Democratic Socialist Republic of Sri Lanka

Ex-Post Evaluation of Japanese ODA Loan Project
"Colombo City Electricity Distribution Development Project"

External Evaluator: Yasuhiro Kawabata,
Sanshu Engineering Consultant

0. Summary

The objective of the project was to provide stable electric supply by reinforcing the electricity distribution network, and reducing the system loss in order to respond to the expected load level of 350 MW as of 2005 in Colombo, thereby contributing to promotion of economic activities in the Colombo district. The project has been highly relevant to the development plans and needs of Sri Lanka, as well as Japan's ODA policies. Thus, its relevance is high. Regarding the efficiency, the originally planned project scope has been implemented almost as planned. However, the quantity of cables under the 11kV/low voltage work was revised due to the budget constraints, as it could be easily adjusted. Thus, the project scope was slightly changed. The project cost was higher than planned and the project period was significantly longer than planned, therefore, efficiency of the project is low. Since reinforcing the electricity distribution network under the project was implemented as planned and the transmission/distribution loss was reduced, the interruption duration was substantially reduced. Consequently, the project has contributed to realization of stable power supply and to promotion of economic activities in the Colombo district. Thus, the project has largely achieved its objectives, and the effectiveness and impact is high. No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system, therefore sustainability of the project effect is considered high.

In light of the above, this project is evaluated to be satisfactory.

1. Project Description

Project Location

Kelanitissa Substation (inside)

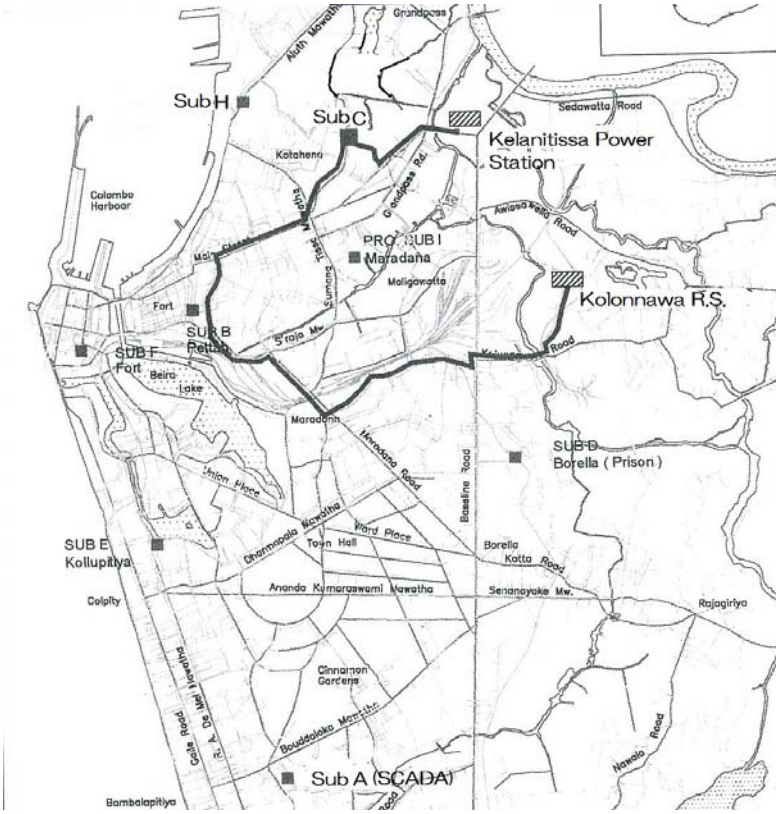
1.1 Background

At the appraisal time (2001), Sri Lanka had achieved the economic growth rate of about 5% per annum during the last 5 years (1996-2000). The generated electricity recorded increase of about 6.8% per annum as well because of progress of industrialization, penetration of home electrical appliances, expansion of rural electrification and other reasons during the same period. However, while electricity demand had been increasing at about 7% per annum, the capacity of generating facilities was only 1,691 MW as of 1999, and Sri Lanka had suffered from lack of electricity supply. In 1999, since hydraulic power generation was limited due to drought, use of air conditioners was restricted, and planned or unplanned electricity outage occurred. Such unstable electricity supply situation was a major constraining factor for people's life and economic activities such as attracting investment.

In order to respond to such situation, the Sri Lankan government identified major agenda and issues in the power sector including development and improvement of facilities for transmission, transformation, and distribution, and enhancement of the electrification rate in order to address aged facility issues and expansion of generation capacity, and disclosed action plans aiming at providing stable electricity supply in the "6-year Development Plan" and "Public Investment Plan".

1.2 Project Outline

The objective of the project was to provide stable electric supply by reinforcing the electricity distribution network, and reducing the system loss in order to respond to the expected load level of 350 MW as of 2005 in Colombo, thereby contributing to promotion of economic activities in the Colombo district. The location of the project site is shown in Figure 1.



Source: Ceylon Electricity Board

Note: A solid line shows 132kV underground transmission cables

Figure 1　Location of Project Site

Loan Approved Amount/ Disbursed Amount	5,959 million yen/5,957 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	October 2001/December 2001
Terms and Conditions	For civil work: Interest Rate: 2.20%, Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: combined For consulting services: Interest Rate: 0.75% Repayment Period: 40 years (Grace Period: 10 years) Conditions for Procurement: combined
Borrower / Executing Agency(ies)	Government of Democratic Socialist Republic of Sri Lanka/Ceylon Electricity Board (CEB)
Final Disbursement Date	April 2012
Main Contractor (Over 1 billion yen)	ABB AG（Germany）、Siemens AG（Germany）、Viscas (Japan)

Main Consultant (Over 100 million yen)	Fichtner GMBH & Company KG. (Germany) / J Power/ Tokyo Electric Power Services Company
Feasibility Studies, etc.	・Feasibility Study, "Development Plan for Electricity Network in Colombo City: Development Plan", Worley International Ltd., New Zealand, 1997 ・JICA Development Study: "Transmission Network Development Plan Study", 1997
Related Projects	Technical Cooperation : ・JICA Power Sector Master Plan Study (2004 - 2006) ODA Loan: ・Greater Colombo Transmission and Distribution Loss Reduction Project (L/A signed in 2013) Other International Organizations: ・Asian Development Bank: Power Sector Development Project (2005)

2. Outline of the Evaluation Study

2.1 External Evaluator

Yasuhiro Kawabata, Sanshu Engineering Consultant

2.2 Duration of Evaluation Study

Duration of the Study: July 2014 - May 2015
Duration of the Field Study: September 13 - 28, 2014, December 7 - 20, 2014

3. Results of the Evaluation (Overall Rating: B[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance to the Development Plan of Sri Lanka

In the "6-Year Development Plan (1999 - 2004)" and "Public Investment Plan (1999 - 2001)" , which were effective at the appraisal time (2000), the followings were listed up as agendas to be urgently tackled: i) enhancement of efficiency and reliability; ii) expansion of generating capacity corresponding to the demand; iii) development of transmission, transformation, and distribution facilities corresponding to deterioration of facilities and expansion of generating capacity, and enhancement of electrification rate; iv) rationalization of tariff charging system; and others. The most prioritized agendas among the above mentioned agendas are as follows: 1) the well balanced power

[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ② Fair, ① Low

generation system (change from “hydro-main and thermal-sub-main” to “thermal-main and hydro-sub-main”); 2) development of transmission and distribution networks; 3) promotion of power sector reforms (streamlining of the whole power sector, reinforcement of finance and management, enhancement of reliability and promotion of private investment); and 4) enhancement of electrification rates in rural areas. Development of distribution related networks at the appraisal stage had been implemented according to “Medium Voltage Distribution Network Development Plan” (1995-2005), which was prepared based on the forecasted electricity demand in each province.

At the ex-post evaluation stage, in the revised version of “Mahinda Chintana” (“Future Vision”), issued in 2010, it aimed at doubling the economic magnitude in 2010 by 2016 (GDP per capita shall be US$4,000) through economic structural reforms. Simultaneously, it also aimed at achieving the well balanced economic development in order to avoid the enlargement of gaps between urban and rural areas. Regarding the power sector, in Chapter 3 of the revised “Mahinda Chintana”, it is stated that the government would take necessary measures including installation of distribution network in order to supply electricity to all the households without power interruption by end 2012, and promote development and improvement of low/medium voltage distribution network in order to achieve the high quality and reliable electricity supply without power interruption. Moreover, the government plans to take necessary measures to respond to the increasing electricity demand by constructing all the required power plants with least generating costs by end 2020.

As mentioned above, at appraisal and at ex-post evaluation, the implementation of the project conforms to the development policies of the Sri Lankan Government.

3.1.2 Relevance to the Development Needs of Sri Lanka

At the appraisal time, substation facilities for distribution in Colombo City, where the project is located were seriously deteriorated and could not respond to rapidly increasing loading level. (The loading level at that time was 231 MW, and it was forecasted to be increased up to 350 MW by 2005.) Under these circumstances, the interruption duration in Colombo City as of 1999 was 8.5 hours/year/customer, which was about 80 times of that in Japan and the reliability was low. Thus, achievement of provision of stable electric supply in a short term by reinforcing the deteriorated distribution network in Colombo City and enhancing reliability in order to promote the socio-economic activities in Sri Lanka was considered to be extremely essential and to be an urgently tackled agenda.

At the ex-post evaluation stage (2014), the economic growth rate for the past four years (2010 - 2013) in Sri Lanka was 7.5% per annum, and the demand for electricity has been increasing. Thus, in order to respond to the increasing demand, development of

power generation has been actively promoted. However, development of transmission and distribution networks cannot catch up with increasing demand, and improvement of transmission and distribution losses and reinforcement of the transmission and distribution capacity are still agendas to be addressed. Particularly, since the electricity consumption in the Greater Colombo Region (occupies about 50% of the country's GDP), which is the core of economic activities in the country, has been increasing by 10% every year, the capacity of existing transmission and substation facilities cannot respond to the increasing electricity demand. Moreover, correspondence to increasing transmission and distribution losses due to increase of the transmission and distribution loading level is an urgently addressed agenda. (Source: Ex-ante evaluation report for Greater Colombo Transmission and Distribution Loss Reduction Project)

The project aiming at provision of stable electric supply by reinforcing the electricity distribution network, and reducing the system loss conforms to the development needs in Sri Lanka at appraisal and at ex-post evaluation,

3.1.3 Relevance to Japan's ODA Policy

In the "Country Assistance Policy for Sri Lanka" (1999), which was effective at the appraisal time, the followings were listed up as the priority agendas: 1) development/improvement of economic infrastructure; 2) development of mining and industrial sectors; 3) development of agriculture and fishery sectors; 4) human resources development; and 5) improvement of health and medical system. Particularly, on development and improvement of economic infrastructure, fundamental development and improvement of underdeveloped transport, power and telecommunication sectors was considered essential in order to promote industry in Sri Lanka. Thus, the assistance policy was to be pursued not only focusing on those in the Colombo District, but also taking into consideration networking in the whole country. The project conformed to the assistance policies at the appraisal stage.

Accordingly, the project has been highly relevant with the Sri Lankan development plan and needs, as well as Japan's ODA policies. Its relevance is therefore considered high.

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

The original and actual output of the project is shown in Table 1.

Table 1　Output (Original and Actual)

	Project Scope at Appraisal Stage	Project Scope at Project Completion
Work:	1) 132kV Work ・ Construction/Upgrading of 3- 132kV Substations (Primary Substation "C", Kelanitissa Grid Substation , Kolonnawa Grid Substation) ・ Installation of 132kV transmission cables (8km) 2) 33kV Work ・ Upgrading a 33kV Substation (Primary Substation "H") 3) 11kV/Low voltage work (a) Installation/replacement of 11kV underground cables (130km) (b) Construction of 11kV compact distribution substations (100 units) (c) Replacement of 11kV RMU (Ring Main Units) (50 units) (d) Installation of low voltage cables (40km) (e) Installation of low voltage feeder pillars (200 units) (f) Replacement of 11kV switchgears (474 units) 4) Others ・Installation of SCADA (Supervisory Control And Data Acquisition) system	1) 132kV Work ・ Construction/Upgrading of 3- 132kV Substations as planned ・ Installation of 132kV transmission underground cables (9.3km)　almost as planned 2) 33kV Work ・ Upgrading a 33kV Substation　as planned 3) 11kV/Low voltage work　slightly revised (a) Installation/replacement of 11kV underground cables (82km) (b) Construction of 11kV compact distribution substations (40 units) (c) Replacement of 11kV RMU(Ring Main Units) (380 units) (d) Installation of low voltage cables (16km) (e) Installation of low voltage feeder pillars (72 units) (f) Replacement of 11kV switchgears (175 units) (g) Installation of optical fiber cables (77km) (these are for automatic distribution, and were originally included in the SCADA system) 4) Others (automatic distribution system) ・ Installation of SCADA system　as planned
Consulting services	1) Detail designs and assistance in bidding 2) Construction supervision 3) Training of engineers of the executing agencies 4) Environmental protection 5) Others Foreign experts: 154M/M Local experts: 180M/M	1) Change to review of detail designs and assistance in bidding 2) Construction supervision as planned 3) Training of engineers of the executing agencies as planned 4) Environmental protection as planned 5) Others Foreign experts: 161M/M Local experts: 213M/M

Source: JICA documents, and Interview survey with the executing agencies

The original project scope was completed almost as planned. However, the original type of contract, in which a consultant undertakes detail designs and a contractor

supplies/installs the equipment was changed to the "turnkey[3]" contract as proposed by the executing agency and subsequently concurred by JICA. Thus, some item among the scope of work for a consultant, which is "undertaking detail designs" was changed to "review of designs to be made by a contractor". The bill of quantities for some items under the 11kV/low voltage work was also changed. The reason for the change is that since quantities of cables, which could be easily adjustable were revised due to budget constraints and the project scope (quantities and items) was changed. These changes are considered rational and appropriate.

Primary Substation "H" (Outside)

Primary Substation "H" (Inside)

3.2.2 Project Inputs

3.2.2.1 Project Cost

The estimated project cost at appraisal was 7,945 million yen, of which the Japanese ODA loan was 5,959 million yen. The actual project cost was 9,919 million yen, of which the Japanese ODA loan was 5,957 million yen. The actual project cost was higher than planned, and is equivalent to 125% of the planned cost.

The main reason for increase of the project cost is that since commencement of the actual work was delayed until 2008 from the originally planned 2003, the estimated cost made in 2001 was increased due to price escalation, particularly the cost of copper, which is the main material for cables during the delayed period.

[3] It is a sort of lump sum contract in which the facility is delivered in the condition, ready for immediate use by unlocking a key (the scheme in which detail designs and supply/installation of equipment are in a package).

Table 2　Comparison of Project Cost (Planned and Actual)

(Unit: million yen)

Item	Planned					Actual				
	ODA loan (foreign)	Local currency		Total		ODA loan (foreign)	Local currency		Total	
		Own fund	ODA loan	Total	ODA loan		Own fund	ODA loan	Total	ODA loan
・Work	3,525	0	1,010	4,535	4,535	3,738	2,707	1,123	7,568	4,861
1. Package A	-	-	-	-	-	-	-	-	1,685	-
2. Package B	-	-	-	-	-	-	-	-	2,390	-
3. Package C	-	-	-	-	-	-	-	-	2,750	-
4. Package D	-	-	-	-	-	-	-	-	743	-
Price escalation	87	0	88	175	175	-	-	-	-	-
Contingency	362	21	97	479	459	-	-	-	-	-
・Consulting services	407	0	16	423	423	633	0	223	856	856
・Taxes	0	1,391	0	1,391	0	0	853	0	853	0
・Land acquisition	0	115	0	115	0	0	0	0	0	0
・Management and others	0	459	0	459	0	0	402	0	402	0
・Interest during construction	367	0	0	367	367	234	0	0	234	234
・Service charges	-	-	-	-	-	6	0	0	6	6
Total	4,748	1,986	1,211	7,945	5,959	4,611	3,962	1,346	9,919	5,957

Source: JICA documents

Exchange rates: at appraisal　1 Rupee＝1.44 yen,　1 US$ =112 yen,
average during implementation (2008.10–2012.6)：1 Rupee＝0.76 yen, 1 US$=87 yen,
1 EUR=118 yen

Price escalation: foreign currency 0.8%/year, local currency 2.8%/year

Contingency：Civil work 10%

Cost base year：February 2001

Note 1: Total amount does not match due to rounding.

Note 2: Originally planned procurement package

Package A: Upgrading of two 132kV substations

Package B: Upgrading of a 132kV substation, installation of a 132 kV transmission cables (8km)

Package C: Upgrading of a 33kV substation, installation/replacement of 11kV underground cables (130km), construction of 11kV compact distribution substations (100 units), installation of low voltage cables (40km), installation of low voltage feeder pillars (200 units)

Package D: Replacement of 11kV RMU (50 units), replacement of 11kV switchgears (474 units), installation of SCADA system

3.2.2.2 Project Period

The originally planned project period was from December 2001 (signing of the Loan Agreement) to August 2006 (work completion) with a total period of 57 months. The actual project period was from December 2001 (signing of the Loan Agreement) to June 2012 (completion of work) with a total period of 127 months, or equivalent to 223% of the plan. Thus, the project period was significantly longer than planned.

Table 3　Comparison of Project Period (Planned and Actual)

	Planned (at the Loan Agreement signing)	Actual
Selection of a consultant	2002.01 - 2002.09	2003.03 - 2005.07
Land acquisition	2001.02 - 2001.12	
Bidding for work	2002.10 - 2003.06	2006.02 - 2008.04
Work	2003.07 - 2006.08	2008.10 - 2012.06
・Package A		2008.10 - 2012.02
・Package B		2009.06 - 2011.01
・Package C		2008.10 -2011.01
・Package D		2008.11 - 2012.06
Consulting services	2002.10 - 2006.04	2005.09 - 2012.03

Source : JICA documents
Note: Numbers show year and month.

Main reasons for extension of the project period are as follows:

1）According to the original implementation plan, it was planned that selection of a consultant would be made by September 2002. However, selection was delayed by 35 months and was actually completed in July 2005. As mentioned above, the delay of selection was caused by the longer time needed for internal clearance process due to changes of the scope of work for consulting services because the supply and installation of equipment was changed to the turnkey scheme by the intention of the executing agencies after the loan agreement was signed.

2）Bidding for work was originally planned to be completed in 9 months. However, it actually took 27 months resulting in about 18 months delay. Delay in stages in the consultant selection and bidding for work is considered to be mainly caused by that the procedure and clearance process for the international competitive bidding (for selection of a consultant and contractors) was not implemented as planned since the appropriate project implementation institution, including delayed mobilization of the originally proposed Project Director of the executing agency (CEB) was not timely established.

3) The period for work was originally planned to be 38 months. However, that of the Package D with the longest work period is 45 months, which is slightly longer than planned. The reason for the longer work period is that detail designs were added to the scope of work for contractors due to change to the “turnkey” scheme.

The project cost was higher than planned, and the project period was significantly longer than planned. Therefore, efficiency of the project is considered low.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

Since it was considered extremely difficult to identify benefits at the appraisal stage, calculation of Internal Rates of Return of the Project was not made. Thus, at the ex-post evaluation stage, calculation of IRRs was not also made.

3.3 Effectiveness[4] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

The outcome of the project is to provide stable electric supply by reinforcing the electricity distribution network, and reducing the system loss. Hereinafter, quantitative effects are examined.

(1) Electricity Sales in Colombo City

Electricity sales for the past four years in Colombo City are shown in Table 4. Since the data on electricity supply from each substation, which was planned at the appraisal stage, is not available, electricity sales (GWh), which are more or less equivalent to the electricity supply from each substation, were examined as an operational indicator.

Table 4 Electricity Sales in Colombo City

(Unit: GWh)

	Baseline	Target	Actual			
	2000	2010	2010	2011	2012	20113
	Baseline year	4 Years after original completion			Year of completion	1 Year after completion
Electricity Sales	786	1,479	1,170	1,239	1,247	1,244

Source: JICA documents, CEB Annual Report (2011), Data provided by CEB
Note: Originally planned project completion date: August 2006

Although the electricity sale in 2013 was increased by about 58% compared with that in the base year, the sales volume has been constant at about 1,240 GWh for the past three years. Comparing the actual value in 2013 with the target in 4 years after the originally planned project completion, the actual sales are lower than targeted by about 14%.

(2) System Average Interruption Duration in Colombo City

The system average interruption duration for the past four years in Colombo City is shown in Table 5.

[4] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 5　System Average Interruption Duration in Colombo City

(Unit: hours/year/customer)

	Baseline	Target	Actual			
	2000	2010	2010	2011	2012	2013
	Baseline year	4 years after original completion			Year of completion	1 year after completion
Interruption Duration	8.7	6.5	0.64	0.3	0.34	n/a

Source: JICA documents, CEB Annual Report (2011), Data provided by CEB
Note: Originally planned project completion date: August 2006

Interruption duration in Colombo City in 2012 was only 0.34 hours/year/customer, which is substantially lower than that in the base year (2000).

(3) Transmission and Distribution Losses in Colombo City

Transmission and distribution losses in Colombo City is shown in Table 6.

Table 6　Transmission and Distribution Losses in Colombo City

(Unit: %)

	Baseline	Target	Actual			
	2000	2010	2010	2011	2012	2013
	Baseline year	4 years after original completion			Year of completion	1 year after completion
Transmission Loss	n/a	9.0	3.11	1.99	2.02	2.59
Distribution Loss	9.5		9.78	9.55	8.59	8.50

Source: Data provided by CEB
Note 1: Originally planned project completion date: August 2006
Note 2: The target value for 2010 is the loss combining both transmission and distribution losses. (JICA documents)

Although the transmission loss in Colombo City was once substantially improved in 2011, it has been slightly worsened since then. Regarding the distribution loss, since 2011 when the main project component was completed, it has been fairly improved.

3.3.2 Qualitative Effects

(1)　Alleviation of Over-loading Condition of Distribution Equipment

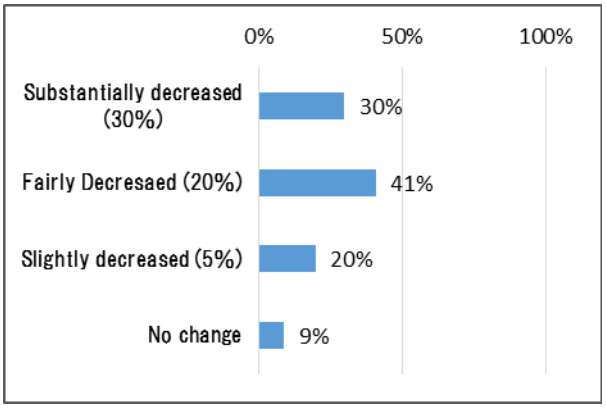
The installed capacity in Sri Lanka as of 2013 was 3,362 MW, while the maximum demand was 2,164 MW. Thus, the over-loading condition of distribution equipment has been alleviated. The contribution of the project to increase of substation capacity is about 79MW. (Source: CEB Statistical Digest 2013)

In order to verify the qualitative effects by the project (stable electricity supply), the beneficiary survey[5] was undertaken.

Results of Beneficiary Survey:

1) Decrease of Interruption Occurrence

Survey results on decrease of the interruption occurrence are shown in Figure 2.



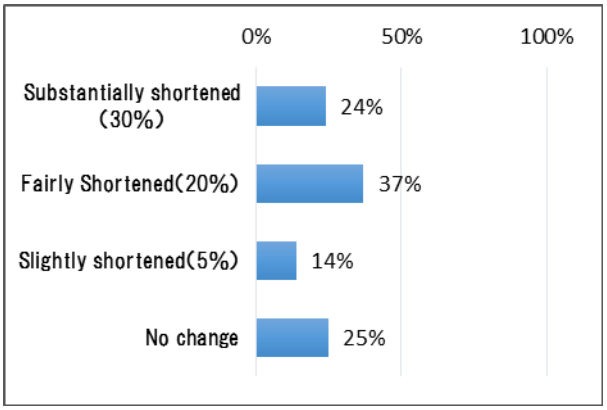
Note: Numbers in ( ) show the level of decrease.

Figure 2 Decrease of Interruption Frequency

About 91% of respondents recognize that the interruption occurrence has been decreased after the project was completed in 2012. Regarding the level of decrease, about 71% of respondents recognize that it is “substantial” or “fair”.

2) Reduction of Duration in case of Interruption

Survey results on reduction of duration in case of interruption are shown in Figure 3.



Note: Numbers in ( ) show the level of reduction.

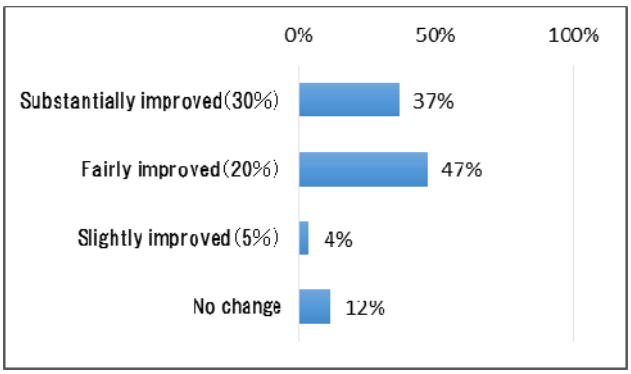
Figure 3 Reduction of Duration in case of Interruption

[5] Number of samples: total 100 (residents in Colombo City; government employees (16%), private company employees (24%), businessman (15%), self-employed (12%), housewife (10%), student (14%), others (9%); male (64%), female (36%); method: interview with a Questionnaire

About 75% of respondents recognize that the duration in case of interruption has been reduced after the project was completed in 2012. Regarding the level of reduction, about 61% of respondents recognize that it is “substantial” or “fair”.

3) Enhancement of Reliability on Electric Supply

Survey results on enhancement of reliability on electric supply are shown in Figure 4.



Note: Numbers in ( ) show the level of enhancement.

Figure 4 Enhancement of Reliability on Electric Supply

About 88% of respondents recognize that reliability on electric supply has been enhanced after the project was completed in 2012. Regarding the level of enhancement, about 84% of respondents recognize that it is “substantial” or “fair”.

3.4 Impact

3.4.1 Intended Impacts

In order to verify contribution of the project to promotion of the economic activities in the Colombo District, the relevant information and data on the transition of electricity consumption by category and the economic activities were collected. Results of analysis are shown in Tables 7 and 8.

(1) Transition of Category Distribution of Electricity Sales

The transition of category distribution of electricity sales is shown in Table 7.

Table 7 Transition of Category Distribution of Electricity Sales (%)

(Unit: %)

	2005	2011	2012	2013
Domestic	33.1	33.7	33.6	32.8
Religious	0.6	0.5	0.5	0.5
General purpose	17.3	19.2	19.5	19.4
Hotel	-	1.6	1.5	1.6
Industrial	33.7	31.2	31.4	31.5
Government	-	-	-	0.8
Supply to LECO	14.2	12.6	12.4	12.3
Street lighting	1.1	1.1	1.0	1.0

Source: CEB Statistical Digest 2011, 2012, 2013
Note 1: General purpose: shops, offices, banks, warehouses, hospitals, schools
Note 2: LECO：Lanka Electricity Company

Regarding the share of electricity consumption by category before and after the project, no major variation is found.

(2) Economic Activities

Indicators on economic activities in Sri Lanka are shown in Table 8.

Table 8 Indicators on economic activities in Sri Lanka

	2001	2010	2011	2012	2013
Economic growth rate (country) (%)	-1.55	8.02	8.25	6.34	7.30
Number of establishments in Colombo (units)	-	3,211	3,428	-	-
New jobs created in Colombo (persons)	-	104,179	187,846	68,223	-
Unemployment ratio (%)	-	3.3	2.9	2.9	-
Trade balance (million $)	-	-4,825	-9,710	-9,417	-7,609

Source：IMF World Economic Outlook Databases, Sri Lanka Labor Force Survey Annual Report 2010-2012 , CEB Statistical Report 2010-2013,

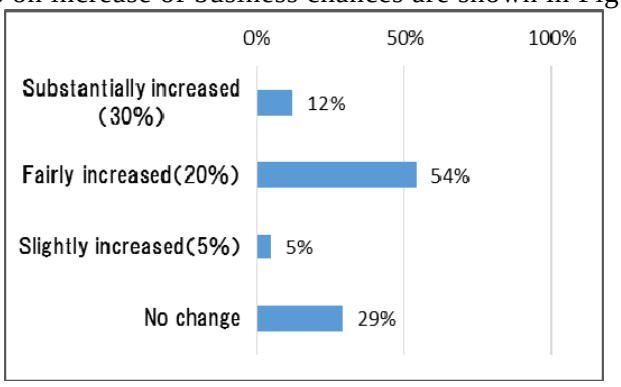
The economic growth rate of Sri Lanka rose from 3.54% in 2009, when the conflict ended to 8.02% in 2010, and since then the economic growth has been in good shape. The unemployment ratio in 2012 was 2.9%, which is lower than the ratio of Japan (4.03%) in 2013. According to the executing agency, it is likely that the contribution of the project aiming at stable electricity supply is high in order to keep the strong economic growth.

Results of Beneficiary Survey:

From the beneficial survey, the following survey results were revealed on the contribution of the project to promotion of the economic activities in the Colombo District.

1) Increase of Business Chances

Survey results on increase of business chances are shown in Figure 5.



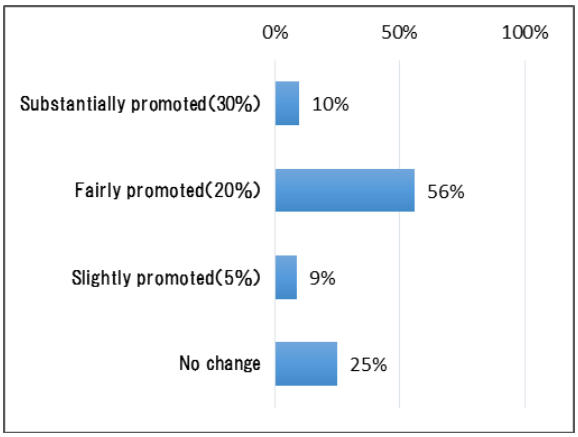
Note: Numbers in ( ) show the level of increase.

Figure 5 Increase of Business Chances

About 71% of respondents recognize that business chances have been increased by stable electricity supply after the project was completed. Regarding the level of increase, about 66% of respondents recognize that it is “substantial” or “fair”.

2) Promotion of Regional Economic Activities

Survey results on promotion of regional economic activities are shown in Figure 6.



Note: Numbers in ( ) show the level of promotion.

Figure 6 Promotion of Regional Economic Activities

About 75% of respondents recognize that regional economic activities have been promoted by stable electricity supply after the project was completed. Regarding the level of promotion, about 66% of respondents recognize that it is “substantial” or “fair”.

3.4.2 Other Impacts

(1) Impacts on the natural environment

Since the project did not fall under the “A” category[6] project in terms of regional and project characteristics at the appraisal stage, the project was classified as a “B” category project according to the “JBIC Environmental Guidelines to be used for Safeguard Issues under the ODA Loan Project”. According to the domestic legislation in Sri Lanka, preparation of an Environmental Impact Assessment (EIA) was not required since the project was to construct the distribution cables. As an environmental issue to be addressed during the project implementation, traffic management at the construction sites was foreseen and a monitoring was to be made by a supervision

[6] Category A: to be applied to the project, in which seriously unfavorable impacts to the environment and community are concerned. Category B: to be applied to the project, in which unfavorable impacts to the environment and community are considered smaller compared with Category A.

consultant during the project implementation.

According to the executing agency, since construction work was planned to be undertaken during the night time (from 8:00 PM to 5:00 AM), the traffic management issue (traffic congestion) due to installation of transmission cables (a total length of about 9 km) under the existing roads was substantially alleviated.

(2) Land Acquisition and Resettlement

At the appraisal stage, land acquisition for construction of compact distribution substations was planned at about 100 sites (4 m^2 per site). However, since majority of land to be acquired was owned by Colombo Municipality, no issues were foreseen on land acquisition. No resettlement due to implementation was also foreseen.

Since compact distribution substations were all constructed in the publically owned land during the project implementation, no land acquisition/resettlement has occurred.

Entrance of Substation “C”

Inside of Substation “C”

(3) Other Positive and Negative Impacts

None.

Since reinforcing the electricity distribution network under the project was implemented as planned and the transmission/distribution loss was reduced, the interruption duration was substantially reduced. Consequently, the project has contributed to realization of stable power supply and to promotion of economic activities in the Colombo District.

Thus, the project has largely achieved its objectives, and the effectiveness and impact is high.

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

At the appraisal stage (2001), Ceylon Electricity Board (CEB) was expected to be subdivided in 2003. However, in 2009 a new Electricity Act was enacted, and the power sector business was converted to the license system. CEB became the licensee, responsible for generating, transmitting and distribution, and subdivision of the organization did not take place. The organization of CEB as of 2014 consists of ten divisions including Corporate Strategy, Generation, Transmission, 4-Distribution (by region), Asset Management & Centralized Services, Projects and Finance. Divisions in charge of operation and maintenance of the facilities and equipment after the project was completed are two divisions including Transmission and Distribution 1 (Colombo City). The total number of CEB employees as of end 2013 is about 16,300.

The organization chart of the office, in charge of operation and maintenance of the Colombo District under the Transmission Division is shown in Figure 7.

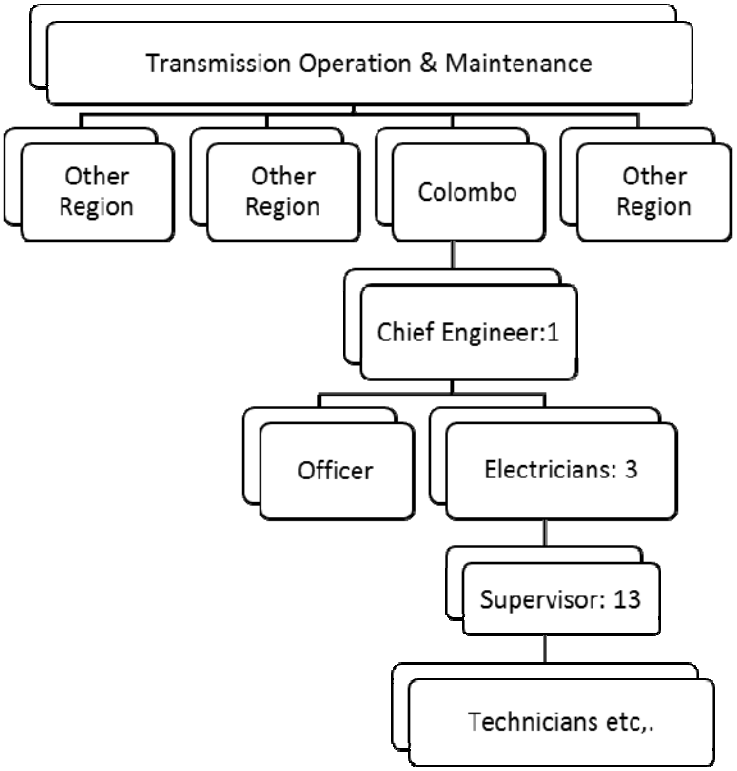


Figure 7 Organization chart of the office, in charge of operation and maintenance of the Colombo District under the Transmission Division

The office, in charge of operation and maintenance of the Colombo District is staffed with 3 Electrical Engineers, 13 Supervisors, and other staff such as administrative staff, technicians, and skilled labors totaling about 250 under Chief Engineer.

The organization chart of the office, in charge of operation and maintenance of the Distribution 1 (Colombo) is shown in Figure 8.

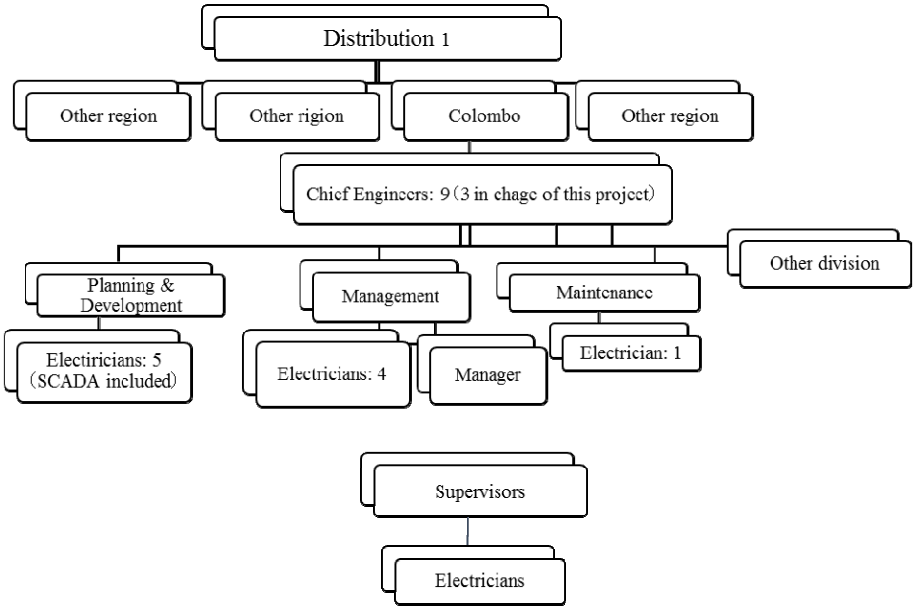


Figure 8　The organization chart of the office, in charge of operation and maintenance of the Distribution 1 (Colombo)

The office, in charge of operation and maintenance of Distribution 1 (Colombo) is staffed with 9 Chief Engineers, and staffs in charge of operation and maintenance of equipment/facilities installed/constructed under the project are following three Chief Engineers: Chief Engineer for Planning/Development (supervising 5 electrical engineers including an engineer responsible for SCADA), Chief Engineer for Operation (supervising 4 electrical engineers and a manager), and Chief Engineer for Maintenance (supervising an electrical engineer). The total number of staffs in charge of operation and maintenance under Distribution 1 (Colombo City) is about 150. According to the management of the offices in charge of operation and maintenance of transmission and distribution work, the number of staffs allocated to operation and maintenance is considered appropriate. (source: CEB Statistical Digest 2013 and responses to the Questionnaire to the Operation and Maintenance Divisions）

The current institutional setup for operation and maintenance is well established and

the number of staffs allocated is considered appropriate.

3.5.2 Technical Aspects of Operation and Maintenance

According to the management of offices in charge of operation and maintenance of equipment/facilities constructed/installed under the project, as far as Transmission Division is concerned, there is no problem on skills of technical staffs and the technical capacity required for operation and maintenance work. However, regarding Distribution 1 (Colombo), as some of trained staffs moved to other units, there is some minor problem at this moment. It is planned that vacant positions would be filled shortly.

In order to be an “Engineer”, he/she needs to acquire the qualification as an “engineer”, which is accredited by Institute of Engineers. All of Engineers allocated to the operation and maintenance offices have this qualification. The orientation and training is provided to the newly recruited technical staff when joining CEB, and they are required to take training on relevant subjects regularly even after joining the firm. Some of training subjects that technical staffs under Transmission Division took are operation and maintenance methods of transformers, substation automation, protection/control, switchgear and general principal of these equipment, which are provided by suppliers and contractors. The training programs generally last for 1 - 2 weeks. Guidelines and manuals required for operation and maintenance of the above mentioned equipment and facilities are well prepared.

Some of training subjects that technical staffs under Distribution 1 took are: training on operation of SCADA[7] undertaken in India (3 - 4 weeks), training on automation of substations undertaken in Germany (5 days), and training on routers[8] and various switches undertaken in Canada (10 days). Various guidelines and manuals including those for operation of SCADA, management system in case of outage, and management of planned outage are well prepared. Regarding the periodic maintenance, as it is still a few years since the work and installation of equipment/facilities were completed, a simple inspection is regularly undertaken.

Technical staffs with well qualified skills are allocated. Undertaking of training and preparation of manuals are appropriately addressed and no specific problems are observed. Thus, no technical issues are observed to sustain the project effects.

3.5.3 Financial Aspects of Operation and Maintenance

The revenue and expenditure status of CEB for the past three years is shown in Table

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7 Supervisory Control and Data Acquisition (remote surveillance/control system)

8 facility determines routes for data transmission

9.

Table 9　Revenue and Expenditure Status of CEB

(Unit: million Rupee)

Item	2011	2012	2013
Turnover	132,460	163,513	194,167
Direct cost	151,449	222,420	166,926
Gross profit	-18,989	-58,907	27,221
Administration expenses	1,636	2,997	2,597
Operating profit	-16,814	-57,679	29,730
Profit before tax	-20,185	-61,447	18,594
Average selling price (Rupee/kWh)	13.21	15.56	17.93

Source: CEB's Financial Statement 2011, 2012, 2013
CEB Statistical Digest 2012, 2013
Note: Table includes only major items.

The balance of CEB had a deficit for two years in 2011 and 2012. The main factor for a deficit is that hydro power generation stations could not be regularly operated, since there was no sufficient precipitation for the said two years. However, in 2013 hydro power generation stations could be fully operational (generated about 60% of all the generated electricity) because of sufficient precipitation, and thus operation of thermal power stations, which use diesel oil as fuel was reduced (generated about 30% of all the generated electricity. Operation of thermal power stations occupied about 60% of the generation made in 2012.), resulting in reduction of direct costs. Thus, the balance went to black.

CEB has recently promoted the generation development based on the "thermal power main and hydro power sub-main" policy in order to achieve the stable electricity supply. The second phase work for Puttalam Power Station, which uses coal as fuel and has a capacity of 900,000 KW in total including both phase 1 and 2, was substantially completed by end 2013. Then, stable electrical supply became feasible since a newly completed power plant became fully operational. The average selling price of electricity was increased consecutively for two years, and it is also one of factors for moving to surplus in the 2013 balance sheet.

According to the management of CEB, it is expected that the 2014 balance sheet would be break-even from black in the previous year since the precipitation of this year was less and thus, operational ratio of hydro power stations was lowered. If it goes into red, CEB would borrow from the State Bank with concurrence of the government, and repay the loan when the balance sheet moves to surplus. Actually, CEB repaid the loan previously made in 2013.

Transition of operation and maintenance costs of Transmission Division (Colombo) is

shown in Table 10 and that of Distribution 1 Division (Colombo) is shown in Table 11.

Table 10 Operation and Maintenance Costs of Transmission Division (Colombo)

(Unit: million Rupee)

	2011	2012	2013
Operation cost	n/a	n/a	185
Maintenance cost	n/a	n/a	25

Source: Responses to the Questionnaire

Table 11 Operation and Maintenance Costs of Distribution 1 Division (Colombo)

(Unit: million Rupee)

	2010	2011	2012
Operation cost	125	149	156
Maintenance cost	115	77	90

Source: Responses to the Questionnaire

Operation and maintenance costs shown in Tables 10 and 11 are both actual figures, and both Transmission and Distribution 1 Divisions report that these costs were sufficient for making operation and maintenance regularly.

Operation and maintenance costs of equipment/facilities installed under the project are covered by sales (in 2013). Thus, there is no specific problem on financial aspects for operation and maintenance.

3.5.4 Current Status of Operation and Maintenance

Daily inspection and repairs of equipment/facilities installed under the project have been regularly undertaken by relevant operation and maintenance offices and entrusted contractors. However, the maintenance contract for SCADA has been under negotiation with the supplier.

In two years after the project was completed, minor irregularities/defects are observed in some equipment, and countermeasures are under consideration or countermeasures have been negotiated with equipment suppliers. However, these irregularities/defects do not cause serious obstacles for operation so that transmission and distribution needs to be stopped. Such minor irregularities/defects include the followings.

- Sudden freeze of computers installed in the control room of a substation (a minor issue); and
- Automation system in main substation “C” under the management of Distribution 1

Division (Colombo) does not function as planned, and sometimes it automatically stops and restarts.

The one-year defect liability period after the project was completed has already ended. Thus, the executing agency has been negotiating on necessary countermeasures to the above mentioned problems with suppliers taking into account the compatibility with the potential equipment to be introduced in the near future. Regarding the automation system, upgrading of equipment is needed, and it is expected that it would be included in the project scope under the next JICA-funded project (Greater Colombo Transmission and Distribution Loss Reduction Project).

Daily inspection and repairs of equipment/facilities installed under the project have been regularly undertaken by relevant operation and maintenance offices and entrusted contractors. In a few years after equipment/facilities were installed under the project, minor irregularities/defects are observed in some equipment. However, these irregularities/defects do not cause serious obstacles for operation so that transmission and distribution needs to be stopped. Countermeasures have been negotiated with suppliers.

In light of the above, no major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system, therefore sustainability of the projects effect is considered high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project was to provide stable electric supply by reinforcing the electricity distribution network, and reducing the system loss in order to respond to the expected load level of 350 MW as of 2005 in Colombo, thereby contributing to promotion of economic activities in the Colombo district. The project has been highly relevant to the development plans and needs of Sri Lanka, as well as Japan's ODA policies. Thus, its relevance is high. Regarding the efficiency, the originally planned project scope has been implemented almost as planned. However, under the 11kV/low voltage work, the quantity of cables, which could be easily adjusted, was revised due to the budget constraints. Thus, the project scope was slightly changed. The project cost was higher than planned and the project period was significantly longer than planned, therefore, efficiency of the project is low. Since reinforcing the electricity distribution network under the project was implemented as planned and the transmission/distribution loss was reduced, the interruption duration was substantially reduced. Consequently, the project has contributed

to realization of stable power supply and to promotion of economic activities in the Colombo district. Thus, the project has largely achieved its objectives, and the effectiveness and impact is high. No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system, therefore sustainability of the project effect is considered high.

In light of the above, this project is evaluated to be satisfactory.

4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

None.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

(1) Inappropriate Review of Project Details (Procurement Implementation Plan) at the Appraisal Stage and Negotiations with the Executing Agency

As mentioned above, the original project scope has been completed almost as planned. However, the original type of contract, in which a consultant undertakes detail designs and a contractor supplies/installs the equipment was changed to the “turnkey” contract as proposed by the executing agency, and subsequently concurred by JICA. Thus, some item among the scope of work for a consultant, which is “undertaking detail designs” was changed to “review of designs to be made by a contractor”. Thus, more time was spent to process the internal clearance procedures within JICA and CEB due to revision of the scope of work. Moreover, at the succeeding tendering stage for work, more time was spent to process the clearance procedures within the relevant authorities (JICA and the Sri Lankan Government) due to changes on the scope of work to be included in the contract and the project scope of procurement packages for work, resulting in substantial delay of the project period. These facts hint that discussions on the procurement implementation plan with the executing agency at the appraisal stage were not thorough enough. Regarding the procurement package which includes plants and equipment for power generation and substations such as this project, a contract package covering supply of equipment, installation and commissioning is more general. It is recommended that JICA’s “Standard Bidding Documents under Japanese ODA Loans: Procurement of Plant Design, Supply, and Installation, February 2013 Version 1.1” is used in the succeeding

similar type of work. It is a common practice that a concept design in which fundamental and absolutely needed specifications are stated is provided to bidders as a bidding document, since in a power sector project, equipment to be supplied includes numerous specific items, and that detail designs are submitted by a winning bidder.

In case discussions and negotiations between JICA and the executing agency at the appraisal stage on the procurement implementation plan (on procurement method (International Competitive Bidding, National Competitive Bidding, Shopping), format and contents of bidding documents, procurement package, procurement implementation schedule (including planning of time span required for each procurement step) are not thorough enough, revisions on “procurement arrangements” quite often occur during the implementation stage, and thus delay of project implementation arises.

In the discussions on the procurement implementation plan at the appraisal stage, details on the above mentioned items need to be discussed and what was agreed should be recorded in writing.

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Output 1) Work	1) 132kV Work ・ Construction/Upgrading of 3- 132kV Substations (Primary Substation "C", Kelanitissa Grid Substation, Kolonnawa Grid Substation) ・ Installation of 132kV transmission cables (8km) 2) 33kV Work ・ Upgrading a 33kV Substation (Primary Substation "H") 3) 11kV/Low voltage work (a) Installation/replacement of 11kV underground cables (130km) (b) Construction of 11kV compact distribution substations (100 units) (c) Replacement of 11kV RMU (Ring Main Units) (50 units) (d) Installation of low voltage cables (40km) (e) Installation of low voltage feeder pillars (200 units) (f) Replacement of 11kV switchgears (474 units) 4) Others ・ Installation of SCADA (Supervisory Control And Data Acquisition) system	1) 132kV Work ・ Construction/Upgrading of 3- 132kV Substations as planned ・ Installation of 132kV transmission underground cables (9.3km) almost as planned 2) 33kV Work ・ Upgrading a 33kV Substation as planned 3) 11kV/Low voltage work slightly revised (a) Installation/replacement of 11kV underground cables (82km) (b) Construction of 11kV compact distribution substations (40 units) (c) Replacement of 11kV RMU (Ring Main Units) (380 units) (d) Installation of low voltage cables (16km) (e) Installation of low voltage feeder pillars (72 units) (f) Replacement of 11kV switchgears (175 units) (g) Installation of optical fiber cables (77km) (these are for automatic distribution, and were originally included in the SCADA system) 4) Others (automatic distribution system) ・ Installation of SCADA system as planned
2) Consulting Services	1) Detail designs and assistance in bidding 2) Construction supervision 3) Training of engineers of the executing agencies 4) Environmental protection 5) Others Foreign experts: 154M/M Local experts: 180M/M	1) Change to review of detail designs and assistance in bidding 2) Construction supervision as planned 3) Training of engineers of the executing agencies as planned 4) Environmental protection as planned 5) Others Foreign experts: 161M/M Local experts: 213M/M
2. Project Period	December 2001 - August 2006 (57 months)	December 2001 - June 2012 (127 months)
3.Project Cost Amount paid in	4,748 million yen	5,308 million yen

Foreign currency	3,197 million yen	3,197 million yen
Amount paid in Local currency	7,945 million yen	9,919 million yen
Total Japanese ODA loan portion	5,959 million yen	5,957 million yen
Exchange rate	1 Rupee = 1.44 yen (as of February 2001)	1 Rupee = 0.76 yen (average between October 2008 and June 2012)