Sri Lanka

Ex-Post Evaluation of Japanese ODA Loan Project

“Transmission and Substation Development Project (Ⅱ)”

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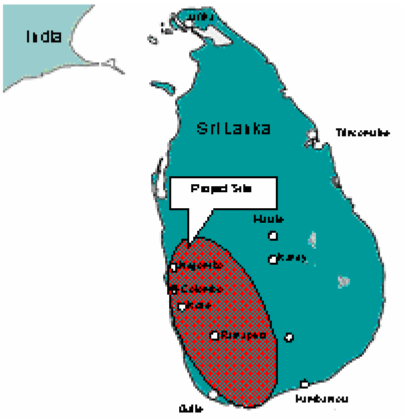
Field Survey: October 2008

1. Project Profile and Japan's ODA Loan



Map of project area


Ratnapura Substation

1.1 Background

Sri Lanka's electric power facility was connected through one system at the voltage of 132kV as the nation's major power transmission grid with 29 major substations (as of the end of 1996). The nation's investment in the power sector was heavily focused on power generation without mid- to long-term power transmission and distribution system development, which resulted in insufficient capacity of the power transmission network. This led to unstable power supply reliability and quality including voltage and frequency. With the intention to improve the condition, JICA formulated a master plan in 1997 and proposed a nationwide transmission and substation development plan until 2015 based on a demand projection.

1.2 Objective

The objective of this project is to meet the increasing power demand and stabilize power supply in Western Province where Colombo is situated, North Western province, and Sabaragamuwa Province by constructing and upgrading substations and enhancing power transmission lines in the area, and there by contribute to the regional economic development and improvement in the living environment for local residents.

1.3 Borrower/Executing Agency

Borrower: Government of the Democratic Socialist Republic of Sri Lanka

Executing Agency: Ceylon Electricity Board (CEB)

1.4 Outline of Loan Agreement

Approved Amount/ Disbursed Amount	4,030 million yen / 2,767 million yen
End Notes Exchange Date / Loan Agreement Signing Date	August 1998 / September 1998
Terms and Conditions	Interest Rate: 1.8% (0.75% for consultation) Repayment Period: 30 years (Grace Period:10 years - 40 years for consultation with 10 years of grace period) Procurement: General untied (Bilateral tied for consultation)
Final Disbursement Date	January, 2005
Main Contractor (Over 1 billion yen)	Alstom T & D Systems Ltd.
Main Consultant (Over 100 million yen)	Nippon KOEI Co., Ltd.
Feasibility Studies, etc.	Government of Sri Lanka: Transmission Grid Development Project (1998-2008)

2. Evaluation Results (rating: B)

2.1 Relevance (rating: a)

This project has been highly relevant with Sri Lanka’s national policies and development needs at the times of both appraisal and ex-post evaluation.

2.1.1 Relevance at Appraisal

Looking at Sri Lanka's national policy, stabilization of power supply was regarded critical in the Public Investment Plan (1993-1997) in relation to the improvement of investment environment for active promotion of inflow of foreign capital. Some 8% of the funds for the plan was allocated to the power and energy sector. The area of the project is the nation's economic center of Colombo and its surrounding areas that include major industrial and commercial districts and thus stable power supply was highly needed.

The Government of Sri Lanka revised JICA's master plan to formulate the Plan for the Development of the Transmission System (1998-2008) based on the New Power Source Development Plan (1997). The requested sub-projects needed to be implemented by 2001 in the transmission system development plan and thus the entire project was a priority and urgent issue.

2.1.2 Relevance at Ex-Post Evaluation

Mahinda Chintana: Vision for A New Sri Lanka (establishment of framework for 2006 to 2016) contains eight key issues in the energy sector, two of which are "access to electricity" and "transmission and substation development". Slow and insufficient investment in the latter, in particular, has been pointed out and its need has been described. Improvement of transmission and substation development is essential for "Satisfaction of Basic Energy Demand," one out of 9 policy issues in the National Energy Policy & Strategies of Sri Lanka that contains 9 policy issues, released in May 2008. In another policy issue "Promotion of Energy Use Efficiency," "reduction of network loss through investment in transmission and substation development" is stated as one of concrete strategies for the promotion.

Transmission and substation development remains critical in the national development plan and electric power policy at the ex-post evaluation.

2.2 Efficiency (Rating: b)

The project outputs were almost as planned. Although the project cost was significantly lower than planned, the project period was much longer than planned; therefore, the evaluation for efficiency is moderate.

2.2.1 Project Outputs

Table 1 below shows the planned and actual outputs.

Table 1 Planned and Actual Outputs

Output Item	Plan	Actual
1. Construction of Ratnapura Substation	・Ratnapura Substation: 132/33kV transformers (31.5MVA X 2), 132kV- T/L bays X 2 (single bus), 33kV- feeder bays (X 8) ・Balangoda Substation: 132kV- D/B T/L bays ・Installation of transmission lines between Balangoda and Ratnapura (40km) (132kV X 2))	・Ratnapura Substation: 132/33kVtransformers (31.5MVA X 2), 132kV- T/L bays X 2 (double bus), 33kV- feeder bays (X 8) ・Balangoda Substation: 132kV- D/B T/L bays ・Installation of transmission lines between Balangoda and Ratnapura (35.44km) (132kV X 2)
2. Construction of Athurugiruya Substation	・Athurugiruya Substation: 132/33kV transformers (3.15MVA X 2), 132kV- T/L bays , 33kV- feeder bays (X 8) ・Connection to the existing 132 kV	Add 10MVA-capacitator banks (X 2)

	Kolonnawa – Polpitiya transmission line	
3. Kelanitissa Kolonnawa transmission line enhancement	2.2km（220kV design）	Add 2 towers and use wires different from the plan at appraisal.
4. Upgrading of Thulhiriya Substation	132/33kV transformers (3.15MVA×2), 33kV- feeder bays , etc.	Built 30 years ago, the substation was old. Thus, the original plan of partial repair was changed to overall renovation.
5. Installation of equipment for parallel operation of 132 kV lines at Chilaw GSS	132 kV S/B T/L bays and Bus section bay	132 kV S/B T/L bays and Bus section bay
6. Upgrading of Kelanitissa /Pannipitiya Substation	100MVA- and 60MVA-capacitator banks	60MVA-capacitator bank became unnecessary.
(Additional item)	None	Although it was not in the original plan, 33kV-service exit (X 2) were added at Madala Substation.
7. Consultation service	Support for bidding, construction management, support for production of maintenance manual, staff training, production of periodical progress report MH: (International consultants): 35 MM (Local consultants): 45 MM	As planned. The executing agency was satisfied with the consultation service in general and the contractor performed well. MH: (International consultants): 44 MM (Local consultants): 60 MM

Source: Replied questionnaire

The changes in outputs were limited to matters that required them technically for yielding positive results. Although the changes pushed up the cost for additional parts and functional enhancement, strictly speaking, such changes were made within the original cost estimate, because more than 10 companies participated in the bidding, which resulted in cost competition.

The term of consultation service was extended due to the extension of the term of some work.

A cross-sectoral project coordination team formed during construction work functioned effectively in schedule management and monitoring. The team consisted of staff from several divisions including divisions such as design, system control center, maintenance and facility management in CEB in addition to the project team.

2.2.2 Project Period

Although the period of the project was originally planned to be 27 months (September 1998-November 2000)[1], the project actually took 72 months, much longer than planned (January 1999-December 2004: 267% of the plan[2]). The major causes are the delay of bidding (13 months of delay) and construction (19 months of delay).

The bidding took so long because more than 10 companies participated in each lot of substation and transmission line and thus this required exchanges of a large volume of document with concerned organizations. The main delay of construction was that of

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1 The completion of the period is the date of warranty expiration. The warranty of the transmission lines and substations expires at the end of November 2003 and December 2004, respectively. (Source: PCR)

2 219%, when calculated with the shorter warranty period of the transmission lines

Ratnapura Substation. It required much more time than the original plan due to scope changes and bad weather. Most of the delays were not avoidable at the discretion of the project team.

In addition, lack of capacity of the contractor (Sri Lankan subsidiary) and delay of agreement changes due to the sales of the contractor also extended the project period. As for the "lack of capacity of the Sri Lankan subsidiary," a British commissioned company originally had it perform the work. However, due to the lack of its capacity, the executing agency strongly requested the UK-based company improvement and it dispatched its staff from UK to handle the matter.

2.2.3 Project Cost

The actual project cost was 3,234 million yen (2,767 million yen of which was yen loan), which was much lower at 62% of the initial plan figure of 5,255 million yen (4,030 million yen of which was yen loan). The table below shows the comparison of the plan and actual cost. The biggest cost of construction cost is lower overall in yen base due to the efficient order resulting from competition and appreciation of yen.

Table 2 Comparison of Planned and Actual Cost

Major Item	Plan *1 (appraisal)			Actual *1		
	Foreign currency	Local currency	Total *2	Foreign currency	Local currency	Total *3
1. Construction cost (including price escalation)	2,836	264	3,381	2,270	194	2,509
2. Contingency	284	26	338	—	—	—
3. Land acquisition	0	37	76	0	5	6
4. Consultation service	149	16	181	187	8	197
5. Administrative expenses	0	67	138	0	24	30
6. Tax	0	491	1,011	0	348	428
7. Interest during construction	130	0	130	64	0	64
Total	3,399	901	5,255	2,521	579	3,234

＊1. The unit is 1 million yen for foreign currency and the total and 1 million rupee for local currency.
＊2. The exchange rate at appraisal is 2.06 yen for 1 rupee (June 1998).
＊3. The exchange rate is 1.23yen for 1 rupee (June 2003).

2.3 Effectiveness (rating: a)

This project has largely produced the planned effects, and its effectiveness is high.

2.3.1 Operational Effect Indicators

The table below shows the operational effect indicator of enhanced or newly installed transmission lines[3].

[3] Although power needs to be measured in the transmission system that includes the transmission lines between Balangoda-Ratnapura and Kelanitissa-Kolonnaw in order to grasp the transmission loss rate, a major indicator, the loss rate was not calculated because the data was unavailable at the executing agency.

Table 3 Annual Length and Frequency of Power Outage and Time-wise Operating Rate

Transmission line*	Indicator	2001	2002	2003	2004 (year of construction completion)	2005	2006	2007
Kelanitissa-Kolonnawa 1	Annual power outage (minute)	23,760	186	12	0	0	246	94
	Yearly frequency of power outage	1	4	1	0	0	2	2
	Line availability (%)	95.48	99.96	100	100	100	99.95	99.98
Kelanitissa-Kolonnawa 2	Annual power outage (minute)	177	268	14	0	0	427	7
	Yearly frequency of power outage	4	3	1	0	0	1	1
	Line availability (%)	99.97	99.95	100	100	100	99.92	100
Balangoda-Ratnapura	Annual power outage (minute)					4	6	503
	Yearly frequency of power outage					1	1	7
	Line availability (%)					100	100	99.90

*Note: There are two enhanced transmission lines between Kelanitissa-Kolonnaw.

The Line availability rate in Table 3 above is high both before and after the project. Length and frequency of power outage are both improved after the enhancement of the transmission lines.

Table 4 Utilization Factor

Unit: %

Transmission line	2005	2006	2007	2008
Balangoda-Ratnapura	6	11	17	17
Kelanitissa-Kolonnawa	35	36	37	33

Source: CEB

The 33kV-distribution line of the Ratnapura Substation in Table 4 above is interconnected with 17 small hydraulic power plants (generation capacity of 9.8 MW per plant) and the electricity is supplied to the distribution line. Thus, the capacity operating rate of the transmission line between Balangoda-Ratnapura declines when the output of hydraulic power is high. When the distribution load is small in the rainy season, power also flows from Ratnapura to Balangoda.

The line between Kelanitissa-Kolonnawa is used mainly for emergencies and thus the facility operating rate is usually low.

As for the power transmission between Balangoda and Ratnapura, the power meter is installed only at the receiving end of Ratnapura and thus Table 5 below shows the electric energy only at the receiving end. It shows increase over time.

Table 5 Electric Energy at Receiving End

Unit: MWh

Transmission line	2005	2006	2007	2008
Ratnapura-Balangoda	3,279	3,644	7,049	6,685

Source: CEB

The electric energy can be measured neither at the receiving nor transmission ends for the line between Kelanitissa and Kolonnawa due to a lack of a power meter.

2.3.2 Results of Financial Internal Rate of Return

Although FIRR was not calculated at appraisal, it is calculated as follows:

（FIRR）

Benefits	・Increase in revenues resulting from the reduction of transmission loss as explained above (National average is used for the sales price.) ・Margin between generation cost and distribution price of power transmission business ・Income of the difference between purchasing price from small hydraulic power plants and sales price
Costs	Construction cost (tax included), facility maintenance cost
Major preconditions	・Power sales price is assumed to see a small decline (based on the forecast of lower power generation cost and fuel prices). ・Ignore power demand increase for each substation. ・0.6% of margin between generation cost and distribution price of power transmission business (theoretical value). ・2% of construction cost as annual maintenance cost. ・20 years of operating period from 2005.
FIRR	5.9%

2.3.3 Results of Economic Internal Rate of Return

Although EIRR was not calculated at appraisal, it is calculated as follows:

（EIRR）

Benefits	This project brings about a variety of benefits including stabilization of voltage and decrease in power outage. However, reduction of transmission loss by the construction of Ratnapura and Athurugiruya substations is the only quantitative estimate we can obtain. The loss is reduced mainly because the transmission line is shortened and voltage is increased to supply power to the neighboring region. In this evaluation survey, the loss is estimated to be 2.5% (Ratnapura Substation) or 0.65% (Athurugiruya Substation) of overall power transmission. In addition, the impact of small hydraulic power generation that commenced with the completion of this project as its prerequisite is also regarded as benefits.
Costs	Construction cost (tax excluded), facility maintenance cost
Major preconditions	・Ignore power demand increase for each substation. ・2% of construction cost estimated as annual maintenance cost. ・20 years of operating period from 2005.
EIRR	9.4%

2.4 Impact

2.4.1 Impacts to beneficiaries

(1) Industrial development: Industrial development is shown in local GDP and other typical macroeconomic indicators. Because this project was not the installation of power transmission network in areas with no such network, it will not have much direct contribution to the macroeconomic indicator.

(2) Improvement of living standards of local residents: 80.0% of Sri Lankan households had access to electricity in 2007. It increased by 10.3% from 2001 when the project began to 2005 when it was completed. Power generation, transmission and distribution all contributed to the increase and the increase rate of each during the period is 35%, 20% and 17%, respectively[4]. As described earlier, the power policy of the Government of Sri Lanka in 2002 included the promotion of regional electrification and many of such projects carried out by donors are a major contributing factor[5].

This project accounted for 13.3 percent of all power transmission projects during the period[6]. However, as said earlier, this is not the installation of transmission network in areas with no such network, its contribution to electrification is only indirect.

The table below shows the account number or the scale of beneficiaries of power user in the beneficiary region (at province level) of this project. The account includes such categories as household, religion, industry, commerce and hotels, the household accounts for nearly 90 percent. It is difficult to calculate the exact number of beneficiaries of power transmission lines because they are not directly connected with the end users.

Table 6 Beneficiary Region (province level) and Account Number of Power Users

Province＊	2002	2003	2004	2005	2006	2007
Western-South2	219,823	233,211	246,317	261,117	275,642	290,592
Sabaragamuwa	261,047	277,354	295,400	314,415	284,147	306,927
North Western	351,965	375,957	402,954	428,433	471,368	509,269
Total of beneficiary region	832,835	886,522	944,671	1,003,965	1,031,157	1,106,788
Nationwide	2,827,713	3,006,720	3,206,892	3,396,047	3,636,242	3,866,987

Source: Ceylon Electricity Board, Sales and Generation Data Book
*Note: 3 provinces that are beneficiary provinces of the project are chosen from nine provinces of the country. The Western Province is further divided into Western-North, Western-South1, Western-South2.

[4] Generation is measured by generated power, transmission and distribution is measured by the length of lines.

[5] Looking at the projects that completed in and after 2000, there are two projects by Asian Development Bank (ADB), one project by the Swedish International Development Cooperation Agency (SIDA), one by Kuwait and one by China.

[6] The ratio is calculated based on the length of transmission lines.

North Western in the table is different from Western-North.

(3) Impact on neighboring regions: Table 7 below shows the reduction of load of other substations as a result of this project.

Table 7 Impact Analysis on Load of Other Substations Caused by Construction of Ratnapura Substation

Unit: MW

Substation	Maximum capacity (Figures in parenthesis is the capacity when 1 transformer stops.) (MW)	Maximum load: 2004 actual (MW)	Maximum load: 2006 projection (MW) *		Maximum load: actual (Oct. 20, 2008) (MW)	Utilization factor: 2004 (without Ratnapura Substation) (%)		Utilization factor: 2008 (Ratnapura Substation completed) (%)	
			Without Ratnapura Substation	With Ratnapura Substation	With Ratnapura Substation	All transformers are running	One transformer is stopped	All transformers are running	One transformer is stopped
Balangoda	50 (25)	33.9	48	29	24	67.8	135.6	48.0	96.0
Matugama	75 (50)	58.9	66	64	52	78.5	117.8	69.3	104.0
Deniyaya	25 (16)	22.4	31	28	18	89.6	140.0	72.0	112.5
Avissawella	50 (25)	22.8	59	43	30	45.6	91.2	60.0	120.0
Ratnapura	50 (25)	0	-	43	24	na	na	48.0	96.0

Source: CEB
*Note: Figures are projections at appraisal (1997).

When the figures in 2004 and 2008 are compared as shown in Table 7 above, construction of Ratnapura Substation reduced the load of other substations to below the projected level. Without this project, transformer failure at the substations might have resulted in a serious situation. Thus, it is fair to say that the project had good effects. However, because the Utilization factor when one transformer is stopped exceeds 90 percent, more substations need to be constructed in the future.

Table 8 Impact Analysis on Load of Other Substations Caused by Construction of Athurugiriya Substation

Unit: MW

Substation	Maximum capacity (Figures in parenthesis is the capacity when 1 transformer stops.) (MW)	Maximum load : 2004 actual (MW)	Maximum load: 2006 projection (MW) (with Athurugiriya Substation)* (MW)	Maximum load: actual (with Athurugiriya Substation) (Oct. 20, 2008) (MW)	Utilization factor: 2004 (without Athurugiriya Substation) (%)		Utilization factor: 2208 (Athurugiriya Substation completed) (%)	
					All transformers are running	One transformer is stopped	All transformers are running	One transformer is stopped
Pannipitiya	75 (50)	70.0	87	40	93.3	140.0	53.3	80.0
Biyagama	100 (50)	60.0	77	60	60.0	120.0	60.0	120.0
Sapugankanda	75 (50)	62.0	75	48	82.7	124.0	64.0	96.0
Athurugiriya	50 (25)	9.3	46	10	18.6	37.2	20.0	40.0

Source: CEB
*Note: Figures are projections at appraisal (1997).

As shown in the actual result in 2008 in Table 8 above, construction of Athurugiriya Substation reduced the load of three other substations to below the projected level. The reliability of power supply of Pannipitiya and Sapugunkanda substations improved in particular.

In addition to the analyses above, some specific impacts are introduced below.

Case 1: In the initial field survey, we visited a small hydraulic power plant and tea factories near Ratnapura Substation for interview. The following are the findings:

① Small hydraulic power plant

Using the transmission network installed in this project, small hydraulic power plants (capacity of 9.8 MW, IPP[7]) supply electricity in their districts. According to an electric engineer of the plant we visited, power generated there had been sent to Balangoda Substation 70 kilometers away from the power plant before the project implementation, during which voltage dropped by 3kV via 33kV-distribution line. Connection to Ratnapura Substation (28km) helped prevent the drop. Power outage between the power plant and Balangoda Substation also decreased, according to him. Voltage around Ratnapura Substation is more stable, which has also benefited the local residents. It is also notable that construction of 17 small hydraulic power plants began in 2004 around the time of the completion of the project, all of which now supply power in the neighboring region via Ratnapura Substation.

② Tea factories

There are many tea factories (some 200) in Ratnapura and we visited two of them. Although no document or accurate statistical figures were available, we talked to the factory managers and electric engineers and confirmed a reduction of power outage incidents.

Case 2: In the additional survey to the initial field survey conducted by the local consultants, we confirmed the impact of the installation of service exit at Matala Substation[8] in this project was confirmed. A thermal power plant with the capacity of 20 megawatt was constructed in 2002 to supply power in Matala. At around the same time, two service exits were installed for distribution lines at the substation. The installation helped improve the power supply capacity to the neighboring areas.

2.4.2 Impacts on the environment

Using the environment checklist that was used for appraisal, we interviewed CEB employees about the present condition. We found no problem related to natural, living or other environment. We also interviewed some local residents in our local visit near Ratnapura Substation and found no adverse impact of the substation.

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7 Independent Power Producer

8 Located 160 kilometers south of Colombo

2.4.3 Resident relocation and land acquisition

This project involved no relocation of local residents in connection with the construction of substations. Land was acquired as explained below and no problem has risen.

For Ratnapura Substation, 1.6ha of land was acquired. It was owned by the government and people expected no difficulty in land acquisition. However, there was a mistake in the address shown in the government gazette and the correction required substantial time. The acquisition was completed in May 2000.

For Athurugiriya Substation, 2.1ha of land was acquired, which was completed in May 1998.

2.5 Sustainability (Rating: b)

Although the executing agency of this project has no problem with its maintenance and management capacity and structure, it has continued to post a deficit, which leaves a question of whether the project can be sustained financially; therefore, sustainability of this project is fair.

2.5.1 Executing agency

2.5.1.1 Structural aspects of Operation and Maintenance

The executing agency of CEB comprises 9 divisions[9] with a total workforce of 14,614 employees[10] headed by the General Manager (GM). This project is operated by the Transmission Operation and Maintenance Bureau (Transmission O&M) of the Transmission Division. The division is headed by the Assistant General Manager (AGM), consisting of 1,020 employees, 71 of whom are engineers.

The Transmission O&M Bureau comprises four regions (Region 1–Colombo, Region 2–Anuradhapura, Region 3–Kandy, Region4 –Galle). Each region has a chief engineer and some engineers. Although the Transmission Division is mainly responsible for transmission lines and substations, Region 1 is in charge of all the transmission lines and each region is responsible for maintenance of substations in their respective region.

According to an interview with the AGM of the Transmission Division, they have the minimum level of engineers. However, judging from the field survey, we did not feel that they have a serious understaffing problem.

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[9] Power generation, transmission, distribution 1, distribution 2, distribution 3, distribution 4, project supervision, Puttalam coal-fired power plant, and finance division

[10] The workforce is as of the end of 2008.

2.5.1.2 Technical aspects of Operation and Maintenance

According to CEB headquarters and on-site engineers, there is no operation-related problem attributable to technical capacity.

Engineers are required for the following qualifications and experiences: chief engineers at each region are required to have an engineer license certified by the engineer association with an experience of around 10 years; electric engineers directly below the chief engineers are required to have a bachelor's degree in electric engineering with an experience of 3 to 4 years; and electric superintendent below the electric engineers are required to have a diploma with an experience of 2 to 3 years.

This project included training for CEB employees provided by consultants. The training was mostly carried out as originally planned. According to 5-level evaluation[11] of the training result, trainees' satisfaction was level 4 for each subject and the usability of what they learned in their work was 3 to 4.

In the appraisal document, the "need for capacity development for environmental impact assessment (EIA) that is essential for electric power development" was emphasized. There has been only one employee in charge of environment in the Transmission Division before the project. However, situation has improved and now a section responsible for environment was set up, with several employees.

2.5.1.3 Financial aspects of Operation and Maintenance

Table 9 below shows the maintenance cost of the Transmission Division for the last 3 years. (Labor cost and cost for spare parts are major costs and investment is excluded.)

Table 9 Trend of Maintenance Cost

Unit: Rupee

Year	Maintenance cost
2007	421,749,200
2008	504,964,959
2009	616,268,300

The maintenance cost of existing facilities is at the minimum level although it is on the rise. More funds need to be allocated for the introduction of latest facilities and parts.

Table 10 CEB Balance of Payment

Unit: Million Rupee

FY	2009 (projected)	2008 (provisional)	2007	2006	2005	2004	2003
Gross sales	115,492	115,653	87,574	69,941	55,978	51,119	47,719
Direct cost	116,199	155,236	112,754	81,733	71,027	61,564	48,363
Gross operating	-707	-39,583	-23,477	-11,792	-15,049	-10,445	-644

11 5 – Excellent, 4-Good, 3-Fair, 2-Poor, 1-Very Poor

profit							
Maintenance cost	4,063	1,415	1,379	2,383	2,518	634	2,347
Operating P/L	-4,770	-40,998	-24,856	-14,175	-17,567	-11,079	-2,991
Other income*1	4,248	3,562	11,748	9,572	16,348	2,017	5,440
Payment interest	1,560	1,600	1,703	1,521	5,634	6,645	6,199
Pretax P/L	-2,082	-39,036	-14,811	-6,125	-6,852	-15,707	-3,750

Source: Annual Report (2006)
Note*1 Other income includes governmental subsidies of 11.3 billion rupees in FY2005, 5 billion rupees in FY2006, and 5 billion rupees in FY2007.

Table 10 shows the balance of payment of the CEB. The direct cost (power generation, transmission and distribution cost) has continued to exceed the gross sales and the CEB has posted the current loss[12]. The Government of Sri Lanka provided more than 5 billion rupees of subsidies in each of the fiscal years from 2005 to 2007[13]. Although the pretax loss in 2008 increased to about 39 billion rupees, the loss is expected to drop to 2.1 billion rupees in 2009. This is because of an increase in sales owing to the power consumption growth and the rise in sales prices and lowering power generation cost due to a drop in crude oil prices.

Furthermore, a coal-fired thermal power station, supported by the Government of China is slated to begin operation in 2011. The power station is expected to account for approximately 20 percent of the total power generation. The increase in the ratio of relatively cheap thermal power generation will further lower the power generation cost.

When all of the conditions are taken into consideration, CEB'S financial status is clearly improving. However, it is almost certain that it will post a deficit until 2009 and the improvement is partly because of a temporary external factor of a rapid crude oil price decline. Thus, the CEB needs to manage the cost effectively to assure a sound financial footing for a long term by grasping the profit and loss of each business division.

2.5.2 Current status of Operation and Maintenance

The operation is generally good, except for the defect of the capacitator bank purchased as part of the project. An expert team is now examining measures to solve the problem together with the manufacturer. This defect has caused no adverse effect to the overall system.

The subject facilities of the maintenance in the project are mainly transmission lines and substations. A summary is provided below.

① Transmission lines

[12] CEB sets charges for consumers to balance out the revenues and expenditures by each fiscal year (not the accumulation of costs)

[13] According to CEB General Manager and the director of the finance division, in addition to such assistance, the Government has granted a moratorium on the payment of the principal and interest of a total of 62 billion rupees of various project loans until the slated beginning of the operation of the thermal power plant in 2011. Half of the loans are planned to be exchanged into stock with no repayment obligation.

The main maintenance work of the transmission lines is inspection, repair and replacement of tower members, insulators, disconnect switches and electric wires. Regular maintenance is conducted every five years and repair work is conducted as necessary.

② Substations

Annual regular maintenance work includes annual inspection, testing and cleaning of such main parts as transformers and breakers, application, testing and cleaning of insulating oil of transformers. Although the maintenance work is conducted based on the manuals provided by equipment manufacturers, it is carried out more frequently than instructed in the manual, when necessary.

The maintenance work described above fully satisfies the industrial standards and spare parts are procured as necessary. Although they are mostly imported, there is no procurement difficulty.

Power outage occurred seven times with the newly installed transmission line between Balangoda and Ratnapura in 2007. If they were not caused by lightning strikes, the cause needs to be investigated. Because the line runs through a hilly area, tree branches may cause such problems.

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

When the evaluation described above is summed up, this project is highly relevant (a), and highly effective (a), although moderately efficient (b) and fairly sustainable (b). In light of the above, this project is evaluated to be satisfactory.

3.2 Lessons Learned

None

3.3 Recommendations

To the Executing agency of CEB

・In response to the passage of the new electric power law by the parliament, it is important for the CEB to introduce a new electricity charges system that reflects the cost.

・In addition, the CEB is recommended to clarify the cost structure of the Transmission Division for efficient management.

・Power outage occurred seven times with the newly installed transmission line between Balangoda and Ratnapura in 2007. If they were not caused by lightning strikes, the cause needs to be investigated. The line runs through a hilly area and thus careful monitoring is needed to avoid problems caused by tree branches.

Comparison of Original and Actual Scope

Item	Original	Actual
(1) Project Outputs		
1. Construction of Ratnapura Substation	・ Ratnapura Substation: 132/33kV transformers (31.5MVA X 2), 132kV- T/L bays X 2 (single bus), 33kV- feeder bays (X 8) ・Balangoda Substation: 132kV- D/B T/L bays ・Installation of transmission lines between Balangoda and Ratnapura (40km) (132kV X 2))	As planned except for change of the single bus to double bus at Ratnapura Substation, change of the length of transmission line (it became longer based on the actual measurement)
2. Construction of Athurugiruya Substation	・Athurugiruya Substation: 132/33kV transformers (3.15MVA X 2), 132kV- T/L bays , 33kV- feeder bays (X 8) ・Connection to the existing 132 kV Kolonnawa – Polpitiya transmission line	Add 10MVA-capacitator banks (X 2)
3. Kelanitissa-Kolonnawa transmission line enhancement	2.2km（220kV design）	Add 2 towers and use wires different from the plan at appraisal.
4. Upgrading of Thulhiriya Substation	132/33kV transformers (3.15MVA × 2), 33kV- feeder bays , etc.	Built 30 years ago, the substation was old. Thus, the original plan of partial repair was changed to overall renovation.
5. Installation of equipment for parallel operation of 132 kV lines at Chilaw GSS	132 kV S/B T/L bays and Bus section bay	132 kV S/B T/L bays and Bus section bay
6. Upgrading of Kelanitissa/ pannipitiya Substation	100MVA- and 60MVA-capacitator banks	Mostly as planned, capacitator bank became partially unnecessary.
Added item	None	Addition of service exits for 2 circuits at Madala Substation, although not planned.
7. Consultation service	International consultants: 35 MM Local consultants: 45 MM	International consultants: 44 MM Local consultants: 60 MM
(2) Project Period	September 1998-November 2000 (27 months)	January 1999-December 2004 (72 months)
(3) Project Cost Foreign currency Local currency Total ODA Loan Portion Exchange rate	 3,399 million yen 1,856 million yen (Local currency: 901 million rupee) 5,255 million yen 4,030 million yen 1 rupee ＝2.06 yen (June 1998)	 2,521 million yen 713 million yen (Local currency: 579 million rupee） 3,234 million yen 2,767 million yen 1 rupee＝1.23 yen (June 2003)