Nepal

Ex-Post Evaluation of Japanese Grant Aid Project
"Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley (Phase 3)"

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1. Project Description

Project Location

Gas Insulation Switch (GIS) and K3 Substation building

1.1 Background

This project (hereinafter referred to as "the Project") is one of those suggested under the "Master Plan and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley in Nepal" (hereinafter referred to as "MP") implemented by JICA in 1991. Projects developed in accordance with the MP were implemented primarily with the financial cooperation of Japan, prioritizing underdeveloped areas in the Katmandu valley.

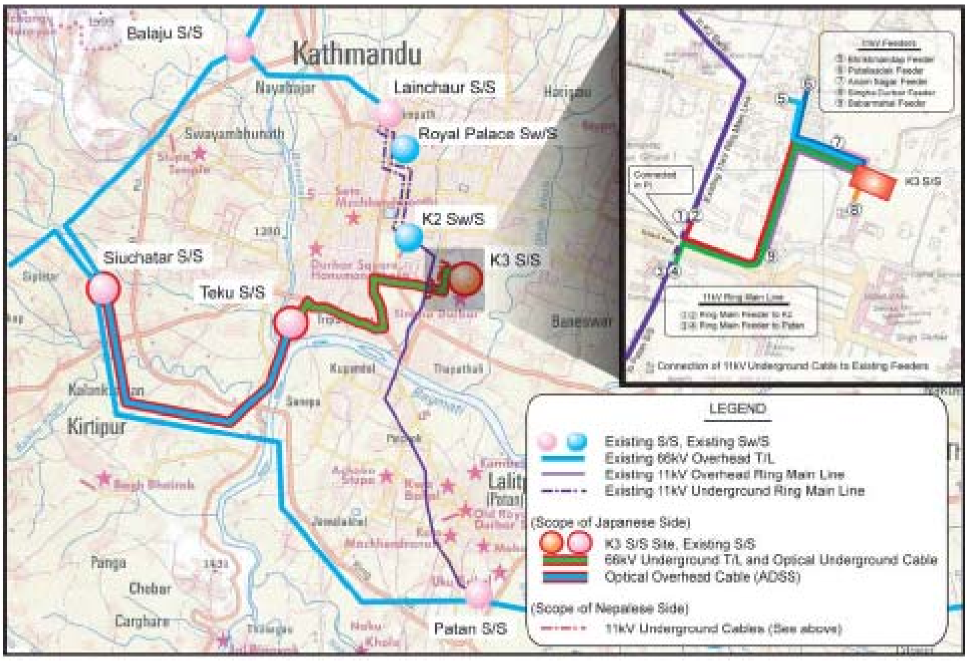
Due to the delay in development of power generation, the power sector in Nepal has suffered from a chronic shortage of power since the first half of 1990. Therefore, as the basic design study for this project (hereinafter referred to as "B/D") stated, the most serious issue was supply shortage in the power sector. With hydropower generation as the source of electricity, scheduled power cuts were conducted in a wide area, particularly during the dry season when power generation capacity declines. In 2002, four new power plants with a total capacity of 254MW (Khimti Khola, Upper Bhote Koshi, Modi Khola, Kali Gandaki A) were completed and commenced operation. In addition, Chilme and Middle Marsyanghi power plants were under construction.

At the time of basic design study (B/D), it was thought that provided this power development plan was implemented smoothly, there would be no problem with power generation shortages until 2013, that is, the shortage of power plants would be mostly solved. Accordingly, at that time, the immediate issues were deemed to be strengthening power transmission capacity and, given the increased use of computer-related equipment, reinforcing the transmission and distribution capacity to obtain a highly stable and reliable power supply.

Power supply in the center of Katmandu came from a rim of suburban substations which transformed the 66kv and 132kV from external lines to 11kV, with onward transmission from the substations through 11kV lines. Power supply to the center of Katmandu heavily depended on the K2 switchyard, which is located on the site of a Nepal Electricity Authority (NEA) building; however, there was a shortage of power supply line capacity from the Patan substation to the K2 switchyard. Moreover, Patan substation was short of transformer capacity, so there was a constraint to the load or load shedding to other substations during the dry (winter) season when the load peak occurs. If one transformer in the Patan substation failed, or an 11kV transmission line from the Patan substation to the K2 switchyard had a problem, a power failure in a wide area for a long time could be triggered. Consequently, new substation construction was indispensable to reinforce the power supply line to the K2 switchyard and to reduce the burden at the Patan substation.

1.2 Project Outline

The objective of this project is to supply highly reliable electric power in the center of Katmandu city, by constructing a new substation for distribution lines (K3 substation) and by extending high voltage underground transmission lines from existing substations (Teku and Siuchatar substations) to a new substation (for locations, refer to Figure 1 "Project Area and Related Facilities").



(Source) "The Kingdom of Nepal: Basic Design Study on the Project for Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley (Phase 3)" November, 2002

Figure 1: Project Area and Related Facilities

Grant Limit / Actual Grant Amount	16 million yen / 16 million yen (Detailed Design) 138 million yen / 113.6 million yen (Main construction)
Exchange of Notes Date	February, 2003 (Detailed Design) July, 2003(Main construction)
Implementing Agency	Nepal Electricity Authority: NEA
Project Completion Date	February, 2005

Main Contractors	Joint Venture of Sumitomo Corporation and Kinden Corporation
Main Consultants	Nippon Koei Co., Ltd.
Basic Design	November, 2002
Detailed Design	February, 2004
Related Projects	[Development Study] “Master Plan (MP) and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley in Nepal” (1991) [Grant Aid] “Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley” (FY 1992-1993) “Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley, Phase 2” (FY 1994-1995)

2. Outline of the Evaluation Study

2.1 External Evaluators

Mitsue Mishima, OPMAC Corporation
Keiichi Fujitani, Tokyo Electric Power Corporation

2.2 Duration of Evaluation Study

For the post evaluation on the Project, evaluators conducted the survey according to this schedule:

Duration of the Study: October, 2009 – August, 2010
Duration of the Field Study: March 12, 2010 – March 21, 2010

2.3 Constraints during the Evaluation Study

With respect to information during the project construction, evaluators checked documents such as project reports and interviewed the Japanese consultant in charge at the time of the project implementation. All personnel in charge on the NEA side at the time of project implementation had already retired and therefore could not be interviewed. In addition, evaluators could not obtain some of the documents (the IEA, or Initial Environmental Assessment) regarding the project implementation from the NEA side. However, through verifying the project site facilities from a technical point of view, interviewing current staff of NEA’s Construction Department, and examining the existing documents from the Japanese side, enough evidence for a proper evaluation was obtained.

3. Results of the Evaluation (Overall Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with Development Plan of Nepal

At the time of the Project implementation, the Ninth Five-year Plan (1997/98 – 2001/02) aimed at poverty reduction and listed 20 priority issues including electric power development. Within electric power development, increase in power supply was prioritized, coupled with institutional reform in the power sector, rural electrification, and so on. In particular, transmission and distribution reinforcement were discussed in response to the demand for electricity in urban areas. Later, the Tenth Five-year plan (2002 - 2007) was integrated with the Poverty Reduction Strategy Paper (PRSP) and indicated the objectives of each sector, pursuing poverty reduction. It emphasized the importance of accelerating economic growth and infrastructure development in order to achieve poverty reduction. In this context, expansion of the power supply, centered on the main issues of rural electrification and export of electricity through hydro power development, was listed as an aim. This project aimed at increasing and stabilizing power supply in Katmandu, and was therefore consistent with power sector goals in the national development plan of the time.

After 2008, no new five-year plans have been forthcoming. The most recent national development plan is the “Three Years Interim Plan” (2008 - 2010). One of the four priority areas is to increase investment in infrastructure such as hydropower, roads, irrigation, and telecommunications to support agriculture, tourism and industry. In the field of electric power and energy, the objectives were discussed as promoting development of hydro power generation and improving access to electricity for people in rural areas. The plan states that reinforcement of transmission capacity (construction of new transmission lines and substations) and expansion of the distribution system will be implemented in both rural and urban areas.

3.1.2 Relevance with the Development Needs of Nepal

The Project was originally planned to be implemented under part of the Japan’s general grant scheme, nemely, Extension and Reinforcement of Power Transmission and Distribution System in Katmandu Valley (Phase-2) (FY 1994-1995); however, in the end this was not undertaken due to the shortage of power generation sources in Nepal side. While the shortage of power was being alleviated by the completion of new power plants and projected output capacity of those under the construction, the lack of capacity of power supply lines and substation transformers was becoming an obstacle in realizing stable power supply to the center of Kathmandu. Given this situation as a background, it appears there was a need for the construction of a new substation in the center of Kathmandu. Necessity for construction of power supply lines and improvement of substation transformer capacity shortage is affirmed as it was examined at the time of planning.

Even after the implementation of this project, however, serious power shortages have continued, due to delays in the development of power plants, lack of power generation caused by shortage of water, and trouble with the transmission line from India. As of March 2009, while peak load was 790MW, actual supply capacity was 420MW, far below the peak load. During 2009, scheduled power cuts were conducted for up to 16 hours per day in the Kathmandu area; in 2010, cuts continue at up to 12 hours per day.

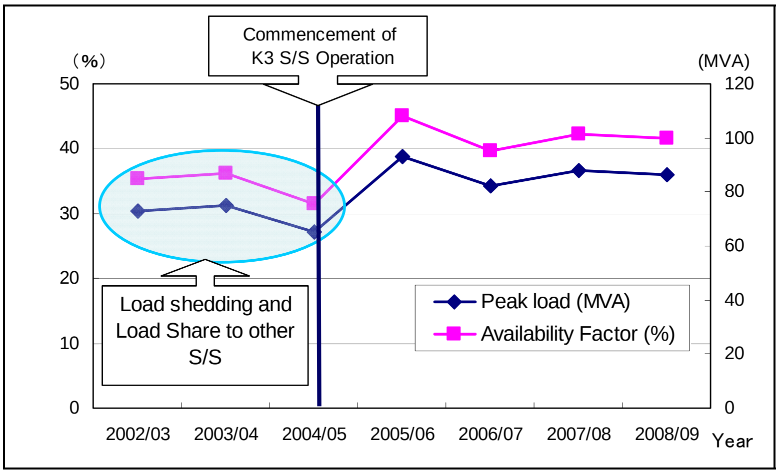
On the other hand, the most recent system plan by NEA, “System Planning Report” (2008)[1], discusses reinforcing transmission and distribution lines, together with basic principles such as a power development plan focusing primarily on hydropower and power transmission with India and so on. This report also indicates that the reliability and quality of the power supply in the power system network plan is secured under any circumstances. Planning the system in line with the “N-1” standard[2] were described in the system plan in 1998, and this planning policy

[1] This report is basically a version of “Power system Master Plan for Nepal: Transmission System Master Plan” (drafted with ADB support in 1998) updated with new data. .

[2] System planning which avoids forced outage in electricity supply upon having trouble in one unit of the facilities – such as power generators, transformers, transmission and distribution lines – comprising the power system.

continues.

This project is consistent with the N-1 standard system plan. At present, the K3 substation and K2 switchyard are each supplying 50% of the load in almost the same area. Without the K3 substation, load shedding due to overload would presumably have continued in power source substations for the K2 switchyard such as the Patan substation. As shown in Figure 2, examining the trends in availability factor and peak load at the Patan substation, stable power supply (without load shedding or replacing the load to other substations) has been realized since the K3 substation commenced operation. If there were no K3 substation, the power supply may have deteriorated further as additional load shedding would have been necessary to meet the increasing demand.



(Source) NEA Document

Figure 2: Availability and Peak Load at Patan Substation

To summarize, the power shortage has not been alleviated as predicted at the time of pre-evaluation; however, the Project is consistent with development needs in terms of avoiding power failures in a wide area in line with the Project objective.

3.1.3 Relevance with Japan’s ODA Policy

At the time of the B/D, ODA policy for Nepal had “Economic growth to contribute to poverty reduction” as a basic principle and stated that Japanese assistance would be implemented to meet the Tenth Five-year Plan (PRSP). It recognized the necessity of accelerating further infrastructure development, the basis of economic development, since for poverty reduction it was indispensable to have the Nepalese economy grow even while the peace is more firmly established. Priority areas were stated as (a) improvement of the social sector, (b) agricultural development, (c) economic infrastructure development, (d) human resource development, and (e) environmental conservation. It indicated specifically that continuing grant aid and technical cooperation from Japanese ODA would primarily support basic infrastructure development in areas such as electric power, road, water supply and sanitation, information and communication and so on. The Project is in line with support for basic infrastructure development and thus consistent with Japan’s ODA policy.

The Project is one of the projects stemming from “the Master Plan (MP) and Feasibility Study on Extension and Reinforcement of Power Transmission and Distribution System in Kathmandu Valley in Nepal”, which was implemented with Japanese assistance. Some higher priority projects suggested by the MP were conducted as phase 1 and 2, and then the Project was conducted as phase 3. The target area of this project is the center of the Kathmandu city, where electricity demand is high and reinforcing transmission and substation systems was considered to be urgent.

This project has been highly relevant with the country's development plan, development needs, as well as Japan's ODA policy, therefore its relevance is high.

3.2 Efficiency (Rating: a)

3.2.1 Project Outputs

Outputs on the Japanese side are shown in Table 1. Comparing the plan and actual implementation, the scope of outputs was as planned.

Photo 1: Overview of Equipment in Siuchatar Substation

Regarding outputs on the Nepalese side, the plan indicated land acquisition and reclamation by soil filling for the area for the K3 substation building, wall construction, 11kV distribution line connection (procurement of materials and construction), telephone and water connection, and furniture procurement. Other than cancellation of wall construction, all works were undertaken as planned. The reason why the wall construction was not necessary was, according to NEA, "the indoor substation is within the premises of Singha-Durbar which already has a safe and secure wall". After examining the Project site, this reason was considered to be appropriate.

Table 1: Project Output

The Japanese side	
Plan (B/D)	**Actual**
• K3 Substation Building, Installation of Remote Terminal Unit (RTU) • Modification of Teku substation • 66kV underground transmission line construction (K3 − Teku) • Extension of 66kV switchgear at Siuchatar substation • Installation of Remote Terminal Unit (RTU) and optical fiber cable to protect transmission line (K3-Siuchatar)	As Planned
The Nepalese side	
Plan (B/D)	**Actual**
• Land acquisition and reclamation by soil filling for K3 substation building • Wall construction for K3 substation • Construction of 11kV distribution line and connection to existing lines (procurement of materials and construction) • Connection of telephone line and water supply, and procurement of furniture	Cancellation of substation wall construction. Other than the above, as planned

3.2.2 Project Input

3.2.2.1. Project Period

As agreements for Exchange of Notes (E/N) for this project were made separately for the detailed design and the main construction work, the planned and actual period for each is compared in Table 2. Detailed design required about twice the planned period: according to the Japanese consultant, this was because the detailed design had to be reviewed after reclamation work was completed by the Nepalese side, and approval for the detailed design took time. The bidding phase also required more time than planned, with two months passing between public announcement of the bidding to disclosure of its result and again because of the lengthy approval process required by the Nepalese government side before the contract was signed.

The period from commencement to completion of main construction work was shorter than planned. It took 14 months compared to 15 months in the plan for total main construction work, which is 93% of the planned period. Main construction work was finished within the due date set by E/N. Examining the total project period, except for the delay caused by the Nepalese government side, the Project was completed within the planned period.

Table 2: Project Period

Items	Plan (B/D)	Actual
Detailed Design	4.5month	10 Months
Main work (construction, procurement, installation)	**15 Months**	**14 Months**
Bidding	2.7 Months	5 Months
Commencement and completion of work	12.7 Months	9 Months

3.2.2.2. Project Cost

The total project cost for detailed design was the same as planned, and the cost for main construction work was less than planned: actual cost was 1.154 billion yen, compared to 1.417 billion yen in the plan. The Japanese grant aid amount was 1.136 billion yen, about 81% of the 1.38 billion yen limit given in the E/N. The main reason why the project cost was less than planned was primarily a decrease in equipment procurement cost as a result of competitive bidding.

Table 3: Project Cost

Items	Plan	Actual
Detailed Design	**16 million yen**	**16 million yen**
Main construction work	**1,417 million yen**	**1,154 million yen**
Japanese side (Grant Aid)	1,380 million yen (E/N due amount)	1,136 million yen
Construction cost	50 million yen	100 million yen
Procurement of equipment and materials cost	1,257 billion yen	965 million yen
Equipment design supervision cost	90 million yen	71 million yen
Nepalese side	20 million yen	17.7 million yen

(Note) exchange rate as of 2002 for the Nepalese side cost: 1 rupee = 1.58 yen、1 US dollar = 121.92 yen

Both project period and project cost were mostly as planned, therefore efficiency of the project is high.


Photo 2: Transformer in K3 Substation

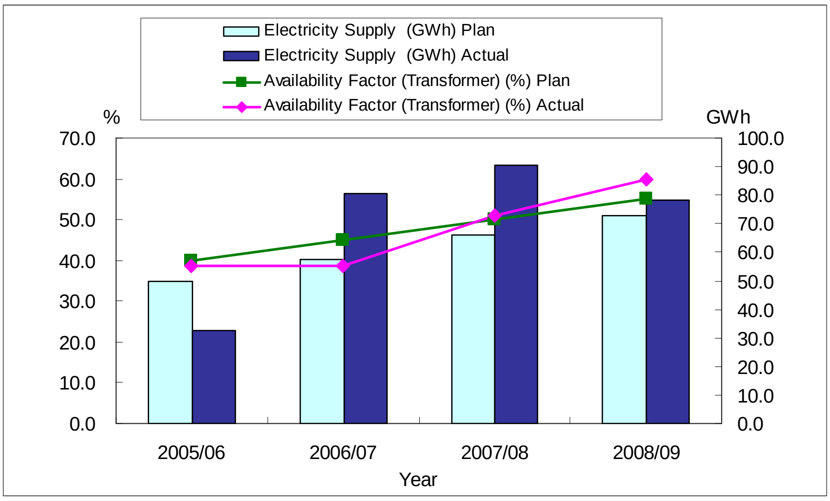
3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1. Results from Operation Indicators

In view of the function and outputs of the Project in the power system, at first examining availability factors and electricity supply from the transformer, it is judged that facility operation is satisfactory as shown in the Figure 3.

The availability factor (total of two transformers) is nearly the same as planned for each year after the third year of operation commencement. The target operation indicator is approximately 50%, so that one transformer can cover the total electricity supply in case of a problem with the other transformer. Actual availability factors have been slightly above or below 50%. The volume of electricity supply has been nearly as per the yearly plan.



(Source) NEA Documents

Figure 3: Availability factor and electricity supply of K3 Substation

In Kathmandu city, scheduled power cuts have continued. Some further indicators were also examined as potentially relevant to the operation of the Project. Table 4 shows such main indicators.

Peak load in the Project area was increased by more than indicated in the plan in years 2007/08 and 2008/09. Unplanned outage time increased in 2008/09; however, the reason was identified as proper functioning of the relay in response to overload or over current. Transmission loss also increased in year 2008/09. According to NEA, this was due to electricity volumes being too high to be measured; therefore this was not attributed to the Project equipment operation. As a result, no problems related to the Project facilities have been identified.

Table 4: Relevant indicators in Project Area

Indicators		**2005/06**	**2006/07**	**2007/08**	**2008/09**
Peak load in Project Area (kW)	Plan	20.00	22	24.2	26.62
	Actual	**19.3**	**19.3**	**25.58**	**29.98**
Planned Outage Hours (hr/year)	**Actual**	**0:00**	**0:00**	**0:24**	**0:00**
Unplanned Outage Hours (hr/year)	**Actual**	**0:00**	**8:55**	**1:25**	**3:14**
Transmission loss (%)	Plan	0.25	0.25	0.25	0.25
	Actual	**0.23**	**0.17**	**0.18**	**0.49**

(Source) NEA Document
(Note) Planned outage is for equipment maintenance. Unplanned outage included those in areas outside of the Project area.

3.3.2 Qualitative Effects

None in particular.

This project has largely achieved its objectives; therefore its effectiveness is high.

3.4 Impact

3.4.1 Intended Impacts

(1) Positive impact on the Project area and beneficiaries (Socio-economic impact)

According to NEA at the time of the ex-post evaluation, there was no change in the scope of the Project area and beneficiaries, that is, approximately 260 thousand people, the same number as at the time of planning. In the target area, there were almost no new electricity consumers after the Project implementation. The impact of the Project was primarily in meeting an increase in electricity demand from existing electricity consumers.

Reliability of power supply was enhanced by the Project; however, scheduled power cuts continue to be conducted. Thus, impact of the Project on the socio-economic activities of residents in the target area cannot be identified.

(2) Technical Impact

A staff member in charge of maintenance and inspection at the time of the Project implementation still works in the same section and trains other staff in related departments and sections within NEA as an instructor (refer to Photo 3). This instructor explained in interview that NEA has applied what they learned about the maintenance and inspection of gas insulated switchgear (GIS; refer to the photo in section *1. Project Description*) to other GIS in other substations. The Project therefore had some technical impact on GIS maintenance and inspection.

Photo 3: Class room of a training instructor who is in charge of the Project facility maintenance and inspection

3.4.2 Other Impacts

(1) Impacts on natural environment

At present, no unintended impact on the natural environment has been reported. The B/D noted that since the new substation site was inside the joint government building area, there would be no environmental impact on residents in surrounding areas and no negative impact on the environment in that area. Transmission lines are underground cables; therefore no visual or electromagnetic radiation problems were predicted.

An examination of the Project site, revealed only a very minor length of underground cable above ground level where crossing a river (Photo 4); no problems were identified with the current situation. Consequently, the chance that serious environmental impact occurred is considered to be almost nil.

Photo 4: Underground Transmission Line Cable (at river-crossing point)

(2) Impacts on social environment

No resettlement of residents or land acquisition was planned. Ex-post evaluation confirms that no new resettlement and land acquisition was required during the Project implementation.

3.5 Sustainability (Rating: b)

3.5.1 Structural Aspects of Operation and Maintenance

The department and section in charge of operation and maintenance (hereinafter referred to as "O & M") for the Project facilities are the Grid Operation Department under the Directorate of Transmission & System Operation, as shown Figure 4. Under the Grid Operation Department, there are several divisions in charge of particular areas. The Katmandu Valley Transmission Division, Bagmati Transmission Branch is in charge of operation and maintenance of the 66kv transmission line and substations related to the Project, and the Distribution & Consumer Services Department is in charge of the 11kv distribution lines. There has been no major change to the units in charge at the time of B/D, however, there was some organizational reform whereby the section in charge of the Katmandu valley became one division and then two branches were established within it.

The total number of staff at the Bagmati Transmission Branch is 160. Of this number, 11 staff are in the Transmission Section for transmission line maintenance, and 10 staff are in the Substation Maintenance Section. They are in charge of operation, preventative maintenance, and dealing with accidents. One engineer is assigned to each of these groups. Eight staff were assigned to K3 substation, including one assistant engineer, three supervisors, and four electricians.

NEA has established 12 technical levels related to job position, running from level 1 (Junior helper) to level 12 (Director). Those with bachelor degrees or higher are at least Level 7 (Engineer). Assistant engineer is level 6, supervisor is level 5, and electrician is equivalent to level 3. Each substation has an assistant engineer who is relatively experienced and supervises both operation and maintenance.

This arrangement of personnel is clearly defined is deemed to be appropriate, since no problems with assignments or shortage in personnel numbers were identified after hearing from stakeholders and verifying the site during the field survey.

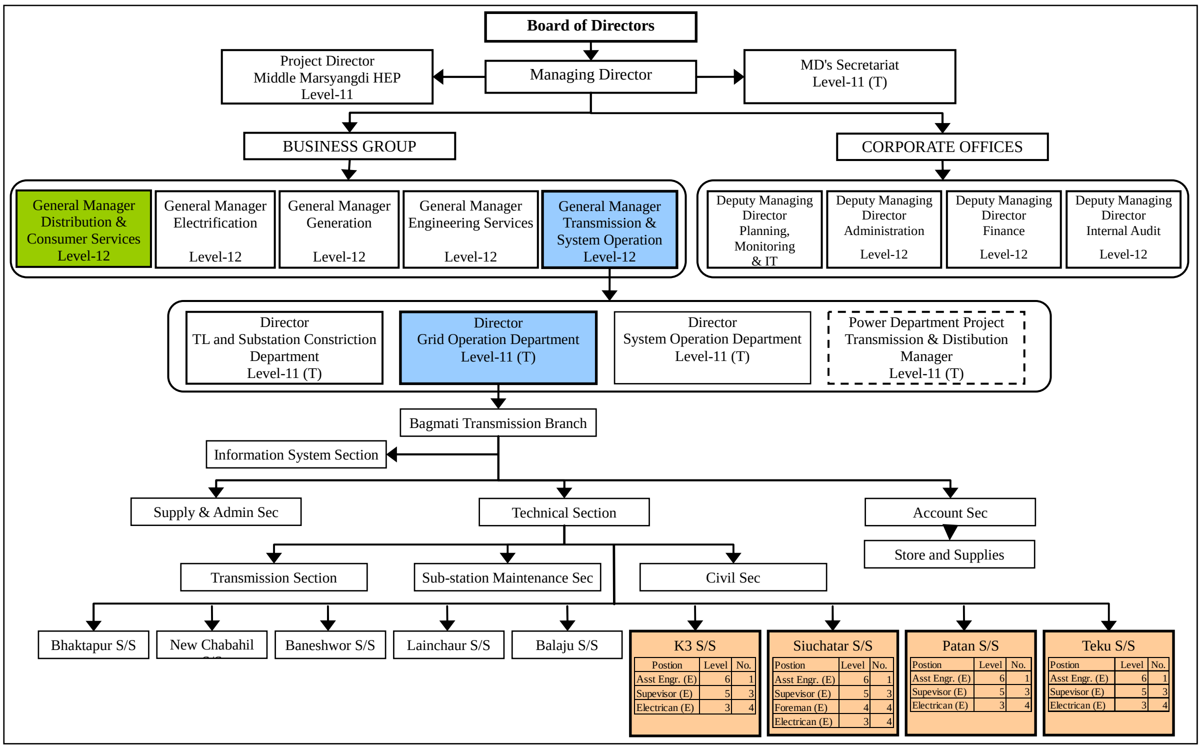


Figure 4: NEA's Organization Chart related to O & M Sections of the Project Facilities

3.5.2 Technical Aspects of Operation and Maintenance

At the time of the B/D, no problems were expected with technical standards or operation and maintenance in particular for the Grid Operation Department under the Transmission and System Operation Directorate, since this department had experience in operating and maintaining facilities similar to the K3 substation. At the time of ex-post evaluation, no particular technical problems were observed.

As for training, targeting level 6 technical staff, a one week training course is conducted every year to enhance their technical capacity with respect to equipment such as high voltage switchgear and O & M of the facility.

Equipment operation manuals which were distributed by the Project for were confirmed to be at necessary locations and, according to NEA, no problems were reported in referring to them. During the site survey, this was verified through checking the content of manuals and interviewing relevant staff.

In addition to the above, a comprehensive assessment including interviews of O&M staff and verification of the equipment status at the Project site indicated their technical level was sufficient for identifying problems and managing basic problems with the equipment.

3.5.3 Financial Aspects of Operation and Maintenance

At the time of the B/D, the yearly operation and maintenance cost for the facilities was predicted to be 2.6 million rupees per year after the third year of operation. The actual cost for the most recent year, 2009, was approximately as predicted. Examining the details by cost item, personnel costs exceeded the predicted amount by 1.2 million rupees, and the spare parts purchase cost was lower than the 1.4 million rupees which was predicted as a necessary cost from three years after the facility commenced operation. In interviews with NEA, however, it was revealed that equipment maintenance funds are allocated as necessary when an emergency arises. In addition, since discussion with relevant personnel and inspection of the Project site during the field survey did not indicate any financial problems affecting the management of maintenance, it is considered that O &M cost has been allocated at the necessary and sufficient level.

Table 5: Operation and Maintenance Cost for the Project facilities

(Unit: Million rupees)

Items	2005 (year of completion)	2006	2007	2008	2009
Operation and Maintenance Cost	**1.73**	**1.74**	**2.32**	**2.23**	**2.55**
Personnel cost	1. 68	1.68	1.92	2.16	2.4
Equipment maintenance (purchase of spare parts)	0.05	0.06	0.4	0.065	0.15

(Source) NEA Documents

3.5.4 Current Status of Operation and Maintenance

Necessary maintenance and inspection for the facilities established by the Project involve a patrol inspection which is conducted every day and periodic inspection conducted once every three to six months.

At the time of inspection at the end of the warranty period after the Project completion, it was judged that no new recommendations were necessary since K3 substation was operated, maintained, and inspected along in accordance with the initial purposes. At the time of visiting the Project site, daily and periodic maintenance and inspection were implemented as recommended at the time of B/D.

Recently in the Grid Operation Department, "Enhanced Performance Reward (EPR)" was introduced. This system sets target indicators for (for example) O&M of the equipment each operation and maintenance group is responsible for, and reflects the degree of target achievement in staff remuneration. According to the most recent annual NEA transmission & system report (August 2009), introduction of the EPR system contributed to the stability and enhancement of system operation.

According to a NEA report on the Project facility operation status, there were accidents involving a short circuit and an earth fault[3] in year 2006 and 2009, however, the problem is reported to be solved at present. Short circuit between cables was caused by a malfunction in a relay (2006) and the earth fault was caused by trouble with a cable (2009). The settings of the relay[4] were checked with its manufacturer and have been modified, and the cable was changed for another one.

Regarding the current status of the equipment, the GIS is currently operated with the DS/ES interlock system is locked, since the GIS's interlock system could not be properly set because of a malfunction in a rotary switch. This requires inspection and repair by a technical expert from the manufacturer. NEA has no plan to solve this problem until the next periodic inspection of the GIS by the manufacturer once every ten years.

The interlock system is intended to prevent accidents caused by mistaken operation through human error. There is no problem if NEA staff remain conscious that they are operating the equipment with the interlock locked. Incorrect operation would cause a risk of harm to personnel or power failure. Consequently, constant attention is required for this equipment malfunction.

As a result of the above-mentioned analysis, O&M of the Project has no major problems with organizational, technical or financial aspects, and sustainability of the effects of the Project is verified; however, since malfunction of a part of the equipment requires ongoing operational attention, sustainability of the project is judged to be fair.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Since the shortage in power generation was not resolved as predicted at the time of pre-evaluation, the expected impact of the Project is not observed. However, the Project was relevant, because it was necessary and urgent to stabilize the power supply and enhance its reliability in order to avoid power failures in wide areas for a long time. The Project facility operation is smooth, achieving the project purpose, and thus effectiveness is high. Verifying current equipment status, malfunction of a part of equipment was identified, however, with careful attention to that, it does not affect the facility operation. The Project is sustainable in organizational structure, and in its technical and financial aspects.

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[3] A short-circuit occurs when a current flows as a result of losing insulation between conducting parts which have different phases to each other in an electric power system, facilities, and so on. An earth fault occurs when a current flows by losing insulation between conducting part and the earth. Accidents in 2006 and 2009 involved a short circuit and an earth fault respectively.

[4] A relay is a device used in a control or signal circuit that is set in advance to open or close depending on the value of physical parameters. Relay setting involves selecting the standard at which to respond to the certain level of the working indicators, time, and so on.

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

4.2 Recommendations

4.2.1 Recommendations to Executing Agency

While the inter-lock system of the GIS in K3 substation is locked, it is necessary to prevent operation errors by instructing operators to pay close attention to it.

4.2.2 Recommendations to JICA

None.

4.3 Lessons Learned

None.

(End)