

ASIAN DEVELOPMENT BANK

IES:SRI 12045

Impact Evaluation Study Series (Number 32)

REEVALUATION OF THE

**RURAL ELECTRIFICATION PROJECT
(Loan No. 436-SRI[SF])**

IN

SRI LANKA

November 1995

CURRENCY EQUIVALENTS

Currency Unit - Sri Lanka Rupee (SLRs)

	At Appraisal	At Project Completion	At Postevaluation	At Reevaluation
SLRs1.00 =	\$0.06452	\$0.03247	\$0.02913	\$0.02027
\$1.00 =	SLRs15.50	SLRs30.80	SLRs34.33	SLRs49.33

ABBREVIATIONS

AR	-	Appraisal Report
CEB	-	Ceylon Electricity Board
DCB	-	Decentralized Budget System
EA	-	Executing Agency
ECU	-	Evaluation and Coordination Unit
EIRR	-	Economic Internal Rate of Return
FIRR	-	Financial Internal Rate of Return
MP	-	Member of Parliament
PCR	-	Project Completion Report
PEM	-	Postevaluation Mission
PPAR	-	Project Performance Audit Report
PPTA	-	Project Preparatory Technical Assistance
RE	-	Rural Electrification
RE2	-	The rural electrification component of Loan No. 1021-SRI[SF]: Power System Expansion (Sector Loan)
RE3	-	The rural electrification component of the proposed Second Power System Expansion Project
REM	-	Reevaluation Mission

WEIGHTS AND MEASURES

A	(ampere)	-	unit of electric current
GW	(gigawatt)	-	1,000,000,000 W
km		-	kilometer
kV	(kilovolt)	-	1,000 volts
kVA	(kilovolt-ampere)	-	1,000 VA
kW	(kilowatt)	-	1,000 W
kWh	(kilowatt-hour)	-	1,000 Wh
MW	(megawatt)	-	1,000,000 W
MWh	(megawatt-hour)	-	1,000,000 Wh
V	(volt)	-	unit of voltage
VA	(volt-ampere)	-	unit of nominal power
W	(watt)	-	unit of active power
Wh	(watt-hour)	-	unit of electrical energy

NOTES

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

I. HIGHLIGHTS

1. **Objectives and Scope.** The Project's main objective was to provide electricity to rural areas. The scope included construction of rural electrification schemes in 1,150 villages, distributed throughout all districts in Sri Lanka, comprising 670 km of 33 kV and 210 km of 11 kV transmission lines, 5,140 km of low voltage (415 volt) lines, 910 substations, procurement of vehicles and equipment and 57,500 consumer connections.
2. **Cost and Implementation.** The Project was expected to cost \$31.8 million. However, because of cost overruns the final cost was \$44.16 million. Implementation was interrupted due to a lack of local currency and was completed three years after the expected completion date.
3. **PPAR Findings.** A project performance audit report (PPAR) was prepared in 1989. It was found that the Project achieved its objectives and that the economic internal rates of return (EIRR) for rural electrification (RE) schemes varied between 8 and 21 percent, but that the financial internal rate of return (FIRR) was negative. It was concluded that: (i) connection ratios and revenues had been affected by the connection charges, (ii) tariffs did not reflect economic or financial costs, (iii) the economic capacity of the Executing Agency (EA) was deficient, and (iv) accounts receivable were not meeting the loan covenant.
4. **Operational Performance.** The Reevaluation Mission (REM) found that, while expansions and modifications made it difficult to identify rural electrification schemes financed under the Project, the overall condition of schemes was satisfactory. Maintenance was sufficient, although the lack of a preventive maintenance program had resulted in relatively long interruptions in power supply. It was observed that many of the original transformers had been replaced because of high failure rates, sabotage, load growth and normal wear and tear. RE designs based on urban specifications were not justified.
5. **Institutional Issues.** The EA was not meeting the financial covenant of an 8 percent rate of return on revalued fixed assets. Accounts receivable had improved, but difficulties in collecting payments from government agencies continued. The debt-service ratio was acceptable. On the organizational side, the REM observed the EA's continued lack of autonomy, which affects in particular its authority to set tariffs. Staff was found to be competent although the need for economists persisted.
6. **Financial and Economic Analysis.** Financially, rural electrification continues to be non-viable with a cost recovery rate of 20 percent at current tariffs. Using the methodology adopted in the project completion report (PCR) and the PPAR, the EIRR is estimated to be 9.1 percent. However, this does not allow for schemes that have been destroyed or are no longer operational because of civil disturbances in the north and east of the country.
7. **Socio-Economic Aspects.** Survey results show that rural electrification has little impact on industrial activity with domestic lighting being the main use. High income households, which can afford the connection costs, are the principal beneficiaries. To encourage connection of households, a lending scheme is operated by the People's Bank. Major benefits derived from electricity include improved education and health facilities, increased working hours, reduced risk from using kerosene lamps, improved security and additional entertainment, particularly radio and television. Women have benefited from rural electrification, for example through reduced time spent on milling rice, but the benefits appear to be largely gender-neutral.

8. **Sustainability.** The REM considers the schemes to be sustainable. Rural electrification constitutes a small part of Ceylon Electricity Board's (CEB's) overall activities and losses can be financed through cross-subsidization. Staff, equipment and resources of the EA are adequate to maintain the schemes.

9. **Major Issues.** The REM observed that on equity grounds the Government's policies on subsidies and tariffs have not been efficacious. Subsidies do not benefit lower income households which cannot afford connection costs and must remain dependent on other, more expensive fuels, notably kerosene. Low tariffs impede the financial performance of rural electrification schemes and resources used for cross-subsidies would yield better results, in terms of attaining equity targets, if invested in other alternatives.

10. **Overall Assessment.** Taking into account non-performing schemes in areas affected by civil unrest, the Project's performance would have to be assessed as partly successful.

II. BACKGROUND

A. The Executing Agency

11. The Executing Agency for the Project was Ceylon Electricity Board (CEB), which was established in 1969 with a mandate to develop, maintain and operate the power supply system of the country. CEB is under the direction of the Minister of Power and Energy and is accountable to its own Board of Directors. Six of the latter are appointed by the Minister of Power and Energy, partly in cooperation with other ministries, and one is appointed by the Minister of Finance. The General Manager is responsible for management and daily operations. CEB has undergone several restructuring exercises during the past few years, mostly as the result of advice from international consultants. At present, plans are underway to further decentralize functions and responsibilities and create quasiprofit centers at the level of provincial offices.

B. The Power Sector in Sri Lanka

12. Power generation, transmission and large parts of the distribution network are the responsibility of the CEB. In addition, the Lanka Electricity Company (PVT) Ltd. (LECO) distributes electricity to customers in the outer Colombo area and south western region. Power generation is largely based on hydropower plants (82 percent), supplemented by thermal plants. Currently, installed generation capacity is 1,409 MW as compared with 401 MW at Project appraisal when approximately 300,000 customers were connected to the grid. The total number of connections is above one million, and total retail sales in 1994 by CEB were 3,565Gw. At the time of Project design, around 1,800 villages or 5 percent of the rural population had access to electricity, compared with about 44 percent at the time of reevaluation.

C. The Project

13. In December 1977 the Bank approved a project preparatory technical assistance (PPTA) to Sri Lanka for planning a rural electrification program.¹ On the basis of this PPTA a loan for the Rural Electrification Project² was approved by the Bank. This Project, which is now commonly referred to as RE1, focused on the physical construction of rural electrification schemes in 1,150 villages, distributed throughout all districts in Sri Lanka, and comprised 670 km of 33 kV and 210 km of 11 kV transmission lines, 5,140 km of low voltage (415 volt) lines, 910 substations (transformers), the procurement of vehicles and equipment and 57,500 consumer connections. In addition, provision was made for 30 months of consulting services in the field of load promotion.

14. The Appraisal Report (AR) indicated that the Government attached high priority to rural electrification and recognized certain shortcomings that hindered the successful implementation of RE plans. These were: (i) a lack of coordinated RE planning, (ii) an absence of selection criteria for villages to be electrified, and (iii) a lack of consumer services and load promotion measures. Moreover, the TA concluded that it was necessary and feasible to introduce improvements to the construction practices of CEB which could have resulted in cost savings estimated between 17 and 18 percent or around \$5.5 million.

15. Project implementation started in 1980, was interrupted during 1981 and 1982 because of a shortage of local currency funds, but was restarted in 1983. The Project was completed in 1989, three years behind schedule. This delay was attributed to the lack of local currency, an over-estimation of the EA's implementation capacity and the need to train local contractors in producing concrete poles. The cost of the Project was \$44.16 million compared with an appraisal estimate of \$31.8 million. This overrun needs to be assessed in light of actual implementation which was below target. Instead of the initially planned 1,150 schemes, only 927 were installed, which meant that the cost per scheme increased from an estimated \$15,817 at appraisal to \$33,362 at Project completion. The load promotion expert, originally scheduled for a 15-month assignment, left after six months. His recommendations for establishing and institutionalizing a load promotion unit were not followed through. In response to the lack of objective criteria for selecting villages for electrification, the Project introduced a model for calculating the EIRR. Schemes are now selected on the basis of a minimum 12 percent rate of return for Bank-funded schemes and 8 percent for schemes funded by the Government.

16. In 1990 the Bank approved a loan for a \$80 million, of which half was for rural electrification projects.³ Following changes in scope it is expected that about \$30 million of the Bank's loan will be used for rural electrification. The RE component is commonly referred to as RE2. Two Advisory and Operational TAs⁴ and a PPTA⁵ were piggy-backed to RE2. A proposed

¹ TA No. 219-SRI: *Rural Electrification*, for \$190,000, approved on 9 December 1977.

² Loan No. 436-SRI(SF), *Rural Electrification*, for \$11.3 million, approved on 10 December 1979.

³ Loan No. 1021-SRI(SF), *Power System Expansion (Sector Loan)*, approved on 31 May 1990. The RE components are completed but other components are not expected to be completed until May 1996.

⁴ TA No. 1307-SRI, *Rural Electrification Development*, for which \$390,000 was approved at the same time as RE2, and an additional \$55,000 was approved on 10 December 1990, and TA No. 1309, *Institutional Review and Development of CEB*, for \$700,000.

⁵ TA No.1308-SRI, *Preparation of CEB's New Thermal Power Station*, for \$690,000.

Second Power System Expansion Project (RE3) for \$145.9 million, including \$80 million for rural electrification, is under preparation.

III. POSTEVALUATION FINDINGS

17. A Project Performance Audit Report (PPAR) was prepared by a postevaluation mission (PEM) in 1989.¹ A reduction in the number of villages (see Appendix 1) was found to be attributable to difficulties of completing schemes in areas of civil unrest and to increased costs.

18. Nonetheless, the PEM found that the main objective of the Project – to supply electric power to villages – was substantially achieved and that commercial and industrial use of electricity had been promoted. The Project was also said to have had a significant impact on CEB's rural electrification program. The PEM did, however, indicate that the success of the Project would have been enhanced if the findings of the PPTA had been more closely followed.

19. The PEM's findings are less qualified than those of the Project Completion Report (PCR), which suggested that the Project had not been an unqualified success in meeting its ambitious objectives. The PCR found that the Project had not resulted in the expected increase in income or employment for households in the rural areas.

20. The PEM estimated the FIRR and EIRR using a similar methodology to the one used in the PCR. It was found that the costs of supplying rural electricity exceeded revenues from the schemes and that electrification of rural villages therefore imposed a financial burden on CEB, largely because of the EA's inability to set tariffs; lower than expected connection ratios, particularly for commercial and industrial consumers; and designs that did not follow least cost principles. The PEM found that the costs of RE were being paid from CEB's net operating income and that they therefore represented a subsidy from urban to rural consumers. It was estimated that the subsidy was about \$4 million or 2 percent of total revenue sales. However, the PEM considered that the burden of this subsidy was not onerous and, an important achievement of the Project was that tariffs had been adjusted and increased so that CEB was financially self-supporting.

21. However, in common with most other studies, the PEM found that there were benefits associated with rural electrification that were not reflected directly in market prices. Many of these additional benefits were taken account of in calculating the EIRR. The PEM estimated that the EIRR was about 15 percent compared with estimates of 24 percent at appraisal, and 12 percent at the time of PCR preparation. In common with the PCR the PEM estimated EIRRs for four representative schemes and found a range of EIRRs between 8 and 21 percent.

22. On the basis of the estimates for the EIRR of individual rural electrification schemes the Project was classified as generally successful. The PEM commented that the economic viability of rural electrification schemes had proved better than projected. However, a number of issues concerning the Project raised in the PPAR are discussed below.

¹ PE -298, *Rural Electrification Project in Sri Lanka*
RE-19.doc

A. Connection Charges

23. The PEM commented that utilization of electricity would have been higher if up-front connection charges had been lower. On the basis of a survey undertaken by the PEM, it was concluded that loans to consumers for connection charges would promote the widespread use of electricity. It was estimated that such loans could be recovered over five years through a surcharge on tariffs but that this would involve a tariff increase of almost 100 percent.

24. At the time of the PEM a credit scheme for households had been implemented under which the CEB guaranteed loans of up to Rs.5,000 by commercial banks to households to cover connection costs. However, the service capacity of households was not satisfactory and banks were reluctant participants.

B. Tariffs

25. The PEM recommended that the Bank should promote a rationalization of tariffs. It was considered that in the past tariff adjustments had been too abrupt and that, even though warranted on commercial grounds, large and infrequent adjustments were likely to weaken the incentive to use electricity and, for political reasons, be difficult to implement. It was therefore recommended that changes should be smaller and more frequent. In addition, the PEM considered that there was potential for a reduction in the extent of cross-subsidization.

C. Institutional Development

26. The PEM found that CEB's consumer-staff ratio had risen from 13:1 in 1975 to 38:1 in 1988.¹ However, the PEM noted a number of deficiencies in CEB:

- (i) **Staffing.** At the time of the PEM, CEB salaries were tied to those of other public sector agencies and were low. This contributed to poor staff morale and low productivity that in turn led to a high turnover of staff and shortages of key personnel. The PEM considered attention to salaries to be crucial for the further growth and successful operation of CEB and it was recommended that the Bank should support CEB's institutional development.
- (ii) **Training.** The Project included a relatively small component for training and the PEM supported CEB's view that greater attention to training would have been desirable.

¹ This compared with the following figures for other countries in 1988: Bangladesh 38:1; Indonesia 65:1; Thailand 90:1; and Korea 244:1.

D. Financial Performance

27. Financial covenants were generally complied with and the PEM found CEB's financial performance between 1979 and 1988 to have been satisfactory. However, CEB had difficulty in meeting the covenant relating to accounts receivable.

IV. REEVALUATION FINDINGS

28. The REM visited rural electrification schemes in the Western, Southern and Uva provinces and held discussions with CEB officials in the provincial offices and in Colombo. The REM also had discussions with officials from various other public and private sector agencies. The findings of the REM were generally in line with those of earlier reviews, including the PEM and the Project Completion Mission.

A. Operational Performance

29. As indicated above, a number of Bank loans to CEB since 1980 have included rural electrification components. In addition rural electrification has been financed under the Government's Decentralized Budget System (DCB) ¹ and from other multilateral and bilateral sources. In many cases these subsequent projects have extended, modified or rehabilitated schemes initiated under RE1. As a result the REM frequently found it difficult to identify equipment and facilities provided under RE1 separately. Nonetheless the REM has the following comments on operational aspects of the Project:

1. Transformers

30. A major component of the RE1 project was the importation of transformers. The original order for transformers included more than 400 63kVA units. However, in spite of repeated inquiries, the REM was not able to locate any 63kVA units in operation. Indeed, during field visits the Mission saw only one transformer that met the specifications for RE1 transformers.² Inquiries by the Mission suggested a number of possible reasons for the absence of original RE1 transformers discussed below.

¹ Under this program funds are allocated to each Member of Parliament (MP) to finance infrastructure work in their constituency. The work is then undertaken by CEB at the request of the MP. In recent years, however, the decision as to whether to undertake such work has been made by CEB on the basis of a model for determining the economic rates of return for projects.

² During a visit of inspection to Lanka Transformers Limited two 63kVA transformers were seen. The manufacturing details (e.g. the date of manufacture and manufacturers name) and the unusual 63kVA rating indicated that these units were probably part of the original Project order. Neither unit had ever been used. They had been brought from central storage for maintenance and were to be returned afterward.

a. High failure rates

31. The initial transformers supplied under RE1 were subject to high failure rates. This problem was identified in the PCR but was said to have been minor and to have been corrected by the suppliers at their expense. On the basis of CEB's records it was not possible to determine the extent of the problem or to confirm that the supplier had indeed met the full cost of rectification.

b. Sabotage

32. There have also been many cases of sabotage of transformers, usually by draining the oil and thereby causing the transformer to burn out.

c. Load Growth

33. For many RE1 schemes, particularly those close to Colombo, the load has expanded because of population growth, extension of the original scheme, or both, to the extent where the capacity of the original transformer was no longer adequate. This would have been a particular problem with the smaller (63kVA) transformers which formed the majority of units included under RE1. The REM was told that the smaller units would then have been returned to Colombo for renovation and reallocated to another (smaller) scheme that was not part of the RE1 Project, or would have gone into storage to await reallocation. CEB's maintenance and equipment records did not readily enable the Mission to determine the extent to which this had taken place.

34. Although this development does attest to the success of the schemes, the proximity of many of the affected schemes to Colombo and other urban areas raises some questions as to whether they should have been covered under a rural electrification program.

d. Normal Wear and Tear

35. The Mission was told that under normal operating conditions the replacement rate for transformers would be about 2-3 percent a year as a result of natural causes such as lightning strikes. The average life for a transformer in Sri Lanka could be expected to be about 20 years. This suggests that of the 840 units of various sizes included in the initial order as many as 200 could be expected to have worn out as a result of natural causes.

2. Maintenance

36. The schemes visited by the REM were generally in good condition. However, the current maintenance practices of CEB involve responding to breakdowns in the system rather than undertaking a program of preventive maintenance. In rural areas, where notification, identification of the problem and travel of maintenance personnel to the affected site take considerable time, this

¹ This is not connected to the security problems in northern and eastern Sri Lanka.
RE-19.doc

leads to lengthy outages. In a survey of RE schemes in Sri Lanka, consumers gave "frequent breakdowns" as a major concern. The resulting lack of reliability reduces the willingness of consumers to commit themselves to electricity and is not conducive to commercial and industrial enterprises locating in these areas.

37. The current maintenance practices add to costs of RE schemes, discourage connections, reduce revenue and negate some of the potential benefits of the schemes. Experience elsewhere suggests that CEB should give consideration to changing to a program of preventive maintenance.

3. Design

38. The design used for rural electrification schemes in Sri Lanka is based on a standard urban distribution model. CEB has continued to use this design in spite of comments from virtually all observers including the consultants who prepared the PPTA. The REM was informed that a major reason for retaining this design in RE schemes was in anticipation of increased demand as a result of population growth and increased connections.

39. Other reasons given by CEB for continuing to use the standard model were:

- (i) familiarity with construction techniques;
- (ii) reduced requirements for inventories; and
- (iii) standardized costing.

40. The REM considers that such considerations are valid but that in rural areas the benefits are more than offset by higher costs and reduction in potential earnings. CEB's urban design is considered to be less well suited to rural areas where population density is low. The PEM agrees that in some areas, particularly those close to Colombo, population growth and the increase in demand appear to have been sufficient to warrant the use of CEB's traditional urban distribution model. However, once again this raises some questions about the appropriateness of including such areas in a Project aimed at rural electrification.

B. Executing Agency

1. Financial Position

41. RE1 included several covenants designed to ensure the financial soundness of CEB. The PEM found that these covenants had generally been complied with and that CEB's projected financial performance, which was based on a proposed 25 percent tariff increase in 1990, was satisfactory. However, despite an average increase in sales of electricity of more than 8.5 percent a year since 1989, CEB has not always been able to comply with the main financial covenants, discussed below.

a. Rate of Return

42. Under RE1 and RE2 CEB is required to maintain a rate of return of 8 percent on net revalued fixed assets. The aim of this covenant was to provide an incentive for CEB to make appropriate adjustments to its tariffs. Although, CEB was meeting this covenant from 1985 to 1988, the rate of return subsequently fell below 8 percent (see Appendix 2) and in 1992 was only 4.25 percent – the lowest level since the covenant was introduced. Following increases in tariffs in July 1993, the rate increased to 4.77 percent in 1993 and 7.84 percent in 1994.

b. Accounts Receivable

43. The PEM found that CEB has had continued difficulties in obtaining repayment from the military and government agencies. In spite of this, CEB's accounts receivable position has improved since the time of the PEM and has been below the covenanted three months of sales in every year since 1989.

c. Debt Service Ratio

44. CEB is required to maintain a debt service ratio of at least 1.5. This covenant has generally been complied with, although in 1992 the ratio was only 1.3. The REM understands that CEB's performance relative to this covenant has been assisted by the way in which the Sri Lankan Government channels loans to CEB. Thus Bank funding for RE1 and RE2 was given to CEB as an equity contribution. This means that CEB effectively received these funds as a grant with no obligation to repay the money.

2. Organizational Aspects

a. Autonomy

45. Difficulties in meeting these covenants reflect, at least in part, CEB's lack of independence. CEB's Board of Directors is largely appointed by the Minister of Power and Energy, who also has the power to dismiss the Directors; CEB is subject to directions by the Minister – although the PEM was informed that such directions had not been issued in the past two years; and decisions on investments, tariffs and other matters must be approved by the Minister. The process of making tariff adjustments is a matter of some concern. Recommendations for tariff increases are made to the Minister who then submits a memorandum to the Cabinet for approval. Approved increases must then be gazetted and objections submitted before implementation. Inevitably such a process means that political, rather than commercial, considerations play a major role in decision making.

b. Staffing

46. The number of staff at CEB has increased from 9,897 at the time of appraisal (1979) to 13,700 at the time of postevaluation (1989) to about 14,300 at present. There has also been an improvement in the consumer-staff ratio from 38:1 in 1988 to 65:1.

47. In recent years CEB has had a high turnover of engineering staff but the REM found that those remaining were competent. However, in spite of recommendations by earlier missions and by various studies CEB still did not have any economists. This has implications for the evaluation of rural electrification schemes. CEB currently assesses potential RE schemes using an economic model prepared by consultants recruited under a Bank-financed technical assistance.¹ To qualify for Bank financing, schemes must have an EIRR of more than 12 percent. For schemes proposed for financing under the Government's DCB program the cut-off rate is 8 percent. This is an improvement on the previous system whereby CEB was required to undertake any schemes proposed by MPs under the DCB program and it provides CEB with an objective means of restricting some of the excesses of that system.² Nonetheless, the relevant staff in CEB appear to have little understanding of the model and to be applying it mechanically. It is therefore considered that an economist should be recruited to assist in interpreting the results of the model and making modifications to it.

C. Financial and Economic Evaluation

48. The available evidence suggests that there has been little change in the financial performance of rural electrification schemes since the PPAR was prepared. Because of changes that have taken place in the original schemes it was not possible to obtain actual data on which calculations of the EIRR and FIRR for the Project could be based.

1. Financial Rate of Return

49. The average cost of power supply to rural consumers is about SLRs11.25/kWh. Consequently, even with an increase in the average tariffs for sales to domestic consumers from SLRs.1.90/kWh to SLRs.4.08/kWh, as proposed under RE3, the cost recovery for RE schemes would rise from the current level of 20 percent to slightly over 37 percent. The FIRR for rural electrification would remain negative.

50. Rural electrification schemes therefore continue to impose a financial burden on CEB. This is partly met by cross-subsidies from other consumers, particularly larger commercial and business users. In addition, the Government provides support to CEB through equity contributions that cover the full capital cost of rural electrification schemes. There has so far been no obligation on the part of CEB to make dividend payments.

¹ TA No. 1307-SRI, *Rural Electrification Development*.

² The REM does, however, consider that a cut-off EIRR of 8 percent is too low.

2. Economic Rate of Return

51. In common with earlier analyses the REM found the economic performance of RE schemes to be better than their financial performance. On the basis of actual capital costs for the Project and data on operational performance from existing RE schemes,¹ the EIRR was estimated to be 9.1 percent (see Appendix 3). The difference between the FIRR and EIRR reflects (i) adjustments for duties and other taxes; and (ii) the benefits to consumers from the lower costs associated with the use of electricity as compared with alternative fuel sources – primarily kerosene.

52. The methodology used is similar to that used in the PPAR and PCR and is based on an analysis of a *typical* RE scheme under *normal* circumstances.² However, the REM's estimated of the EIRR is lower than the EIRR for an average scheme estimated by the PEM. An important reason for this is that growth of consumption has been lower than expected. At the time of the PEM, it was expected that for an average scheme, total consumption would rise to about 130 megawatt-hours (MWh). Experience since 1989 suggests that this estimate was too optimistic and that within the assumed operating life of an average RE scheme (i.e., 20 years), total consumption is unlikely to increase to much more than 70 MWh.

53. The REM considers that the methodology is appropriate and provides a realistic indication of existing RE schemes. However, the EIRR does not reflect the overall performance of the Project. This would be difficult in normal circumstances, but in the case of this Project, estimation of an overall EIRR would not be possible. For example, there were no data on the sabotage of transformers, nor on the technical problems with the original batch of transformers. More seriously, there are no operational data for schemes affected by the civil disturbances (in the northern and eastern areas); the Mission was informed that, as a result of the disturbances, 95 of the schemes completed under the Project are not functioning and at least 15 of these have been destroyed.

54. In the light of these developments there must be some doubtst about the overall performance of the Project. It is considered likely that on an overall basis the EIRR would be lower than estimates for a *typical* scheme and the Project is accordingly considered to be only *partly successful*.

D. Socioeconomic Aspects

55. Over time there have been a number of surveys of the rural electrification schemes covered by the Project. The first of these, which was considered to be a pilot survey, was undertaken by CEB in 1985 and covered 26 schemes. The major findings of this survey were that:

- (i) the major beneficiaries of rural electrification had been the domestic sector;

¹ Because of the difficulties in isolating RE1 schemes, this is based on the experience of all RE schemes.

² It was originally expected that a "typical" or "average" scheme would consist of 0.77 km of MV line, a 69.6 kVA substation (transformer) and a 4.47 km LV system. The final "typical" scheme comprised 1.42 km of MV line, a 74 kVA substation and 3.3 km of LV circuits.

- (ii) provision of electricity had little impact on development of rural industries – this was attributed to, among other things, interruptions in supply;
- (iii) the connection ratio, after an average scheme life of 1.73 years, was under 45 percent – an important reason for the low connection ratio was the high cost of the initial connection;
- (iv) CEB was sustaining losses from RE schemes in almost every sector of activity (e.g. generation, distribution, maintenance)

56. The 1985 survey was largely of a technical nature. A 1987 survey by CEB, of the same schemes included questions on socioeconomic aspects. Subsequently, surveys were carried out by CEB in 1990 and 1993. The number of schemes covered increased on each occasion but the 26 schemes covered by the original survey have been covered in each survey.

57. There are some problems of comparability between the surveys, with changes in definitions and changes in the schemes themselves. Nonetheless, the results of the later surveys appear to confirm the earlier findings that rural electrification has not led to any significant increase in income or to an increase in industrial or commercial activity. The field visits undertaken by the REM supported these findings. There was little evidence of significant industrial activity. The surveys suggest that although the proportion of households connected has been increasing over time – from just over 46 percent in the 1987 survey to more than 63 percent in the 1993 survey (see Appendix 4) – the largest consumers have the highest incomes and the highest connection ratios. Further, results from the 1993 survey show that in all regions the average income for electrified households was higher than for non-electrified households¹. These results are not surprising but they do imply that wealthier households are the primary beneficiaries of rural electrification.

58. The surveys also suggest that among users the main benefits of rural electrification are considered to be savings in expenditure on fuel (see Appendix 5, page 1). In the 1993 survey this was ranked highest in all areas of the country. The importance of other benefits – *improvements of economic activities, longer working hours, longer study hours, improved security and convenience for social activities* – varied considerably among regions. However, *improvement of economic activities* and *convenience for social activities* were generally ranked lower than other categories.

59. Among non-electrified households covered by the 1993 survey the major reason for not having electricity was that the cost of a connection was too high. This is in line with the findings of the Postevaluation Mission.

¹ Non-electrified households are households that do not currently have electricity but are within 100 meters of a low voltage distribution line.

60. In addition to the CEB surveys, the Evaluation & Co-ordination Unit of the Ministry of Policy Planning and Implementation (ECU) carried out a Beneficiary Survey in early 1994 of 48 schemes and more than 550 households covered by RE1. The findings of this survey were similar to those of the CEB surveys. Rural electrification was found to have:

- (i) improved educational and health facilities in rural areas;
- (ii) increased working hours;
- (iii) reduced the risks associated with open-flame bottle kerosene lamps;¹
- (iv) improved security; and
- (v) provided increased opportunities for leisure activities.

61. The ECU survey also obtained information on ownership of electric appliances by households. It was found that more than 86 percent of households had radios and about 75 percent had televisions (see Appendix 6). The only other appliance that was found in the majority of households was an electric iron (70 percent).

62. The data collected by CEB provide considerable information on rural electrification in Sri Lanka and on the RE1 Project in particular. The REM concurs with the view expressed in the PCR that the data from these surveys "...may be one of the most comprehensive bodies of rural electrification data collected by any developing country..." However, it is clear that the information is of little use to CEB in its decision making processes or to anyone else. The REM had considerable difficulty in locating copies of the earlier studies and although data pertaining to the most recent surveys are stored on computer disc it was apparent that it was not often accessed.

63. In the view of REM the main reason for collecting the data was to satisfy the Bank's requirements and this raises some questions about the rationale for undertaking surveys of this type. If collection is to be continued then CEB should be given guidance on the use of the data, on collection methods and on handling. It would be helpful if CEB had an economist to assist in data collection and processing.

E. Loans for Rural Electrification

64. In view of the comments in the PPAR and PCR concerning the cost of new connections the Mission reviewed the alternatives available to consumers for financing connection costs. The 1993 survey by CEB showed that average connection costs varied from SLRs6,815 in Sabaragamuwa Province to SLRs9,499 in the Western (south) Province (see Appendix 5). This represented as much as 4.7 times the average monthly income of non-electrified households in the

¹ It is interesting to note, however, that CEB's criteria preclude the connection of temporary or semi-permanent houses.

Western (south) province. In most provinces self-financing was the most common means of funding connection costs but credit from either a commercial bank or CEB has also been important.

65. The People's Bank administers a scheme under which loans of up to SLRs7,500 are provided to cover the cost of connection (SLRs5,500) and internal wiring (SLRs2,000). The maximum repayment period is 5 years and the rate of interest 22 percent per annum. CEB maintains an amount of SLRs40 million in a fixed deposit savings account (with People's Bank) with an interest of 11 percent per annum to cover any defaults on these loans. In the event of a default CEB disconnects the user. The recovery rate under this scheme averages 86.2 percent (see Appendix 7).

66. In addition, CEB provides loans of SLRs2,000 to low income earners to cover the cost of connection (SLRs1,000) and internal wiring (SLRs1,000). The loans are repayable over 5 years at an annual interest rate of 10 percent. These amounts are based on a 5 ampere connection with a maximum distance of 35 meters from the point of supply. The supply is sufficient for lighting only and outlets are not included in the wiring. The scheme is not popular with engineers for safety reasons because there is a tendency for consumers to put appliances into light fittings.

F. Women in Development

67. While electricity as such does not create gender-specific benefits, its usage may lead to improvements in the lives of women. Electricity-driven rice mills, for instance, minimize time required by women to mill rice paddy manually, thus freeing them for other activities. An evaluation undertaken by ECU observed this to have considerable time saving effects. Similarly, increased economic activity, which in rural areas tends to be of cottage-industry nature, provides additional employment opportunities for women. Household use of electricity could also ease daily household chores through the use of labor-saving devices; however, as discovered, the major appliances used by consumers in rural areas have been radio and television.

G. Sustainability

68. Although revenues from rural electrification schemes are not adequate to cover the associated costs, this appears to pose no threat to sustainability. The capital costs of the schemes are covered by equity contributions from the Government and operational losses, arising from the low average returns from sales to rural consumers, are covered by imposing relatively high tariffs on nonrural consumers and in particular on industrial and medium and large commercial users (see Appendix 8). Sales to Bank-financed RE schemes are estimated to account for about 4 percent of CEB's total sales and it is therefore considered that these cross-subsidies could be continued indefinitely without posing a serious threat to CEB's financial position. However, increases in the proportion of sales at subsidized rates will inevitably have an adverse impact on CEB's financial position.

69. These views are supported by the REM's observations during field visits and by discussions with CEB officials. It appears that CEB has the financial resources, equipment and technical capabilities to undertake the necessary maintenance of RE schemes, although its maintenance practices are not fully satisfactory.

V. MAJOR ISSUES

70. The major issues arising from the reevaluation of the Project concern the level of tariffs and subsidies for rural electrification.

A. Subsidies

71. The PEM considered that an important achievement of the Project was the influence on setting tariffs so that CEB was financially self-supporting. However, CEB is not totally independent of Government funding and indeed this was not intended. The Government has repeatedly declared its commitment to rural electrification and has always financed rural electrification on a grant basis or through reimbursements of capital expenditure on RE programs undertaken under the DCB.¹ The AR for RE1 recommended that this practice should continue and that the OPEC Special Fund and the Bank loans for RE1 should be provided to CEB in the form of grant contributions.²

72. These contributions are effectively subsidies to CEB and as such have efficiency and equity implications. The question of providing subsidies is a complex issue and there is probably no definitive answer as to whether subsidies should be provided for rural electrification. It is, however, a common practice in both developed and developing countries. Repeated estimates of the EIRR for rural electrification in Sri Lanka suggest that there is a case on efficiency grounds for undertaking such investments. However, estimates of the FIRR for rural electrification provide equally clear evidence that at existing tariff levels such investment are not financially viable. This could suggest a market failure that warrants Government intervention to ensure that resources were used most efficiently. However, as in other countries, the case for Government intervention appears to have been based on equity or social considerations rather than efficiency grounds.

73. The REM is not convinced by the equity arguments for Government subsidies for rural electrification. Available evidence suggests that rural electrification in Sri Lanka has not had any major impact on the development of industry or on employment in the areas covered by the schemes and as such cannot be said to have provided even indirect benefits to the poorest sections of the community. Further, surveys over the years make it clear that access of poorer households has been limited because they have not been able to afford connections. Accordingly, the major beneficiaries have been higher income groups, who have received the gains from using electricity rather than kerosene – which is considered to be the main alternative to electricity for

¹ The Appraisal Report for the Project indicated that, because of the large social gains, the Government attached high priority to rural electrification. More recently the rationale for the proposed "Second Power System Expansion Project" stated that "Rural electrification has been given a high national priority...because of its social impact....".

² The AR commented that:

"...there is distinct advantage in insulating CEB's overall financial position from the adverse impact of RE programs. As the Project revenues during the life of the Project will be barely adequate to cover direct operating costs, the provision of funds in the form of grant contribution is necessary and appropriate to safeguard CEB's financial position. Any other financing terms would saddle CEB with varying amounts of cash losses...."

households. It has been estimated that the average cost of electricity for household consumers is SLRs2.35/kWh compared with a price for kerosene equivalent to SLRs26/kWh.

74. Further, the provision of subsidies has broader implications. The costs of the subsidies are met through the Government's budget which means that the Government must either increase taxes or reduce expenditure on other activities. If the Government is to increase revenues then this will inevitably have an adverse impact on those who must pay the increased taxes. Frequently, in countries such as Sri Lanka, the burden of increased taxation falls on industry and reduces incentives for investment. This has the potential to reduce the competitiveness of Sri Lankan industry and to result in a misallocation of resources.

75. Alternatively, if there is no increase in revenue, the subsidy for rural electricity reduces resources available for other pressing needs – of which there is no shortage in Sri Lanka. It could, for example, lead to a reduction in the amount available for the kerosene subsidy, which would clearly have an adverse impact on equity.

76. The REM considers it important that the Government make clear the rationale for investing in rural electrification. If, as in many other countries, it is considered that rural electrification is in the best interests of the wider community, either because of market failures or for equity reasons, then it is appropriate that CEB should be compensated for undertaking those investments that it would otherwise not have taken. Failure to do this may have a number of adverse consequences. First, CEB would be obliged to increase charges on other users and thereby affect their consumption decisions. Second, the prices facing managers would be distorted which could affect such matters as investment, pricing and staffing. In this regard, the arrangements under which the Government provides equity financing to cover the investment cost of rural electrification schemes would appear to be appropriate.

B. Tariffs

77. The FIRR for rural electrification schemes is estimated to be negative. To a large extent this reflects the capital costs of such schemes. However, recent analysis shows that even if the capital costs of rural electrification schemes are excluded (on the grounds that these are established at the behest of the Government and for which the Government provides full compensation) CEB would incur a loss on such schemes. This reflects the CEB's tariff structure and in particular charges to domestic consumers.

78. The average domestic tariff of SLRs2.35/kWh compared with an average tariff for all consumers of about SLRs3.8/kWh. For domestic consumers in rural areas the average tariff is SLRs1.90/kWh. Perhaps of more significance the average cost of power supply to rural consumers was estimated to be about SLRs11.25/kWh.

79. Under tariffs established in May 1994 domestic consumers have "lifeline" rates of SLRs0.60/kWh for the first 10 kWh and SLRs1.20/kWh for the next 40 kWh. Such "lifeline" rates are common in many developing countries and are apparently set for equity reasons. However, the REM considers that this rationale is not sound. Lifeline rates are only available to those who could afford the connection charges but these tend to be the wealthier sections of the community.

80. For households that consume less than 50 kWh, the amount of electricity involved would cover little more than lighting requirements. However, in the case of households that are unable to afford a connection, these same lighting requirements must be met using kerosene, which in Sri Lanka is considerably more expensive.

81. The above figures indicate that in addition to the subsidy that rural consumers are receiving on the capital costs of RE schemes they are also receiving cross-subsidies from commercial and industrial consumers. The largest share of these cross-subsidies is met by industry and this has implications for the competitive position of industry in Sri Lanka. In addition, cross-subsidies distort prices and thus inhibit the role that prices play in allocating resources. They may therefore result in inappropriate decisions by managers.

82. CEB's institutional setting means that decisions on tariffs have tended to be politically motivated. The REM considers it important that the tariffs should be adjusted so that they more accurately reflect the costs of supplying power. This would involve a substantial increase for domestic consumers. Further, REM considers that power tariffs should be determined on a commercial basis and that, with this in mind, CEB should be given responsibility for determining its own tariffs.

VI. CONCLUSIONS

A. Overall Assessment

83. In assessing the performance of RE schemes the methodology adopted by the Bank has been to calculate the EIRR for a "typical" scheme under "normal" circumstances; this approach was used in estimating the EIRR for the PCR, and the PPAR. In view of the difficulties of obtaining reliable data on almost 1,000 schemes, which are spread over the whole country and which in most cases are no longer separately identifiable because they have been expanded or combined with other schemes, the REM considers that this is an appropriate methodology for evaluating the performance of RE projects and of RE1. The REM therefore concludes that the EIRR of 9.1 percent is indicative of the performance of those RE1 schemes that are still operating.

84. However, the REM found a number of RE1 schemes had been adversely affected by extraneous factors, including disturbances in northern and eastern Sri Lanka and sabotage in southern areas. Because of difficulties in visiting Project sites in the affected areas and because of deficiencies in CEB's records, it was not possible to quantify the impact that these factors have had upon the performance of the Project. Nonetheless, the REM considers that they substantially affected the performance of the Project and reduced the overall EIRR. The Project was found to have been only partly successful.

85. In addition, the REM identified a number of positions relating to the Project and the operations of CEB. First, in spite of repeated attempts to persuade CEB to adopt a different design that used for rural electrification projects is the same as the traditional urban electrification project. The REM recognizes that use of a common design has some benefits but considers that on balance there would have been substantial cost advantages in using a different design for rural electrification projects. The REM considers that this aspect should be kept in mind in planning future RE projects in Sri Lanka.

86. Second, the REM considers that there is little justification for the large subsidies and cross-subsidies that are being given to rural consumers. Since rural users come from higher income groups, these subsidies do not appear to be warranted on equity grounds and, in addition, it seems likely that they adversely affect resource allocation because:

- (i) the burden falls on other groups in the community; this can affect the competitive position of industries and the larger commercial users, which pay the largest subsidies;
- (ii) low prices for electricity relative to the cost of production and to alternative fuel (i.e. kerosene) encourage over-use by domestic consumers;
- (iii) domestic consumers contribute to the systems' peak-load and consequent increased use by these consumers necessitates investment in additional generating capacity; and
- (iv) distorted prices affect decision making within CEB.

B. Lessons Learned

87. The REM considers that the major lessons learned from the Project are that utility companies should be given greater autonomy and that tariffs should be set on commercial rather than political grounds. Ideally, tariffs should be set by the relevant utility subject to review by an *independent* regulatory body. Failing this they should be raised according to a predetermined schedule.

88. The REM endorses the view that the benefits of rural electrification would be increased by employing designs that meet the specific requirements of rural areas and that in general it is less appropriate to adapt an urban design for use in rural areas.

C. Follow-up Action

89. The REM considers that the Bank should:

- (i) encourage the Government to increase electricity tariffs, particularly for household consumers;
- (ii) continue the dialogue with the Government with a view to reducing its involvement in the power sector and increasing the autonomy of CEB; and
- (iii) continue to support CEB's institutional development through technical assistance.