	1,050	2,339	3,442			
Total Funds Applied	7,120	4,937	6,201	6,376	7,981	7,488	5,701	6,239	10,578	11,560	15,066	12,089	18,971	21,272	19,331	19,749	22,452			

**Ratios**

Debt Service Coverage (DSC)	3.5	3.0	3.1	3.5	3.5	2.3	1.9	2.2	2.9	2.9	2.9	2.2	2.9	3.0	2.7	2.3	2.5
Covenanted DSC	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Self-financing - Annual (%)	16	(0)	9	51	44	39	5	143	155	46	64	39	47	53	56	49	56
Self-financing - 3-year Ave. (%)	NA	(0)	8	55	50	37	6	131	116	50	69	31	52	58	55	45	66

**SECOND POWER SYSTEM EXPANSION (SECTOR LOAN) PROJECT  
ASSUMPTIONS FOR FINANCIAL PROJECTIONS**

**CEYLON ELECTRICITY BOARD (CEB)**

**1. Income Statement**

<b>Energy Sales</b>	-	A growth rate of 10 percent has been forecast from 1995.
<b>Average Tariff</b>	-	Tariff increases necessary to satisfy the covenanted 8 percent rate of return have been assumed.
<b>Fuel Surcharge</b>	-	The surcharge levied to recover fuel costs was abolished in February 1994. No separate fuel cost recovery is indicated. All fuel cost is recovered in base tariff.
<b>Other Operating Revenue</b>	-	Includes dividends received from subsidiaries and is assumed to increase at 5 percent per annum from 1995.
<b>Interest Earnings</b>	-	12 percent of average positive cash balances.
<b>Interest Payments</b>	-	18 percent of average negative cash balances other than foreign loans which are at the Government's lending rate (13 percent).
<b>Fuel Cost</b>	-	Based on thermal generation requirements for CEB-owned plant derived from energy balance projections, which in turn are based on weighted-average hydrological conditions (1995 based on budgeted fuel costs).
<b>Purchased Power</b>	-	Generation requirements are derived from energy-balance projections based on weighted average hydrological conditions. Unit cost (per kWh) including fuel is estimated at \$0.07 in 1996 and escalated in line with the wholesale price increase.
<b>Operation and Maintenance</b>	-	Estimated at 1.6 percent of average gross fixed assets in use.
<b>Turnover Tax</b>	-	5 percent for the first month of 1995, 6 percent for the next nine months of 1995 and abolished thereafter; replaced by a goods and services tax from which CEB is exempt.
<b>Administration</b>	-	Increased annually by 10 percent from 1995 onwards.
<b>Depreciation</b>	-	2.5 percent of gross fixed assets in use at the beginning of each year.
<b>Inflation</b>	-	Local inflation assumed to be 8.5 percent in 1995 and 7.5 percent annually thereafter. Historic inflation rates were 9.5 percent in 1994; 11.7 percent in 1993; 11.4 percent in 1992; 12.2 percent in 1991; and 21.5 percent in 1990.



## 2. Balance Sheet

- Fixed Assets** - Revalued in proportion to changes in the average of (i) the local wholesale price index, (ii) the import price index, and (iii) the annual increase in the gross national product (GNP) deflator index. The average index is forecast to increase at:

<u>1994</u>	<u>1995</u>	<u>1996-2004</u>
7%	8.5%	7.5% per annum

- It is also assumed that the Sri Lanka Rs devalues in proportion to the differential between the local rate of inflation and the international rate of inflation.

**Investment in Subsidiaries**

- Assumed at SLRs10 million per annum.

**Insurance Escrow Account**

- 0.1 percent of gross fixed assets.

**Inventories**

- Forecast as 2.0 percent gross fixed assets in use from 1995.

**Accounts Receivable**

- Forecast as 2.5 months of electricity sales from 1995.

**Other Receivables**

- Assumed to increase by 10 percent each year.

**Current Liabilities**

- Forecast as 50 percent of current assets other than cash.

**Capital Expenditure**

- Ongoing Projects: (i) for 1995 as per the CEB Board-approved Budget 1995; and (ii) for 1996 and onwards as per Public Investment Programme 1994-1998 as submitted.
- Planned Projects: as per Long-Term Generation Expansion Planning Studies 1995-2009 adjusted for known changes. In particular, all thermal generation requirements in excess of the capacity of existing CEB generating stations and ongoing generating projects are assumed to be met by independent private power producers.

**Transfers to Fixed Assets**

- Generation Projects - at completion.

Ongoing Transmission Projects - at 40 percent of expenditure each year and the balance in the final year. Planned Transmission Projects are transferred at the end of the Project.

RE programs - at 75 percent of expenditure up to that year and the balance in the final year.

**FINANCIAL INFORMATION FOR LECO**  
Significant Data, Statistics and Ratios  
Years Ending December 31

Item	Audited					Unaudited					Projections				
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002		
Operational Data															
Consumers at Year End	No.	176,955	191,729	205,125	218,173	238,455	256,039	274,118	292,675	311,697	331,173	348,955	369,892	392,086	
Sales	Gwh	311.0	342.0	385.1	421.7	471.5	516.7	558.7	602.5	648.6	697.5	747.5	799.9	855.9	
Annual Growth	%	57.1	10.0	12.6	9.5	11.8	9.6	8.1	7.8	7.7	7.5	7.2	7.0	7.0	
Electrical Losses (% of units purchased)	%	13.7	13.9	10.1	8.1	10.7	9.5	8.7	8.0	7.5	6.8	6.8	6.8	6.8	
Average Revenue Yield per kWh Sold	Rs	2.27	2.41	2.82	3.26	3.84	3.78	3.97	4.18	4.51	4.90	5.07	5.42	5.88	
Average Purchase Cost per kWh Sold	Rs	1.60	1.62	1.82	2.03	2.53	2.49	2.66	2.86	3.17	3.55	3.67	3.98	4.37	
Margin on Energy Sales(% of revenue)	%	29.7	33.0	35.3	37.6	34.1	34.2	33.0	31.5	29.8	27.7	27.6	26.5	25.6	
Employees at Year End	No.	1,143	1,216	1,255	1,265	1,290	1,321	1,347	1,370	1,388	1,419	1,451	1,507	1,573	
Consumers per Employee at Year End	No.	155	158	163	172	185	194	204	214	225	233	240	245	249	
Financial Data															
Revenue	MRs	705.8	825.3	1,086.3	1,375.7	1,810.3	1,954.6	2,219.8	2,515.8	2,927.5	3,419.0	3,788.8	4,337.8	5,035.9	
Operating Profit	MRs	78.6	103.0	138.2	209.3	243.0	241.5	260.2	263.9	297.0	319.3	362.0	398.7	460.4	
Interest Expense (net)	MRs	68.4	72.3	51.4	42.3	11.4	(9.8)	7.1	23.2	47.0	79.1	98.4	110.0	107.2	
Net Profit After Tax	MRs	10.2	30.7	86.8	167.0	231.6	251.3	253.1	240.7	250.0	218.3	228.2	251.2	300.7	
Net Revalued Fixed Assets	MRs	1,531.0	1,848.6	2,301.9	2,536.6	2,532.2	2,931.1	3,341.6	3,974.9	4,598.4	5,031.7	5,421.7	5,786.7	6,176.9	
Working Capital	MRs	355.8	504.0	903.6	1,038.6	1,443.1	1,530.3	1,462.0	1,333.5	1,222.6	1,198.5	1,178.7	1,249.2	1,354.3	
Total Capital Employed	MRs	1,886.8	2,352.6	3,205.5	3,575.2	3,975.3	4,461.3	4,803.6	5,308.4	5,821.1	6,230.1	6,600.5	7,036.0	7,531.1	
Shareholders' Equity	MRs	694.4	1,013.2	1,744.2	2,282.1	2,829.5	3,383.5	3,746.7	4,126.5	4,526.5	4,914.7	5,353.0	5,856.5	6,445.6	
Long -term Debt	MRs	1,162.3	1,339.4	1,389.3	1,223.8	1,145.8	1,077.9	1,057.0	1,182.0	1,294.6	1,315.5	1,247.5	1,179.5	1,085.5	
Debt Service	MRs	79.3	109.2	127.2	126.6	110.3	248.4	133.0	188.6	205.8	216.2	214.9	233.5	224.5	
Capital Investment Program	MRs	530.8	384.8	242.0	180.9	148.2	349.0	377.8	599.4	610.2	422.0	386.4	362.0	390.0	
Returns															
Return on Revenue	%	11.1	12.5	12.7	15.2	13.4	12.4	11.7	10.5	10.1	9.3	9.6	9.2	9.1	
Return on Capital Employed	%	4.2	4.4	4.3	5.9	6.1	5.4	5.4	5.0	5.1	5.1	5.5	5.7	6.1	
Return on Average Net Fixed Assets in Service - at Revalued Cost (RONRFA)	%	11.6	10.4	8.7	10.4	10.6	9.1	8.6	8.0	8.5	8.3	8.4	8.2	8.4	
Net Profit After Tax / Shareholders' Equity	%	1.5	3.0	5.0	7.3	8.2	7.4	6.8	5.8	5.5	4.4	4.3	4.3	4.7	
Ratios															
Long-term Debt : Equity (D:E)	times	63.37	57.43	44.56	35.65	29.71	24.76	22.78	22.78	22.78	21.79	19.81	17.83	14.86	
Debt Service Cover (DSC)	months	1.7	1.9	2.7	3.5	4.5	2.1	4.0	3.0	3.0	2.9	3.1	3.1	3.6	
Receivables (months sales outstanding)	months	3.1	2.1	2.5	2.6	2.1	1.8	1.8	1.8	1.8	1.8	2.0	2.0	2.0	
Self-financing (SFR) - 3-Yr Average	%	NA	9	78	68	90	132	46	89	50	48	33	91	143	

a/ For 1990-1991 returns are calculated on historical costs.

\* Covenanted objectives: D:E <=1.5; DSC >=1.5; SFR 20 %; RONRFA >=8%

Note : Detailed financial statements and underlying assumptions for LECO are available from the Bank Mission.

## **ENVIRONMENTAL REVIEW AND APPROVAL OF SUBPROJECTS**

### **A. Reviews Conducted Prior to Sector Loan Approval:**

1. The Bank's formats for preparation of initial environmental examinations (IEEs), environmental impact assessments (EIAs), and their summaries (SIEE or SEIA) have been conveyed to the Ceylon Electricity Board (CEB) and Lanka Electricity Company (Private) Limited (LECO). Three sample IEEs have been prepared by CEB for transmission subprojects, including (i) new grid transmission substation (132/33 kV) at Veyangoda; (ii) installation of additional transformers at Anuradapura substation; and (iii) reconductoring of the 132-kV transmission line from Kolonnawa to Kotugoda. The Bank has reviewed these subprojects and found them to be generally satisfactory from an environmental viewpoint, and not environmentally sensitive (ES). The SIEEs for these subprojects will be available on request.

### **B. Action Plan for Environmental Review of Subprojects:**

2. Environmental considerations will be incorporated in the selection criteria for subprojects under the loan. An Action Plan will be implemented after sector loan approval, and will be covenanted in the Loan Agreements. The Action Plan will comprise the following elements:

- (i) The capabilities of technical staff of CEB, LECO, and at the option of the Ministry concerned, the Project Approving Agency (PAA) of the Ministry of Irrigation and Power, as well as the Central Environment Authority (CEA), in respect of preparation of IEEs/SIEEs and EIAs/SEIAs and their review will be enhanced through an interactive training program to be funded by the Bank (see Appendix 11).
- (ii) The agreed upon checklist for scrutiny of environmental impacts of specified subprojects is shown in Table 1. This checklist will be adopted for relevant subprojects (specified below) financed under the sector loan. In addition, the Bank's prescribed format for preparation of IEE/SIEE and EIA/SEIA will be adopted during implementation of the Project.
- (iii) A Cell will be set up comprised of technical staff of CEB and LECO, who have undergone training in IEE/EIA preparation and review (under [i] above), and one or more similarly trained nominees of the Ministry of Irrigation and Power (who are not involved in its environmental evaluation process in the PAA). The functions of the Cell are detailed in the following procedure for environmental clearance of subprojects financed under the Bank loan:
  - (a) The Cell will review the completed checklists of environmental impacts of electricity distribution subprojects with capital investment below \$100,000 to determine which of them have significant environmental impacts warranting a IEE study. The checklists will be prepared by field level technical staff of the proponents. Those subprojects that are judged not to require an IEE will be cleared on environmental aspects by the Supervisor of the Cell. Where an IEE is judged to be necessary by the Supervisor of the Cell because some environmental issues need further examination, the IEE will be prepared by the Cell with the help of the proponent.

- (b) The Cell will also prepare the IEEs of all other subprojects with the help of the proponents concerned.
- (c) The Cell will examine all completed IEEs to determine whether any of the subprojects are ES, and whether or not they require an EIA study. Norms to determine whether the subprojects are ES will be developed in the course of the training program, in which the practical knowledge of local conditions and concerns of the participants will be drawn upon.
- (d) All subprojects that are deemed to be not ES, and that under the existing regulations are not required to be cleared by the PAA or the CEA, may be cleared from the environmental standpoint by the Supervisor of the Cell.
- (e) Where the subprojects are deemed to be not ES but require clearance by the PAA/CEA under the existing regulations, the Cell will advise the proponent to apply for the same, together with the IEE prepared by the Cell.<sup>1</sup>
- (f) For all ES subprojects, the Cell will determine and advise the proponent whether or not an EIA is necessary. In such cases, the proponent will prepare the EIA.
- (g) For ES subprojects the Cell will request the proponent to submit the IEE/EIA to the PAA/CEA for clearance.
- (h) In the case of ES subprojects that are above the "free limit", the Cell should advise the proponent that, after PAA/CEA clearance, the IEE/EIA should be submitted to the Bank for review.

3. The above procedure is illustrated in Figure 1. Each of the environmental assessment documents (Checklist, IEE, EIA) should generally be available at the field office of the subproject, as well as at the Cell, for scrutiny by any person who requests such access. The proponents will not proceed with ES subprojects that are above the "free limit" without the Bank's clearance. The "free limits" will be a total capital cost of \$5 million in the case of transmission and distribution line projects and a total capital cost of \$20 million in the case of transmission substation projects.

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<sup>1</sup>

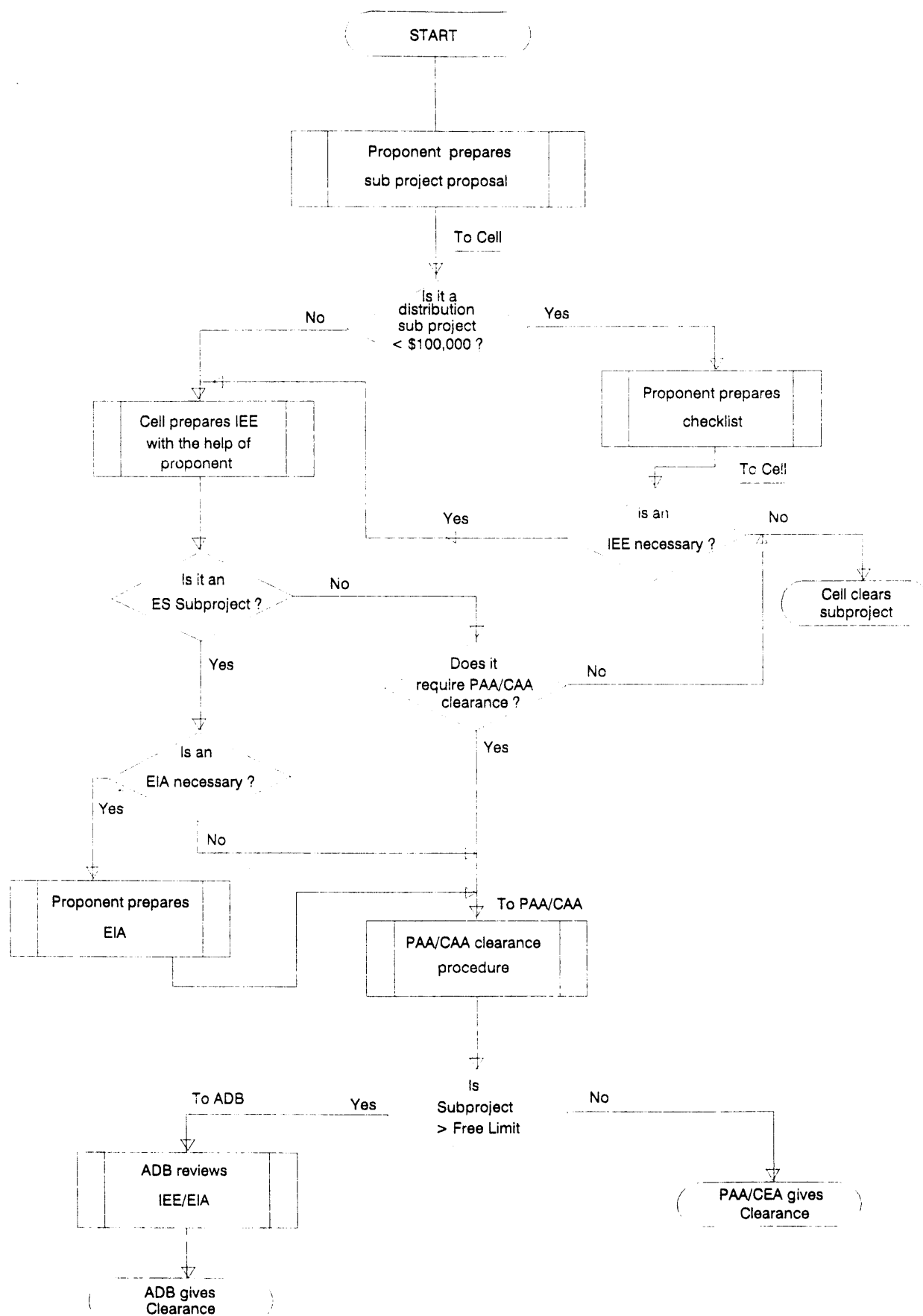
If an EIA is to be prepared upon the finding of the PAA, it should conform to the Bank's format, in addition to the terms of reference that may be formulated by the PAA.

**Table 1**  
**CHECKLIST FOR DISTRIBUTION SUBPROJECTS WITH CAPITAL INVESTMENT LESS THAN \$100,000**

<b>A. Distribution Substations (including Approach Roads):</b>		
1.	Are any homes for more than 5 persons in all to be demolished/relocated?	Y/N
2.	Are more than 2 hectares of farmland or 1 hectare of forest/wetland to be converted to other use?	Y/N
3.	Are more than 5 high-value trees and/or 10 trees in all to be cut down?	Y/N
4.	Are PCBs and/or asbestos from old transformers to be disposed off?	Y/N
5.	Are prescribed safety measures <u>not</u> provided?	Y/N
6.	Is a freshwater source located at the site of the substation?	Y/N
<b>B. Power Lines (including Maintenance Roads):</b>		
1.	Are any homes for more than 5 persons in all to be demolished/relocated?	Y/N
2.	Are more than 2 hectares of farmland or 1 hectare of forest/wetland to be converted to other use?	Y/N
3.	Are more than 15 high-value trees and/or 50 trees in all per kilometer of distribution line to be cut down?	Y/N
4.	Are the power lines located on migration/perambulation paths of wildlife?	Y/N
5.	Are the proposed power lines visible from generally recognized scenic sites/views?	Y/N
6.	Are the proposed power lines within 50 meters of historical/heritage sites?	Y/N
7.	Do the proposed power lines pass through a protected area, old growth forest, or wildlife/bird reserve?	Y/N
8.	Do the proposed power lines require widening of more than 2 kilometers (km) of rural roads/pathways?	Y/N
9.	Do the proposed power lines traverse irrigation tanks and/or canals?	Y/N

**Note:** A single "Y" in answer to the above questions will mean that an IEE should be prepared.

Figure 1: Processing of Subprojects for Environmental Clearance



## ECONOMIC AND FINANCIAL ANALYSIS

### A. Economic Analysis

#### 1. Economic Benefits of Power Consumption

1. The primary use of electricity by rural consumers is for lighting in households and in small shops and commercial establishments. The economic benefits of electricity consumption by residential consumers are based on the alternative costs of kerosene that would be used for lighting in the absence of electricity. The methodology used to estimate these benefits can be explained with the help of Figure 1, which shows a theoretical demand curve for residential electricity use. In Figure 1,  $P_e$  is the price of electricity;  $P_k$  is the equivalent cost of kerosene for lighting, expressed in SLRs/kWh;  $Q_k$  is the quantity of electricity required to supply lighting levels equivalent to those currently supplied by kerosene lights; and  $Q_e$  is the total quantity of electricity consumption by a typical household. The Ceylon Electricity Board (CEB) has conducted several surveys over the past decade to record data on rural household expenditures on kerosene consumption and quantities of kerosene used, as well as surveys of electricity use by newly connected consumers. On the basis of these surveys, it is estimated that  $Q_k$  is about 15 percent of  $Q_e$  for residential users (the exact amount varies for three different standard household sizes). The average economic value of  $P_k$  is quite high, at about 28 SLRs/kWh (\$0.56/kWh),<sup>1</sup> whereas the average tariff ( $P_e$ ) is only about SLRs1.6/kWh (\$0.03/kWh) for residential use. Electricity consumption up to  $Q_k$  will have an average value of  $P_k$ , and consumption in excess of  $Q_k$  will have a declining marginal value, as shown by the demand curve, A-B, which eventually declines to a marginal value of  $P_e$  at a level of total consumption corresponding to  $Q_e$  (point B). Energy consumption up to  $Q_k$  is valued at the economic cost of displaced kerosene. The induced energy consumption,  $Q_e - Q_k$ , is valued at local prices, which are converted to economic border prices by multiplying these by the standard consumption conversion factor of 0.80.

2. The total area between the demand curve A-B, (i.e., the maximum willingness to pay curve) and the tariff level (line  $P_e$ -B) is the consumer surplus, which represents economic benefits to consumers in excess of the tariff level. The slope of the demand curve between the points A and B can only be assumed, although it is related to the price elasticity of electricity demand, which is also difficult to estimate. In many studies this slope is assumed to be linear but in this case, due to the high value of  $P_k$ , it was considered appropriate to be more conservative and to assume that the average consumer surplus over this range is 40 percent of the difference between  $P_k$  and  $P_e$ . This results in an average overall economic value for electricity consumption of SLRs12.6/kWh (\$0.25/kWh) for residential users. About one third of the resulting total benefits of residential electricity consumption is due to the cost saving of kerosene fuel displaced and about two-thirds is due to the benefits of induced consumption.

3. Most commercial users in rural areas are small shops and offices that use electricity primarily for lighting, and the economic benefits of this use were estimated on the

<sup>1</sup> The basis for this estimated value is that the average cost of kerosene is SLRs12.5/liter. It takes about 0.7 liters of kerosene burned in a pressure lamp, or 3.0 liters burned in a kerosene wick chimney lamp, to produce light equivalent to 1 kWh for an incandescent light bulb. On average it is estimated that about 2/3 of lighting is supplied with wick lanterns, and about 1/3 with pressure lanterns, resulting in an average equivalence factor of 2.2 liter/kWh. This factor when multiplied by the average kerosene price of SLRs12.5/liter, results in a value of SLRs28/kWh for electricity that displaces kerosene lighting.

above basis. For industrial users, electricity is used for motors, and the cost of alternative small diesel motors was considered. Electricity saves fuel costs and also reduces capital costs, with a total value of about SLRs5.20/kWh for industrial users.

4. In the evaluation of project costs, the economic analysis uses border prices, which exclude the costs of duties and taxes on imported materials and equipment, and all local costs and benefits are converted to border prices at a standard conversion factor of 0.80.

## 2. Rural Electrification Project

5. Within ten years of project commissioning, CEB's rural electrification to be financed under Part A will serve about 110,000 rural households and other consumers with a total population of about 530,000 people. This will correspond to an increase of about 7.6 percent in the total number of consumers served by CEB. It will result in a 3 percent increase of the total proportion of the national population with electricity supply, from the relatively low current rate of 44 percent to about 47 percent. Most of the energy sales (about 87 percent) will be to residential consumers, and the balance will be to commercial and small industrial consumers. The sales forecast, which is calculated in Table 1, is based on average consumption rates and connection rates, etc., experienced with CEB's previous rural electrification projects. Part A is estimated to cost \$60 million for distribution and consumer connection costs (by year 10), which corresponds to an average cost of \$545 per new connection.

6. With the economic benefits described above, the economic evaluation of Part A, shown in Table 2, results in an estimated economic internal rate of return (EIRR) of 10.9 percent for the base case. For several reasons this EIRR is considered to be conservative. The quality of electric lighting is much better than kerosene lighting (it is cleaner, quieter, more convenient, without fire hazard, and can be directed more readily for various uses), but this higher quality is not considered in the benefit evaluation. Also, electricity is used for many other purposes such as operation of radios, televisions, fans, and refrigerators, for which kerosene is not a feasible substitute energy source. These other uses also have high values, which are likely to exceed kerosene fuel costs. Sensitivity analysis has been conducted for the scenarios described below:

### Sensitivity Analysis for Part A

<u>Sensitivity Scenario</u>	<u>EIRR</u>	<u>SI<sup>a</sup></u>
Base case	10.9%	--
RE sales reduced by 10%	9.9%	0.10
Benefits reduced by 10%	7.7%	0.32
Capital costs increased by 10%	10.0%	0.09

<sup>a</sup> SI is the ratio of percentage change in the EIRR to the percentage change in the given parameter.

7. The economic analysis indicates that the economic performance of Part A is marginal with these conservative assumptions, and only the better than average subprojects will qualify for financing under the Bank loan. Since it will be a sector loan, CEB will evaluate each separate rural electrification subproject (of which there will be about 1,100) to ensure that its EIRR is at least 10 percent. The economic evaluation of particular subprojects will be done with a computer spreadsheet model that was developed several years ago for the second rural



electrification project financed under Bank Loan No. 1021-SRI(SF), and refined based on advice from Bank missions and the consultants for the Rural Electrification Development Study. This model will be further revised as described in Appendix 8.

### **3. LECO Distribution Project**

8. Within ten years of project commissioning, the development of the distribution system of Lanka Electricity Company (Private) Limited (LECO), to be financed under Part D of the Bank loan, will serve about 46,000 rural households and other consumers with a total population of about 220,000 people. The total cost of Part D is estimated to be about \$23 million, which corresponds to an average cost of only \$500 per new connection. Average connections costs are lower than for CEB's Part A because population densities are higher in LECO's service area. Economic development and average income levels are also higher, resulting in higher average consumption rates for LECO customers. The resulting EIRR for LECO's distribution system expansion under Part D is estimated to be 16.3 percent. The methodology used for this evaluation is similar to that used for Part A described above.

### **4. CEB Transmission and Distribution Components**

9. The transmission component to be financed under Part C of the Project will include new transformers, a substation, transmission lines, and capacitors for the CEB system, which are required on a high priority basis for the period 1996-1998. These subprojects are required to support ongoing load growth on CEB's system. A national transmission system planning study by international consultants was recently completed for CEB, which demonstrates that these projects are required technically and are part of the least cost plan for CEB's transmission development.<sup>1</sup> The distribution component under Part B is required to strengthen CEB's existing 33-kilovolt (kV) distribution system in rural and provincial areas for loss reduction and improved security of supply, and for five new 33/11-kV primary substations required to supply power to LECO.

10. Subprojects under Parts B and C cannot be readily evaluated for economic and financial performance on an isolated basis, but must be considered as part of CEB's integrated power system expansion program. An economic evaluation of CEB's total investment program was therefore carried out for additional power supply over the eleven-year period from 1996 to 2006 (see Table 3). The total capital expenditures for generation expansion and transmission and distribution system development were determined, as well as the incremental costs for operation, maintenance and fuel. These total incremental costs at economic prices are compared with the incremental economic benefits of electricity consumption. The resulting EIRR for the eleven-year expansion program is estimated to be 21 percent, and the benefit-cost ratio is estimated to be 1.59 at 12 percent discount rate.

### **B. Financial Analysis**

11. The financial analysis of Part A from CEB's perspective is based on the total financial costs of developing and operating Part A and the additional tariff revenues generated by it. Part A is unprofitable, because of the low tariff revenues. Average tariffs are currently only

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<sup>1</sup> Power System Study for CEB, completed in December 1994 by Lahmeyer International.

SLRs1.60/kWh for residential sales to rural consumers, and about SLRs5.37/kWh for commercial and industrial sales to rural consumers. These will increase on 1 January 1996 to SLRs2.04/kWh and SLRs5.66/kWh respectively. Table 4 shows the financial evaluation of Part A, and the basic input variables used for this analysis. Since the net financial cash flow is negative throughout the period of analysis, it is not possible to calculate the financial internal rate of return (FIRR). A more meaningful measure of project performance in this case is the average cost recovery ratio (i.e., the financial benefit-cost ratio), which will be only 23 percent with 1996 tariffs. This indicates that only 23 percent of the financial costs of power supply for rural electrification would be recovered. However, average residential tariffs will increase over the next five years, according to the covenants agreed upon for the Bank loan, so that they should equal or exceed average overall retail tariffs after the year 2001. This will require an average residential tariff of about SLRs4.18/kWh at 1995 prices. Assuming this is also the average tariff for rural electrification schemes, then the financial cost recovery on such schemes would increase to about 38 percent after 2001. The average tariffs described above may be compared with the average financial cost of power supply to rural consumers of SLRs11.8/kWh. This average cost is after allowance for costs of generation and transmission required for bulk power supply, but does not include service connection costs which are recovered through connection fees. About half of this total cost is due to bulk power supply at the 33-kV level, and the other half is due to distribution costs and losses, as shown in Table 4.

12. Parts B, C, and D of the Project can be regarded as parts of the integrated power system developments of CEB and LECO. The FIRR for the integrated power system expansion programs of CEB and LECO should be close to 8.0 percent, since both CEB and LECO are obliged under loan covenants to earn an 8.0 percent rate of return on revalued net fixed assets in service. The actual rate of return on revalued assets of LECO in 1994 was 10.6 percent, and for CEB was 7.8 percent.

**Table 1**  
**Sales Forecast for Rural Electrification under Part A**

Year		Total Distrib. Line (km)	Potential Consumer Density (cons./km)	Connection Rate	Connected Consumer Density (cons./km)	Total Consumers	Average Consump. kWh/mo/co	Total Consump. MWH/yr
1998	1	4280	34.0	40.0%	13.6	58,208	50.9	35,553
1999	2	4280	34.8	44.3%	15.4	65,912	51.8	40,964
2000	3	4280	35.6	47.2%	16.8	71,820	52.7	45,417
2001	4	4280	36.4	50.1%	18.2	77,927	53.6	50,122
2002	5	4280	37.2	52.9%	19.7	84,232	54.7	55,262
2003	6	4280	38.0	55.8%	21.2	90,736	55.8	60,719
2004	7	4280	38.4	58.3%	22.4	96,003	56.9	65,529
2005	8	4280	38.9	61.0%	23.7	101,533	58.0	70,689
2006	9	4280	39.4	63.5%	25.0	107,000	59.2	75,985
2007	10	4280	40.1	65.0%	26.1	111,499	60.4	80,764
2008	11	4280	40.8	66.0%	26.9	115,252	61.6	85,152
2009	12	4280	41.5	67.0%	27.8	119,105	62.8	89,759
2010	13	4280	42.3	68.0%	28.8	123,058	64.1	94,593
2011	14	4280	43.0	69.0%	29.7	127,115	65.3	99,666
2012	15	4280	43.8	70.0%	30.7	131,279	66.6	104,989
2013	16	4280	44.6	70.0%	31.2	133,642	68.0	109,016
2014	17	4280	45.4	70.0%	31.8	136,047	69.3	113,198
2015	18	4280	46.2	70.0%	32.4	138,496	70.7	117,540
2016	19	4280	47.1	70.0%	32.9	140,989	72.1	122,049
2017	20	4280	47.9	70.0%	33.5	143,527	73.6	126,731
2018	21	4280	48.8	70.0%	34.1	146,111	75.1	131,592
2019	22	4280	49.6	70.0%	34.8	148,740	76.6	136,640
2020	23	4280	50.5	70.0%	35.4	151,418	78.1	141,882
2021	24	4280	51.4	70.0%	36.0	154,143	79.6	147,324
2022	25	4280	52.4	70.0%	36.7	156,918	81.2	152,976

Basis for load forecast model:

1. CEB has conducted surveys on average connection rates, connected consumers per km., and average consumption rates for the first rural electrification project in 1986 (year 2), 1990 (year 6) and 1993 (year 9) for RE1). The load forecast assumes that connection rates will be similar, and that consumption rates will begin at the same 1990 level, due to the increase in per capita income levels.
2. Average consumption per consumer after 1002 is estimated to grow at the per capita income growth rate of 2% annually.
3. Total potential consumer density after 2005 is estimated to increase at the national population growth rate of 1.8%.
4. Connection rates after year 9 are forecast to increase more slowly, and to level out at 70%.
5. For convenience, the economic analysis assumes all subprojects will be commissioned at the same time although in reality, subproject commissioning and expenditures will be spread over about three years.

**Table 2: Part A: CEB's Rural Electrification Project**  
**Calculation of Economic Rate of Return**  
 (All costs and benefits at 1995 prices, exchange rate is SLRs50 = \$1.00)

Year	FORECAST SALES			COSTS			BENEFITS				NET ANNUAL BENEFITS SLRs mil.		
	Consum-ers	Average Consum. kWh/mo	Total Sales GWh	RE Distribution Capital SLRs mil.	House Wiring O&M SLRs mil.	33 kV Supply SLRs mil.	Dist. Losses SLRs mil.	Total SLRs mil.	Residential			Commercial	
									Sales GWh	Benefits SLRs mil.		Sales GWh	Benefits SLRs mil.
1996				952				952					(952)
1997				952				952					(952)
1998	58,208	50.9	35.6	204	22	326	230	794	31.0	389	4.6	54	442
1999	65,912	51.8	41.0	27	23	43	265	374	35.7	448	5.3	62	509
2000	71,820	52.7	45.4	21	23	33	294	390	39.6	496	5.9	68	565
2001	77,927	53.6	50.1	21	23	34	324	427	43.7	548	6.5	75	623
2002	84,232	54.7	55.3	22	23	35	358	467	48.1	604	7.1	83	687
2003	90,736	55.8	60.7	23	47	36	393	534	52.9	664	7.8	91	755
2004	96,003	56.9	65.5	18	47	29	424	560	57.1	716	8.5	99	815
2005	101,533	58.0	70.7	19	48	31	457	603	61.6	773	9.1	106	879
2006	107,000	59.2	76.0	19	48	31	492	645	66.2	831	9.8	114	945
2007	111,499	60.4	80.8	16	48	25	523	675	70.3	883	10.4	122	1,004
2008	115,252	61.6	85.2	13	48	21	551	700	74.2	931	11.0	128	1,059
2009	119,105	62.8	89.8	13	49	22	581	734	78.2	981	11.6	135	1,116
2010	123,058	64.1	94.6	14	49	22	612	771	82.4	1,034	12.2	142	1,176
2011	127,115	65.3	99.7	14	49	23	645	809	86.8	1,089	12.9	150	1,239
2012	131,279	66.6	105.0	15	50	23	679	848	91.4	1,148	13.5	158	1,306
2013	133,642	68.0	109.0	8	74	13	705	886	95.0	1,192	14.1	164	1,356
2014	136,047	69.3	113.2	8	74	13	733	917	98.6	1,237	14.6	170	1,408
2015	138,496	70.7	117.5	9	74	14	761	949	102.4	1,285	15.2	177	1,462
2016	140,989	72.1	122.0	9	74	14	790	982	106.3	1,334	15.7	184	1,518
2017	143,527	73.6	126.7	9	74	14	820	982	110.4	1,385	16.3	191	1,576
2018	146,111	75.1	131.6	9	74	14	852	1,016	114.6	1,438	17.0	198	1,637
2019	148,740	76.6	136.6	9	74	15	884	1,052	119.0	1,494	17.6	206	1,699
2020	151,418	78.1	141.9	9	74	15	918	1,089	123.6	1,551	18.3	214	1,765
2021	154,143	79.6	147.3	10	74	15	953	1,127	128.3	1,610	19.0	222	1,832
2022	156,918	81.2	153.0	10	74	16	990	1,167	133.2	1,672	19.7	230	1,902
Totals			542	2,453	313	879	3,508	6,542	472	5,925	70	816	6,741
NPV@10%				1,925	436								EIRR: 10.9%

#### Basic Results:

12.07 SLRs/kWh average total economic cost of service  
 5.60 SLRs/kWh average cost of distribution, including losses  
 10.9% Economic internal rate of return  
 1.03 Benefit/cost ratio at 10% discount rate

#### Basic Input Variables:

2,527 million SLRs total financial cost, excluding service connections  
 1,904 million SLRs total economic cost, excluding service connections  
 4372 SLRs/consumer average cost of service connection  
 7000 SLRs/household average cost of house wiring  
 0.80 Standard conversion factor for local costs  
 2.0% average annual O&M cost, years 6 to 15  
 12% average losses on distribution system after 10 years  
 6.73 SLRs/kWh average cost of 33-kV bulk supply for residential use (24% load factor)  
 4.71 SLRs/kWh average cost of 33-kV bulk supply for commercial use (36% load factor)  
 6.47 SLRs/kWh weighted average cost of 33-kV bulk supply, economic prices  
 87.1% of total sales will be residential by year 9  
 12.6 SLRs/kWh average economic benefit of residential consumption  
 11.7 SLRs/kWh average economic benefit of commercial and industrial consumption

**Table 3**  
**Economic Evaluation of CEB's Power System Expansion Program, 1995-2006**

Based on the investment plan for the econometric forecast described in CEB's  
 Report on Long Term Generation Expansion Planning Studies, October 1994

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	from 2007 to 2035
<b>Summary of:</b>													
<b>Load Forecast</b>													
Generation Required (GWh)	4615	4962	5346	5762	6201	6668	7168	7681	8234	8836	9517	10244	10244
Sales (GWh)	3819	4136	4491	4876	5285	5722	6192	6683	7212	7775	8375	9015	9015
Peak Load (MW)	939	1006	1080	1160	1244	1333	1428	1525	1629	1742	1873	2016	2016
<b>Expansion Program</b>													
Net Capacity Commissioned (MW)		0	236	42	68	70	256	-32	174	6	300	0	
Total CEB Generation Capacity (MW)	1339	1339	1575	1617	1685	1755	2011	1979	2153	2159	2459	2459	2459
Reserve Capacity (% of installed)	43%	33%	46%	39%	35%	32%	41%	30%	32%	24%	31%	22%	22%
Capital Expenditures (\$ million)	85.4	223.6	207.6	280.8	236.6	164.6	150.1	141.8	109.2	27.6	0.0		0.0
CEB Power Plants	68.5	80.0	75.4	89.2	84.9	85.5	71.3	72.8	78.0	84.8	98.3	107.3	
Transmission and Distribution													
Operating Expenditures (\$ million)													
Fuel Costs	34.5	44.2	39.6	53.6	70.4	80.9	61.9	79.9	83.6	112.9	105.8	133.4	133.4
O&M Costs	50.2	59.0	65.5	73.5	80.4	85.4	92.0	98.1	101.4	103.2	105.5	108.5	108.5
Incremental Operating Costs (1995 base)		18.5	20.4	42.4	66.1	81.7	69.2	93.3	100.4	131.4	126.7	157.3	157.3
Total Capital Expenditures and Incremental													
Operating Costs at 1995 Prices (\$ million)	85.4	322.1	303.4	412.4	387.6	331.7	290.6	307.8	287.5	243.7	224.9	264.5	157.3
Total Incremental Energy Sales (1995 base) (GWh)	0	317	672	1,057	1,466	1,903	2,373	2,864	3,393	3,956	4,556	5,196	5,196
Economic Benefit due to Incremental Sales (\$ million)	0	49	105	165	229	297	371	447	530	618	711	811	811
Net Incremental Benefits - Costs (\$ million)	-85	-273	-198	-247	-159	-35	80	139	242	374	486	547	654

#### Basic Results

0.156 \$/kWh average economic benefit of electricity sales

0.098 \$/kWh average incremental cost of electricity sales

(Economic cost at 1995 prices, 12% interest rate)

21% Economic internal rate of return on expansion program, 1995-2006

1.59 Benefit/cost ratio for expansion program, 1995-2006, at 12% discount rate

Consumer Category	Share of Sales	Economic Benefit SLRs/kWh
Residential	26%	12.60
Commercial	17%	8.90
Industrial	40%	5.20
LECO Bulk Supply	17%	5.52
Weighted Average		7.81 SLRs/kWh
	or	0.156 \$/kWh

**Table 4: Part A: CEB's Rural Electrification Project**  
**Calculation of Financial Rate of Return**  
 (All costs and benefits at 1995 prices, exchange rate is 50 Rs/\$)

Year	Total Sales GWh	COSTS				Total SLRs mil.	INCOME				Service Connect. SLRs mil.	Total SLRs mil.	NET CASH FLOW SLRs mil.
		RE Distribution		33 kV Supply SLRs mil.	Dist. Losses SLRs mil.		Residential		Commercial				
		Capital SLRs mil.	O&M SLRs mil.				Sales GWh	Revenue SLRs mil.	Sales GWh	Revenue SLRs mil.			
1996		1,263				1,263							(1,263)
1997		1,263				1,263							(1,263)
1998	35.6	254	28	230	12	525	31.0	50	4.6	25	254	329	(196)
1999	41.0	34	28	265	16	343	35.7	57	5.3	28	34	119	(224)
2000	45.4	26	28	294	20	368	39.6	63	5.9	31	26	121	(247)
2001	50.1	27	29	324	24	404	43.7	70	6.5	35	27	131	(273)
2002	55.3	28	29	358	29	443	48.1	77	7.1	38	28	143	(301)
2003	60.7	28	58	393	35	515	52.9	85	7.8	42	28	155	(360)
2004	65.5	23	59	424	41	547	57.1	91	8.5	45	23	160	(388)
2005	70.7	24	59	457	48	589	61.6	99	9.1	49	24	172	(417)
2006	76.0	24	60	492	56	631	66.2	106	9.8	53	24	182	(449)
2007	80.8	20	60	523	63	665	70.3	113	10.4	56	20	188	(477)
2008	85.2	16	61	551	66	694	74.2	119	11.0	59	16	194	(500)
2009	89.8	17	61	581	70	728	78.2	125	11.6	62	17	204	(524)
2010	94.6	17	61	612	73	764	82.4	132	12.2	66	17	215	(550)
2011	99.7	18	62	645	77	802	86.8	139	12.9	69	18	226	(576)
2012	105.0	18	62	679	82	841	91.4	146	13.5	73	18	237	(604)
2013	109.0	10	93	705	85	894	95.0	152	14.1	76	10	238	(656)
2014	113.2	11	94	733	88	925	98.6	158	14.6	78	11	247	(678)
2015	117.5	11	94	761	91	957	102.4	164	15.2	81	11	256	(701)
2016	122.0	11	94	790	95	990	106.3	170	15.7	85	11	266	(724)
2017	126.7	11	95	820	98	1,024	110.4	177	16.3	88	11	275	(749)
2018	131.6	11	95	852	102	1,060	114.6	183	17.0	91	11	286	(774)
2019	136.6	11	95	884	106	1,097	119.0	190	17.6	95	11	297	(801)
2020	141.9	12	96	918	110	1,136	123.6	198	18.3	98	12	308	(828)
2021	147.3	12	96	953	114	1,176	128.3	205	19.0	102	12	319	(856)
2022	153.0	12	96	990	119	1,217	133.2	213	19.7	106	12	331	(886)
Totals		3,213											
NPV@10%	542	2,533	393	3,508	360	6,794	472	755	70	375	341	1,472	(5,323)

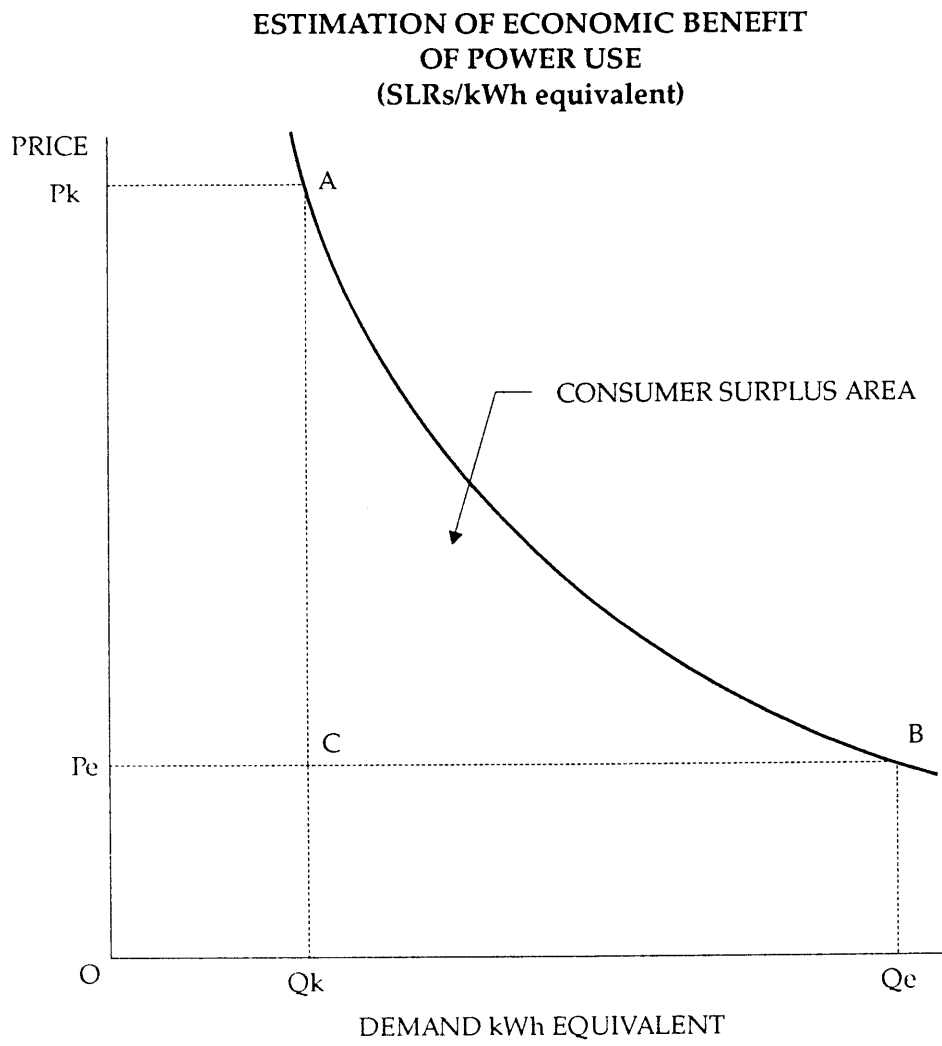
**Basic Input Variables:**

- 2,527 million SLRs total financial cost for RE3, excluding service connections
- 4372 SLRs/consumer average cost of service connection
- 2.0% average annual O&M cost, years 6 to 15
- 12% average losses on distribution system after 10 years
- 6.47 SLRs/kWh weighted average cost of 33 kV bulk supply
- 87.1% of total sales will be residential by year 9
- 1.60 SLRs/kWh average tariff for residential consumption in 1995
- 5.37 SLRs/kWh average tariff for commercial and industrial consumption in 1995

**Basic Results:**

- 12.54 SLRs/kWh average total financial cost of service
- 6.06 SLRs/kWh average cost of distribution, including losses
- 0.22 Benefit/cost ratio at 10% discount rate

FIRR:



### Income Distribution for RE Customers

