India

FY2017 Ex-Post Evaluation of Japanese ODA Loan Project

"Haryana Transmission System Project"

External Evaluator: Keishi Miyazaki, OPMAC Corporation

0. Summary

The objective of this project was to ensure a stable power supply to meet rapidly growing power demand by developing an intra-state transmission and substation system in India's northern state of Haryana, thereby contributing to economic growth and improvement of living conditions in the region. The relevance of the project is high, as the objective was consistent with India's development policies and development needs as well as with Japanese ODA policies. The efficiency of this project is fair, as although the project cost was within the plan, the project period significantly exceeded the plan.

Regarding the operation and effect indicators of this project, such as the capacity operation rate of transmission lines and transformers and system availability, system availability mostly achieved its target values in 2017 (the project completion year). On the other hand, data could not be obtained by the executing agency for the capacity operation rate of transmission lines and transformers and therefore it was difficult to verify the level of achievement. However, the average capacity operation rate in 19 substations of the project was 72% in 2017 (the project completion year), which was verified to be lower than the target value of 75%. This means that the project substations were operated within their installed capacity and with enough remaining capacity. After the implemenation of this project, improvements such as increase in power supply time, stabiliztion of voltage fluctuation, and reduction in power outage hours and frequency were observed in the project target areas. For this reason, it was judged that the project objective of ensuring a stable power supply had been achieved. Also, this project had a certain positive impact on regional economic development through the reduction of operation and maintenance costs for backup power generators as well an increase in productivity and services for bulk electricity users in Gurgaon. Furthermore, there was an improvement of living standards in villages of the central part of Haryana state. No negative impact on the natural environment was observed, and land acquisition was appropriately executed in accordance with the related domestic laws and regulations of India. No resident resettlement was executed. Therefore, the effectiveness and impact of this project are high. Meanwhile, no major problem has been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

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

1. Project Description

Project Location


Sector 20 Substation (Gurgaon)

1.1 Background

The northern Indian state of Haryana includes Gurgaon, a neighbouring city of the capital Delhi, where an industrial cluster has rapidly developed. Many foreign companies, including those from Japan, already conduct their operations in the region. The economic growth rate of this region reached 12.6% in the fiscal year of 2005. As a result of this rapid growth, the power demand for the entire state rose on average at a rate of 11.8% per annum, from 3,465 MW in FY2003 to 4,837 MW in FY2006, and it was expected to continue to increase at about the same rate in the coming few years. To meet this demand, the state of Haryana planned to purchase electric power from other states as well as to develop new power sources. Meanwhile, the capacities of transmission lines and substations became tight with many facilities in the state's transmission grid due to the new construction of transmission lines and substations corresponding to the development of new power plants as well as the increase in power supply volumes. Therefore, there was an urgent need to expand the existing transmission and substation networks. As of February 2007, 57 Japanese companies had already moved into the state, and it had become a target area for the Delhi-Mumbai Industrial Corridor Project[1], meaning that the region could be expected to have more Japanese companies in the future. For this reason, the securing of a stable power supply through the implementation of this project would expect to have positive effects for these Japanese companies.

1.2 Project Outline

The objective of this project was to ensure a stable power supply to meet the rapidly growing power demand by developing an intra-state transmission and substation system in India's northern

[1] A regional development project agreed between the Japanese and Indian governments in 2006. This project aimed at developing one of the world's largest industrial zones between Delhi and Mumbai through the construction of an approximately 1,500km railway for cargo and the development of industrial estates and logistical hubs alongside the railway by using private funds.

state of Haryana, thereby contributing to economic growth and an improvement of living conditions in the region.

Loan Approved Amount/ Disbursed Amount	20,902 million yen / 11,809 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2008 / March 2008
Terms and Conditions	Interest Rate 0.65% Repayment Period 15 years (Grace Period) (5 years) Conditions for Procurement General Untied
Borrower / Executing Agency	Rural Electrification Corporation Limited (REC) / REC (Guarantee by the President of Republic of India) and Haryana Vidyut Prasaran Nigam Limited (HVPN)
Project Completion	February 2017
Main Contractors (Over 1 billion yen)	• K. Ramachandra Rao Transmission & Projects PVT. Ltd. (India)/SEW Infrastructure Ltd. (India) (JV) • Shreem Electric Ltd. (India) • K. Ramachandra Rao Transmission & Projects PVT. Ltd. (India)/Deepack Cables (India) Ltd. (India) (JV) • Cobra Instalaciones y Servicios S.A.(Spain)
Main Consultant (Over 100 million yen)	N.A.
Related Studies (Feasibility Studies, etc.)	Feasibility Study by REC and HVPN (March 2007)
Related Projects	• JICA, "Haryana Distribution System Upgradation Project" (March 2014) (Japanese ODA loan) • World Bank, "Haryana Power System Improvement Project" (2009-2017)

2. Outline of the Evaluation Study

2.1 External Evaluator

Keishi Miyazaki (OPMAC Corporation)

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: November 2017 – January 2019

Duration of the Field Study: February 11 – 28, 2018, June 17 – 23, 2018

3. Results of the Evaluation (Overall Rating: A[2])

3.1 Relevance (Rating: ③[3])

3.1.1 Consistency with the Development Plan of India

At the time of the appraisal, the Government of India had placed emphasis on new power supply development and strengthening of the transmission network in *the 10th Five-Year Plan* (April 2002 - March 2007), followed by *the 11th Five-Year Plan* (April 2007 - March 2012). A new power supply of 78,000 MW was planned together with the strengthening of the high voltage transmission network nationwide in order to supply power efficiently from the northern, north eastern and eastern regions where the power supply were centered, to other areas. The plan targeted a decrease in power transmission and distribution losses, which exceeded 30% in 2007, to 15% by 2012 through developing the transmission network. In addition, since 2001, the Government of India had executed *the Accelerated Power Development and Reform Program (APDRP)*, in order to decrease the high rate of transmission loss, and to promote efficiency in terms of facilities and finance for the power distribution sector. Furthermore, the Government of India established *Rajiv Gandhi Grameen Vidyutikaran Yojana (RGGVY)* in April 2005 for the promotion of rural electrification, which targeted secure power access for all households nationwide by 2009.

At the time of the ex-post evaluation, the Government of India stated in *the Three-Year Action Agenda* (FY2017/18-FY2019-20) starting from April 2017 that the energy sector was one of the important engines for economic growth and development, and listed the strengthening of power generation capacity as well as development of the transmission and distribution system as part of its action agenda for the period. In addition, *the Draft National Energy Policy*, which is currently under development, has the goal of providing power 24 hours a day for all households by 2022. A solid transmission and distribution infrastructure, an efficient power market and the improvement of the financial situation of the power distribution companies are listed as policies for the transmission and distribution sector.

The Haryana Five-Year Plan (2012-2017) stated the following as targets for the power sector: (1) enhancement of the power generation capacity, (2) enhancement, modernization and augmentation of the transmission and distribution network, (3) reduction of transmission and distribution loss to 15% by FY2019/20, and (4) enhancement of the financial capacity of the power distribution sector. The specific goal for the power distribution sector was to add a distribution capacity of 5,650 MVA at a 220kV level during the Five-Year Plan (investment amount of 307.6 million rupees).

As mentioned above, the importance of the development of the transmission and distribution system was often stated in the national development plan, energy policy and the Haryana State

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

Development Plan at the time of the appraisal as well as the ex-post evaluation, therefore it is considered to be relevant to this project.

3.1.2 Consistency with the Development Needs

At the time of the appraisal, Haryana state was experiencing rapid industrialization of Gurgaon, in the south, a neighbouring city of the national capital Delhi, and the increase in electricity demand which accompanied this economic growth was remarkable (as mentioned in *1.1 Background*)**.** It was expected that the power demand would continue to increase and the state attempted to enhance its power supply capacity by the development of new power supply as well as the purchase of power from out of state. There was an urgent need to expand the state's power transmission network in order to respond to the increasing power supply volume.

As for power supply in Haryana at the time of the ex-post evaluation, there had been a power shortage until FY2014/15. However the situation had improved since FY2015/16 as Independent Power Producers (IPPs) had led power supply development (Table 1). On the other hand, however, power supply shortages had been constant for peak power demand and supply, except for the FY2013/14 through FY2016/17, and this was expected to continue in the future (Table 2). Although approximately 50% of the electricity in Haryana state was generated by the public power corporation of the state, the rest was dependent on power purchase from the national power company, the National Thermal Power Corporation (NTPC) and IPPs.

Table 1: Power Supply-Demand in Haryana

Unit: MU

Fiscal Year	Energy Requirement	Energy Availability	Energy Deficit/Surplus
2009/10	33,441	32,023	-1,418 (-4.2%)
2010/11	34,552	32,626	-1,926 (-5.6%)
2011/12	36,874	35,541	-1,333 (-3.6%)
2012/13	41,407	38,209	-3,198 (-7.7%)
2013/14	43,463	43,213	-250 (-0.6%)
2014/15	46,615	46,432	-183 (-0.4%)
2015/16	51,901	70,543	18,642 (+35.9%)
2016/17	56,350	72,426	16,076 (+28.5%)
2017/18	61,380	73,872	12,492 (+20.4%)
2018/19	66,821	75,102	8,281 (+12.4%)

Source: HVPN
Note 1: Estimation for FY 2015/16-2018/19.
Note 2: 1 MU (Mega Unit) = 1 GWh = 1,000 MWh

Table 2: Peak Power Supply-Demand in Haryana

Unit: MW

Fiscal Year	Energy Requirement (At Peak Hours)	Energy Availability (At Peak Hours)	Energy Deficit/Surplus (At Peak Hours)
2009/10	6,133	5,678	-455 (-7.4%)
2010/11	6,142	5,554	-588 (-9.6%)
2011/12	6,767	6,443	-324 (-4.8%)
2012/13	8,086	6,725	-1,361 (-16.8%)
2013/14	8,114	8,114	0 (0%)
2014/15	9,152	9,152	0 (0%)
2015/16	9,113	9,113	0 (0%)
2016/17	9,262	9,262	0 (0%)
2017/18	11,126	9,773	-1,353 (-12.1%)
2018/19	12,112	9,967	-2,145 (-17.7%)

Source: HVPN
Note: Estimation for FY2015/16-2018/19.

Haryana state attempted to expand its power transmission and distribution facilities along with further development of power generation in order to respond to the vigorous power demand, mostly in the southern part of the state, which includes the Gurgaon region. As of the end of August 2017, the number of substations managed by HVPN was 418, and the total extension of power transmission lines was approximately 15,000 km. According to the HVPN *Capacity Addition Program* (2016-2022), the development of 75 new substations, the augmentation of 328 substation, and the installation of 1,560 km of power transmission lines were planned. This includes the construction of 17 new substations, the augmentation of 45 existing substations and the installation of 191 km power transmission lines in the Gurgaon.

As mentioned above, the lessening of power shortages at peak hours in Haryana state remained a priority at the time of both the appraisal and the ex-post evaluation, therefore the development needs for this project was high.

3.1.3 Consistency with Japan's ODA Policy

At the appraisal, the *Country Assistance Policy for India* (established in May 2006) listed the promotion of economic growth as a priority target, and emphasized support for infrastructure development contributing to economic growth led by private investment through an improvement in the investment environment in India. Emphasis was particularly placed on support for the electric power and transportation sectors. The policy included (1) the development of power generation to increase the power supply, (2) the development of the power transmission and distribution network for a stable and efficient power supply, and (3) organizational reform targeting the improvement of project effectiveness in the electric power sector as well as enhancement of capacity building such as human resource development.

JICA's (former JBIC's) *Medium-Term Strategy for Overseas Economic Cooperation Operations* (April 2005-September 2008) listed support for poverty reduction and fundamental

development for sustainable growth as its overall priority area, and development of the economic infrastructure as its priority area for India. Also, the electricity was positioned as the main sector for support in India in JICA's (former JBIC's) *Country Assistance Strategy for India in FY2006*. Support was planned for (1) the development of new power generation to increase the power supply volume and power transmission and distribution network to stabilize the power supply, and (2) the development of power distribution network and rural electrification in order to vitalize the economy and reduce poverty through a stable power supply.

As seen above, the objective of this project is to provide a stable power supply in order to respond to a rapidly increasing power demand through the development of the transmission network in Haryana state, which was relevant to Japan's ODA policy at the time of appraisal.

In light of the above, this project has been highly relevant to India's development plan and development needs, as well as to Japan's ODA Policy. Therefore, its relevance is high.

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project outputs were the installation of 492 km of power transmission lines (including the construction of a transmission tower) and the construction and augmentation of 220 kV substations in 14 locations. However, the actual outputs were the installation of 582.7 km of power transmission lines and the construction and augmentation of 220 kV substations in 13 locations, as well as 132 kV substations in 6 locations (a total of 19 substations) which exceeded the project outputs (Table 3). The details of the actual inputs are shown in Table 1. Although there were some changes such as the cancellation of or additions to parts of the subproject, these changes were made in order to respond to demand predictions, changes in the needs for power needs and problems of land acquisition in the target areas, therefore they were considered to be appropriate when compared to the project objective (Table 4).

Table 3: Project Outputs (Plan/Actual)

Items	Plan	Actual
(1) Procurement and installation of the power transmission lines, transmission tower, and related equipment	Total length of transmission lines: 492 km	Total length of transmission lines: 582.7 km
(2) Procurement and installation of transformer, substation related equipment (circuit breakers, switching, current transformers, arresters, insulators, etc.)	220kV substations: 14 locations	220kV substations: 13 locations 132kV substations: 6 locations

Source: Documents provided by JICA and HVPN
Note: There were some changes in the length of transmission lines for some subprojects in the original project scope. However, Table 3 does not indicate the details of the changes in length of transmission lines in each subproject.

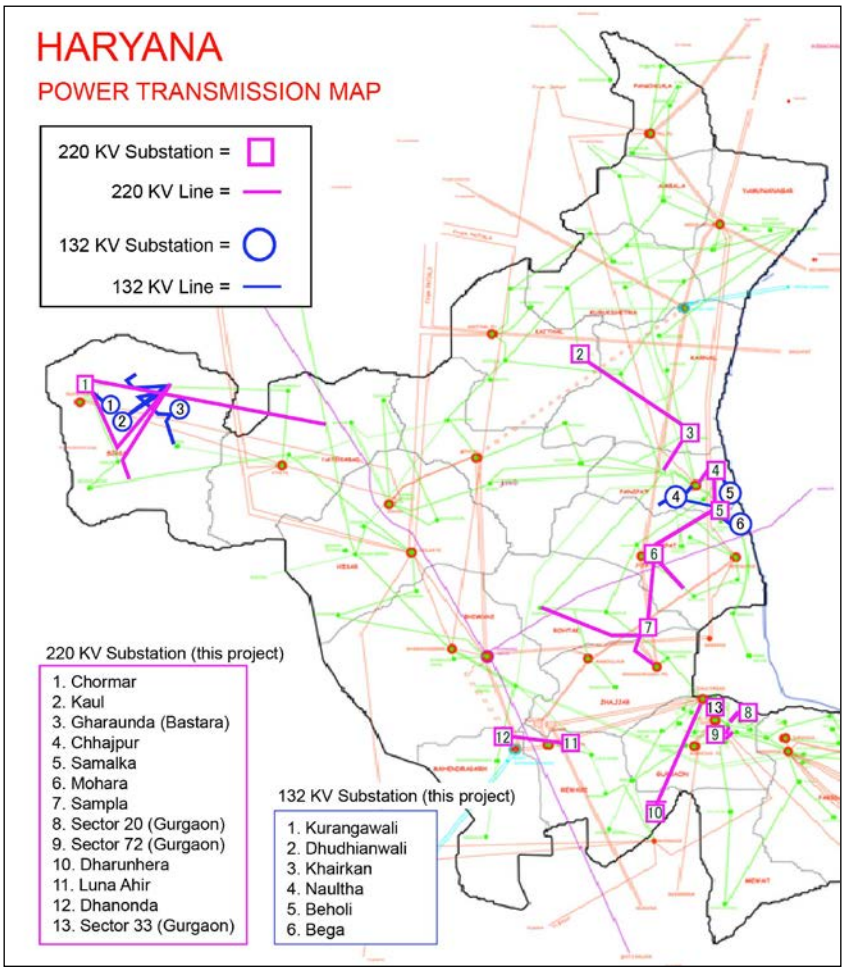
Table 4: Changes in Project Outputs

Items	Changes	Details
Cancelled subprojects	5 subprojects	220kV substations: 2 locations (2 subprojects) 220kV transmission lines: 82 km (3 subprojects)
Additional subprojects	2 subprojects	220kV substation: 1 location (1 subproject) 132kV substations: 6 locations (6 subprojects) 220kV power lines: 1.7 km (2 subprojects) 132kV power lines: 119.3 km (9 subprojects) 66kV power lines: 7.4 km (2 subprojects)

Source: Documents provided by HVPN

The procurement of contractors for transmission lines and substation equipment was planned to be undertaken by 10 procurement packages through international competitive bidding. However, in the end, the number of packages increased to 14 (if the sub-packages spilt from the existing package are included, the total number of packages was 18). No consultant supporting the project implementation was employed for this project.

As for the structure of project implementation, the project steering committee, consisting of the related departments from REC and HVPN, was held every 6 months in order to implement the project smoothly, and project monitoring, decision making and coordination between related departments was carried out. The REC Haryana office in Panchkula took charge of daily monitoring of the project. The REC then reviewed the monthly progress reports submitted by HVPN, and if any problem arose, discussion between REC and HVPN took place. In addition, staff of the JICA India office visited the project sites every six months or one year, regular meetings were held with HVPN, and monitoring was carried out to confirm progress.



Source: HVPN

Figure 1: Project Sites

As already mentioned, this project has newly constructed or expanded substations in 19 locations and constructed 582.7km of power transmission lines. These are equivalent to 4.5% of HVPN's overall substation facilities and 5.6% of the total power transmission lines (there were 418 substations and a total of approximately 15,000km power transmission lines in total in HVPN as of the end of August 2017).

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 18,532 million yen against the planned cost of 26,364 million yen (ratio against the plan: 70%). This was within the plan (Table 5).

Table 5: Project Cost (Plan/Actual)

Items	Plan			Actual		
	Foreign Currency (Mill. Yen)	Domestic Currency (Mill. Yen)	Total (Mill. Yen)	Foreign Currency (Mill. Yen)	Domestic Currency (Mill. Yen)	Total (Mill. Yen)
Substations	9,925	0	9,925	0	7,537	7,537
Transmission Lines	9,018	0	9,018	0	7,384	7,384
Price Escalation	964	0	964	0	0	0
Contingency	995	0	995	0	0	0
Subtotal	**20,902**	**0**	**20,902**	**0**	**14,921**	**14,921**
Administration Cost	0	1,045	1,045	0	664	664
Tax (VAT and Duties)	0	2,508	2,508	0	1,593	1,593
Land Acquisition Cost	0	1,524	1,524	0	968	968
Interest during Construction	260	0	260	260	0	260
Commitment Charge	125	0	125	125	0	125
Total	**21,287**	**5,077**	**26,364**	**385**	**18,147**	**18,532**

Source: Documents provided by JICA and HVPN

Although there were additional outputs, the actual project cost was within the plan. This was mostly because of the 36% change in the exchange rate that was used to calculate the actual project cost (the yen appreciated 36% more against the rupee). For reference, if the actual project cost is calculated using the exchange rate from the time of appraisal (1 rupee = 2.85 yen), the result it 28,959 million yen, which is 109.8% against the plan. In addition, when the project cost is compared with rupees, the actual project cost was 10,723 million rupees (1 rupee = 1.81 yen) (average for 2008-2016) against the planned cost of 9,251 million rupees (1 rupee = 2.85 yen), which is 116% against the plan.

3.2.2.2 Project Period

The actual project period was 108 months (from March 2008 to February 2017) against a planned project period of 30 months (from March 2008 to August 2010) (ratio against the plan: 360%), therefore the actual exceeded the planned.

The project consisted of 14 procurement packages (total of 18 packages to include the splits in existing packages), and packages 1, 3, 11, 12, 13 and 14 exhibited significant delays of more than 4 years. For package 1, despite prior approval, there was a subway construction within part of the target section of the power transmission lines which made it difficult to secure Right-of-Way, meaning that a change in the route of the target section had to be made. For package 3, although one of the three target substations was almost completed, installment of the control room was delayed due to a delay in land acquisition. For package 11, although the construction of two 220 kV substations was originally planned in Sector 20 and Sector 57 of Gurgaon, the forecast for power demand in the target area was lower than expected. Therefore, the Sector 57 construction was excluded from the target scope, and bidding was carried out again. The delay was also due to the fact that it required some time to conduct contract negotiation among

suppliers for the selection of equipment for substations. Further delay was taken place in civil works caused by a change in the method of foundation construction because of soft ground. Packages 12, 13, 14 were additional scopes, and therefore, the bidding for each package started at the beginning of 2013. This caused the main construction works to drag on after 2013. Because of these delays, the loan expiry date was extended from September 2014 to March 2016.

The common causes of delays for other packages are as follows, listed in order of frequency: (1) delay accompanying land acquisition, (2) delay accompanying the acquirement of Right-of-Way and (3) performance of contractors. Most of the land acquired for this project was public property owned by so called Panchayat, traditional rural autonomous organizations in India. According to HVPN, conventionally, when Panchayat land was acquired for a project, there were many cases where the community understood the necessity for land acquisition and provided the land for free. They also received many benefits from the newly constructed substations. However, because there was a change in the procedure for land acquisition as well as changes in the awareness of people, in recent years it became necessary to provide financial compensation for Panchayat land which also meant that more time was required for the compensation procedure.

3.2.3 Results of Calculations for Internal Rates of Return (Reference Only)

(1) Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) of this project was 5.6% at the appraisal. The preconditions for the FIRR calculation are shown in Table 6. The recalculation of the FIRR was made at the time of the ex-post evaluation by applying the same precondition at the appraisal, which turned out to be 6.0%, exceeding the original FIRR value. This was because the actual project cost was lower than the planned project cost. Also, if the FIRR were to be recalculated assuming that the project life starts from the signing of the loan agreement, the FIRR would be 5.2% at the appraisal and 4.9% at the ex-post evaluation. It is because the period after project completion would be shorter in the project life and the benefits scaled down due to the prolonged project implementation period.

Table 6: The Financial Internal Rate of Return (FIRR) at the Project Appraisal

Items	
Financial Internal Rate of Return (FIRR)	5.6%
Costs	Project cost, Maintenance cost
Benefits	Increase of revenue from transmission tariffs, increase of revenue from reduction of transmission loss
Project Life	30 years after project completion

Source: Documents provided by JICA

(2) Economic Internal Rate of Return (EIRR)

The Economic Internal Rate of Return (EIRR) of this project was 33.2% at the appraisal. The preconditions for the FIRR calculation are shown in Table 7. The recalculation of the EIRR was made at the time of the ex-post evaluation by applying the same precondition as at the appraisal, which turned out to be 24.6%, falling below the original EIRR value. This was because the timing of the production of the benefits was delayed due to the prolonged project implementation period. Also, if the EIRR were to be recalculated assuming that the project life starts from the signing of the loan agreement, the EIRR would be 33.2% at the appraisal and 24.5% at the ex-post evaluation. This is because the period after the project completion would be shorter in the project life and the benefits would be scaled down due to the prolonged project implementation period.

Table 7: The Economic Internal Rate of Return (EIRR) at the Project Appraisal

Items	
Economic Internal Rate of Return (EIRR)	33.2%
Costs	Project cost (excluding tax), Maintenance cost
Benefits	Effect on incremental power transmission volume, effect on the reduction of transmission loss, effect on saving costs for alternative power generation
Project Life	30 years after project completion

Source: Documents provided by JICA

In light of the above, although the project cost was within the plan, the project period exceeded the plan significantly. Therefore, the efficiency of this project is fair.

Substations and Transmission Facilities built by the Project

Bastara Substation

Shamalhka Substation

Power Line (Samalhka Substation)）

Sector 20 Substation (Gurgaon)
Gas Insulated Switchgear (GIS)

Sector 72 Substation (Gurgaon)

Transmission Lines (Gurgaon)

3.3 Effectiveness and Impacts[4] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

For the operation and effect indicators for this project, the capacity operation rate of the transmission lines and transformers and the system availability were established, each with a target value of two years after project completion. Meanwhile, because this project was completed in February 2017 when the construction of the Sector 20 Substation in Gurgaon was completed, this was set as the year of project completion at the time of the ex-post evaluation in 2017. Therefore the two years post project completion for which the target value was set is 2019. Thus, the actual value for each indicator was analyzed as of 2017 at the ex-post evaluation while referring to the target value for two years after project completion (2019). The actual value for each indicator is shown in Table 8.

Table 8: Operation and Effect Indicators

Unit: %

Indicator	Baseline	Target	Actual	
	2007	2012	2016	2017
		2 years after project completion		Year of project completion
Capacity Operation Rate				
Transmission Lines	60	60	N.A.	N.A.
Transformers	83	75	N.A.	N.A.
System Availability	99.6	98.0	99.04	98.7

Sources: Documents provided by JICA and HVPN

Note 1: The above indicator is the value for the entire Haryana state. The target values are those with estimated increase in power generation volume.

Note 2: The capacity operation rate of the transmission lines is the percentage of the peak load against the designed capacity of the transmission lines. That of the transformers is a percentage of the peak demand against the installed capacity of the substations.

Note 3: The actual value of the system availability in 2016 shows the data for 12 months from April 2016 to March 2017 and the actual value in 2017 shows the data for 4 months from April 2017 to July 2017 (The fiscal year in India is from April to March).

As for the capacity operation rate of the transmission lines and transformers for which the value for the entire Haryana state was assigned, actual data from HVPN could not be obtained as it was not possible for HVPN to formulate this indicator with the same definition. Instead, data for the capacity operation rate was obtained from 19 substations of the project. Although there were some differences in operational conditions depending on the circumstances of each substation, the average capacity operation rate in these 19 locations was 72% in 2017 (the year of project completion) (Table 9). This is lower than the target value of 75% established by the operation and effect indicator for the two years post project completion (2019). This means that these 19 substations were operating within their installed capacity with enough remaining

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

capacity. The capacity operation rate at Sampla substation from 2013-2015 exceeded 100%. In this case, normally, nearby substations provide backup for such overloaded substations by taking a detour to other substations temporarily in order to prevent overload of a specific substation.

Table 9: Capacity Operation Rate of the Project Substations

Unit: %

Substation	2011	2012	2013	2014	2015	2016	2017	Completion
220 kV Substation								
Chormar	N.A.	67.04	72.18	70.90	60.95	73.90	67.61	Sep. 2011
Kaul	37.00	44.00	49.00	94.00	96.00	81.00	79.00	May 2016
Gharaunda (Bastara)	92.0	90.00	90.00	90.00	92.00	92.00	96.00	May 2016
Chhajpur	98.00	90.00	84.00	92.00	98.00	96.00	95.00	May 2016
Samalka	73.60	93.60	69.00	85.50	71.20	87.10	90.00	Mar. 2011
Mohana	52.00	68.00	84.00	55.50	81.20	95.60	96.00	Mar. 2011
Sampla	45.56	93.73	107.16	105.38	103.10	63.21	72.96	Mar. 2011
Dharunhera (Mau)	83.94	57.79	91.43	95.15	93.17	82.73	78.65	Oct. 2011
Luna Ahir	N.A.	N.A.	53.62	73.28	63.74	73.28	71.95	Nov. 2011
Dhanonda		N.A.	26.20	52.29	55.53	56.10	62.40	Nov. 2011
Sector 20 (Gurgaon)	―	―	―	―	―	―	37.30	Feb. 2017
Sector 33 (Gurgaon)	N.A.	N.A.	N.A.	N.A.	N.A.	N.A.	48.00	Oct. 2011
Sector 72 (Gurgaon)	25.90	28.60	31.00	40.00	45.80	61.00	67.30	Nov. 2011
132 kV Substation								
Kurangawali	N.A.	33.82	55.76	39.00	47.84	43.57	39.61	July 2011
Dhudhianwali	N.A.	96.88	97.80	90.50	88.22	82.28	81.36	July 2011
Khairkan	N.A.	53.48	57.14	57.14	44.08	49.97	62.16	July 2011
Naultha	57.70	57.70	66.80	74.80	80.10	74.80	74.80	Oct. 2010
Baholi	75.00	75.00	37.00	80.00	80.00	91.00	93.00	Oct. 2010
Bega	57.60	60.00	57.00	67.00	53.00	51.00	58.40	Oct. 2010

Source: HVPN

For system availability, the actual value in 2017 was 98.7%, almost achieving the target value of 98% set for the two years after project completion (2019). The system availability of 98% means that there was hardly any power shortage, and that the operational status was good. Meanwhile, the Haryana Electricity Regularity Commission (HERC) established its annual target value for system availability of the transmission system (Table 10). In comparison with this, the actual system availability of HVPN mostly achieved the target value of HERC for each year. In addition, although power transmission loss in 2008 (at appraisal) was 2.57% (already sufficiently low), it is further improved to 2.31% in 2016 and 2.20% in 2017.

Table 10: Comparison with System Availability and Target Value set by the HERC

Unit: %

Year	System Availability		Transmission Loss (HVPN Actual Value)
	HERC Target Value	HVPN Actual Value	
2008	N.A.	99.57	2.57
2009	N.A.	99.39	2.68
2010	N.A.	99.59	2.63
2011	N.A.	99.56	2.76
2012	N.A.	99.67	2.49
2013	98.5	99.72	2.73
2014	98.8	99.13	2.61
2015	99.0	98.29	2.69
2016	99.2	99.04	2.31
2017	98.8	98.71	2.23

Source: HVPN
Note 1: HERC: Haryana Electricity Regularity Commission
Note 2: The HVPN Actual Value in 2017 shows 4 months of data from April to July 2017.
Note 3: N.A. means that the target value was not set.

3.3.1.2 Qualitative Effects (Other Effects)

(1) To Ensure Stable Power Supply

<Distribution Corporation>

According to key informant interviews with the Haryana Northern Power Distribution Company (UHBVN) and the Haryana Southern Power Distribution Company (DHBVN)[5], the stability of the power supply as well as voltage from HVPN had improved in the project target areas after project implementation.

<Bulk Electricity Users in Gurgaon>

Key informant interviews were carried out with six bulk electricity users which received a direct power supply through 66 kV and 11 kV feeder lines from the 220 kV substations of Sector 20 in Gurgaon. Of the six companies, two were manufacturers (steel and iron processing), and the others were a soft drink bottling factory, a hotel, a large-scale shopping mall, and a rental office building company. The following were seen in all six bulk users: (1) an increase in the power supply time (increased from 20-23 hours/day to 23.5-24 hours/day), (2) stable voltage fluctuation, and (3) a decrease in power outage hours and frequency (decreased from 1-5 hours/day to 0-0.5 hours/day). For these companies, because there was a distance from the nearest substations to their business facilities, the feeders between them were 2.5-8.0 km long with many branch points. It was for this reason that there were issues such as transmission loss, voltage fluctuation and accident blackouts. However, after the project constructed a 220kV substation at Sector 20, the feeder distances from the substation to each business facility decreased to 0.5-1.0 km, making a more stable power supply in terms of

[5] An ODA loan "Haryana Power Distribution Facility Improvement Project" (March 2014) is being implemented in Haryana, with UHBVN and DHBVN as executing agencies.

quality and quantity possible. The six bulk electricity users were generally satisfied with the current power services.

<Villages in Central Haryana >

Key informant interviews were carried out with representatives of seven villages in the target regions of four 220 kV substations (Sampla substation, Mohana substation, Samalka substation and Chhajpur substation) constructed by the project in Central Haryana. The seven villages[6] had already been electrified before project implementation and their household electrification rates were at a fairly high level. The key informant interviews revealed the following: (1) increases in power supply time (increased from 6-12 hours/day to 12-18 hours/day) (one village had been receiving power supply for 24 hours/day), (2) stable voltage fluctuation, and (3) decreases in malfunctions from overload and low voltage. A 220 kV substation was constructed close to the villages and thus the reliability of the power distribution system for the 132 kV substations and the rest increased. This resulted in an improved stable power supply in terms of quality and quantity. The seven villages were satisfied with the current power services.

<Local Industrial Organizations>

A key informant interview was carried out with the Chamber of Industry of Udyog Vihar, a local industrial organization in Gurgaon. The Chamber of Industry has 400 member companies (manufacturers, IT, rental office business, etc.) that operate in the Udyog Vihar area (Phase 1-5[7] in Gurgaon where the Udyog Vihar industrial complex is located). The 220kV substation completed by this project at Sector 20 distributes power to the Phase 1-3 areas in Gurgaon, where 25% of the industrial clusters belonging to the Chamber of Industry are concentrated. There are 45-50 member companies located in Sector 20.

According to the Chamber of Industry, after the construction of the 220 kV substation in Sector 20 as well as the transmission facilities between Sector 20 substation and Sector 23 substation, power status in Sector 20 and Sector 23 improved, with significant improvement in the 11 kV distribution lines in Sector 20. However, during the summer months from May to July when the power demand was at its peak, the power supply to general households had a higher priority, therefore the power supply for industries was limited to 7-8 hours a day. For this reason, the issue of responding to peak demand remains a challenge in the power sector of Haryana state.

[6] The target villages are (i) Chulkana Dham, (ii) Chhajpur, (iii) Garhi Sampla, (iv) Garhi Hakikat, (v) Jaji, (vi) Naina Tatarpur, and (vii) Maachhri.

[7] In Gurgaon, the largest unit of a lot is called a “Phase”, and then there is a “Sector” which is a subordinate unit of a Phase.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(a) Regional Economic Development

According to the key informant interviews with six bulk electricity users who receive direct power supply from the 220 kV substation at Sector 20 in Gurgaon, the bulk users had to use their in-house power generators (diesel powered generation) on a daily basis due to the regulation of power supply time and frequent accident blackouts. The operation and maintenance costs of this were burden to them. However, after the construction of the 220 kV substation at Sector 20, in-house power generators were no longer needed thanks to the stable power supply. Therefore, the costs of in-house generators were cut. The range of cost savings vary depending on the customer's power usage, but for example, a large-scale shopping mall could save 12,500,000 rupees/month (approximately 20 million yen/month). In addition, the repair costs for the feeder cables from the substation to each business facility was borne by the customers, but as cable malfunction was almost eliminated after project implementation, these expenses have decreased, meaning a reduction in the customers' financial burden. The customers' administrative burden for the maintenance of in-house power generators has also been reduced.

Also, a large-scale shopping mall and a rental office building company charged the electricity bill to their tenant companies which included additional cost for their in-house power generators. After the reduction of the above additional cost, the financial burden of the tenant companies relating to the electricity bill was reduced.

Because a more stable power supply has been attained, there have been positive impacts on the productivity and improved service of corporate customers. There has been an increase of 5% in sales and production in the iron manufacturing industry. At a hotel, in-house power generation automatically switches on in the case of a power outage, although there has been a time lag of tens of seconds to a few minutes. Although this has caused complaints from customers coming from developed countries, such complaints have decreased.

(b) Improvements in Living Standards

According to the key informant interviews with representatives of seven villages in the target region of four 220 kV substations (same seven villages referred in "3.3.1.2 Qualitative Effects"), positive impacts have been seen in all of the villages as a result of an increased power supply period and stable voltage fluctuation. These have included (1) improved access to information through TV, radio, mobile phones or the internet, (2) improvement in educational opportunities as the result of students being able to study at home at night, (3) a reduction in domestic work hours as the result of the use of home electrical appliances, and (4) improved safety at night.

However, the above impacts may have come not only from the project but also from improvements in the related power distribution facilities.

3.3.2.2 Other Positive and Negative Impacts

(1) Impacts on the Natural Environment

This project fell under category B in *the Guidelines for Confirmation of Environmental and Social Considerations* (established in April 2002) as it was considered that the project was not likely to have significant adverse impact on the environment due to the fact that the project sector and project characteristics were not likely to exert impact and the project was not located in a sensitive area. Therefore, potential adverse environmental impacts of the project were not likely to be severe. An Environmental Impact Assessment (EIA) for this project was not required by Indian domestic law.

During project implementation, the contractor took the necessary mitigation measures in order to reduce negative impacts on air, noise, water quality and soil erosion. Monitoring of the environment impact of the noise during the construction period was also carried out by HVPN. Meanwhile, environmental monitoring after the project completion has not been carried out by HVPN as it is not required by law. The purpose of this project was to develop substations and power transmission lines, and no air pollution, noise, deterioration of water quality or soil erosion is expected through the operation of project facilities. No negative impact on the natural environment is expected in the future. According to HVPN, no negative impact on the natural environment has been reported nor have there been any particular complaints from nearby residents caused by project implementation.

Therefore, no negative impact on the natural environment has been observed.

(2) Land Acquisition and Resettlement

Although land acquisition of 97.5 ha was planned at the appraisal, the actual land acquisition area was 106.29 ha (Table 11). The reason for the 8.79 ha increase in the land acquisition area was the increase in the number of substations as the result of the additional scope. Most of the acquired land was a public property owned by the Panchayat, traditional rural autonomous organizations, with only 4 ha of land acquisition from private property. In addition, compensation for agricultural products was provided for the acquisition of the Right-of-Way for the power transmission lines. The above land acquisition was undertaken appropriately in accordance with the related laws and regulations of Haryana state. There was no resettlement of residents related to this project.

Table11: Actual Value for the Land Acquisition Areas

Substation		Land Acquisition Areas (Actual Value) Hectare	Note
220 kV Substation	Chormar	8.26	Panchayat
	Kaul	6.07	Panchayat
	Gharaunda (Bastara)	6.47	Panchayat
	Chhajpur	5.07	Panchayat
	Samalka	6.07	Panchayat
	Mohana	10.12	Panchayat
	Sampla	3.24	Panchayat
	Dharunhera (Mau)	9.06	Panchayat
	Luna Ahir	9.64	Panchayat
	Dhanonda	17.60	Panchayat: 13.6 ha, Public Property: 4 ha
	Sector 20 (Gurgaon)	3.89	Panchayat
	Sector 33 (Gurgaon)	0.97	Panchayat
	Sector 72 (Gurgaon)	4.62	Panchayat
132 kV Substation	Kurangawali	2.75	Panchayat
	Dhudhianwali	2.33	Panchayat
	Khairkan	2.79	Panchayat
	Naultha	2.83	Panchayat
	Baholi	2.89	Panchayat
	Bega	1.62	Panchayat
Total		**106.29**	

Source: HVPN

Regarding the operation and effect indicators, system availability mostly met its target value and the average capacity operation rate for 19 substations of the project also achieved the target value. There were improvements such as an increase in the power supply time, stable voltage fluctuation, and a decrease in power outage hours and frequency in the project target area following project implementation. Therefore, it is judged that the project objective of securing a stable power supply was achieved. This project also had a certain positive impact on regional economic development through the reduction of operation and maintenance costs for backup power generators as well as the increasing productivity and services for bulk electricity users in Gurgaon. Furthermore, there was an improvement in living standards for villages in the central part of Haryana state.

In light of the above, this project largely achieved its objectives. Therefore, the effectiveness and impacts of this project are high.

3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspect of Operation and Maintenance

HVPN is the operation and maintenance institution of this project, and its technical department is responsible for the operation and maintenance of the project facilities. There were 3,740 staff

in HVPN as of the end of May 2018. Although the current number of HVPN staff does not fulfil the authorized number of positions of 10,480, HVPN outsources approximately 3,000 external staff to execute its duties. The HVPN organizational chart is shown in Figure 2.

There are approximately 10-20 staff allocated at each 220 kV and 132 kV substation depending on its scale. There, the persons in charge of substations (junior engineers) possess diplomas (polytechnic), the operators, maintenance staff, and the linemen have graduated from Industrial Training Institutes, and assistant workers possess a high school diploma. On the other hand, the Chief Engineer, Superintending Engineer, Divisional Engineer and Assistant Engineer who manage and supervise the entire operation and maintenance of the substations and power transmission facilities possess a bachelor's degree. When accidents happen at a project facility (substations and power transmission facilities), it is mainly the field staff at each substation who respond to them. However, there is a system whereby technical staff from nearby substation, regional offices or the headquarters can be sent for support as needed.

As described above, although the number of HVPN staff does not fulfill the authorized number of positions, the shortfall is supplemented by the hiring of outsourced staff. HVPN requests approximately 1,400 new staff from the state government and continuously works on increasing the number of its staff members. Staff who possess a certain level of technical qualification are allocated to each substation, and there have been no obstacles in their work so far.

Therefore, no major issues have been observed in terms of the institutional aspects of operation and maintenance.

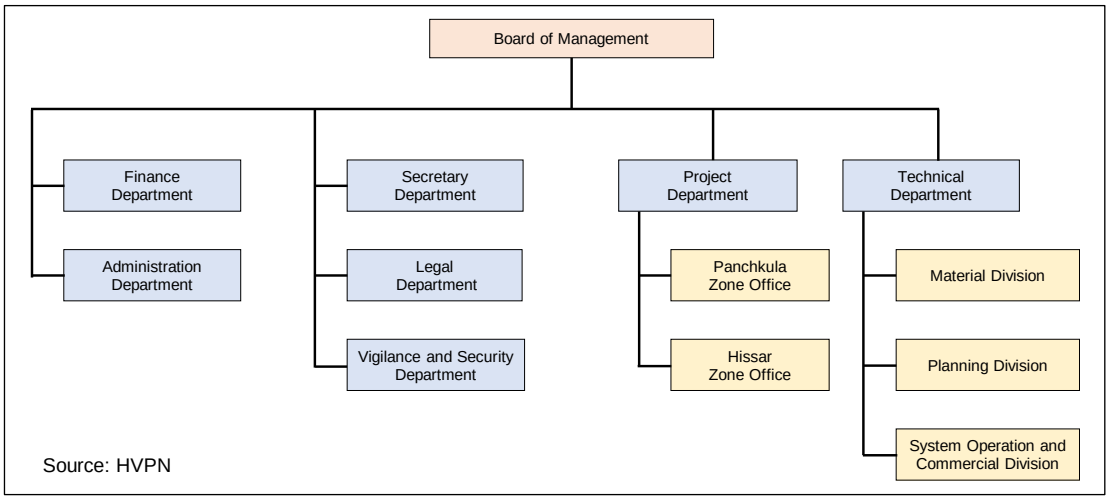


Figure 2: HVPN Organogram

3.4.2 Technical Aspect of Operation and Maintenance

HVPN has introduced a performance management system[8] in order to evaluate the technical skills of the operation and management staff. It has an inhouse training institution, the "HVPN Power Training Institute", and it carries out training programs in various fields every year, including operation and maintenance training for substation and power transmission facilities, safety management and disaster prevention training, financial management training, computer and IT skills training, freshman training, and management training. The staff to be trained include technical staff as well as officials in administrative departments such as accounting/auditing, human resource development and legal affairs. Table 12 shows the training record for the past five years.

Table 12: The Training Record of HVPN in the Past Five Years

Fiscal Year	Number of Training Days	Number of Participants (Total Number of Persons)
2013/14	177	592
2014/15	175	826
2015/16	243	1,180
2016/17	107	591
2017/18	177	990

Source: HVPN
Note: For FY 2017/18, the data period is from April 2017 to February 2018 (11 months).

The operation and maintenance of the substations and power transmission facilities is implemented based on the operation and maintenance manual. Each substation and power transmission facility has its own inspection manual, which defines the inspection items and schedule in detail according to facility and equipment type. Checkups and inspections are carried out according to the manual. This project has introduced gas insulated switchgear (GIS) in the Sector 20 substation and the Sector 33 substation in Gurgaon. HVPN has had experience in the operation and maintenance of GIS for over seven years in other substations and therefore there is no issue in this regard.

Therefore, no major issues have been observed in terms of the technical aspects of operation and maintenance.

3.4.3 Financial Aspect of Operation and Maintenance

According to the head of the HVPN finance department, income and expenditure was in deficit until FY2014. However, as the result of the approval of a new power transmission tariff with price increases by the Haryana Electricity Regulatory Commission (HERC) following the general election of the state assembly in October 2014, the balance has been in profit since

[8] An management method to promote the sustainable growth of enterprises and individuals by aiming at achieving business goals and promoting motivation and the capacity of employees.

FY2015. Table 13 shows a comparison of the income and expenditure of each state electric corporation (power generation, power transmission and power distribution) in Haryana state between FY 2013/14 and FY 2016/2017.

Table 13: Income and Expenditure of Each State Electric Corporation (Power Generation, Power Transmission, and Power Distribution) in Haryana State

Unit: 10 million rupees

Fiscal Year	Haryana Power Generation Company	Haryana Power Transmission Company	Haryana Northern Power Distribution Company	Haryana Southern Power Distribution Company	Total
2013/14	-26.31	-175.14	-1,465.00	-2,089.00	-3,755.45
2014/15	104.77	-8.42	-1,481.00	-636.00	-2,020.65
2015/16	27.08	153.98	-465.00	-480.00	-763.94
2016/17	-32.29	74.99	-204.22	-11.96	-173.48

Source: HVPN
Note: FY 2016/17 is a predicted value.

The actual record of the operation and maintenance budget of the power transmission facilities (FY 2012-2016) is shown in Table 14. Although repair costs for the power transmission facilities temporarily increased in FY 2014/15, the operation and maintenance costs had a steady growth every year except for that year. According to HVPN, the operation and maintenance budget is sufficiently secured.

Table 14: Operation and Maintenance Budget of the Power Transmission Related Facilities

Unit: 10 million rupees

Fiscal Year	Power Transmission Facility	Haryana Power Station	Total
2012/13	1,371.08	145.66	1,516.74
2013/14	1,555.50	142.52	1,698.02
2014/15	3,983.26	82.98	4,066.24
2015/16	1,812.10	54.47	1,866.57
2016/17	2,325.64	60.03	2,385.67

Source: HVPN

The key financial data of HVPN (FY 2014/15-2016/2017) is shown in Table 15. Profitability has improved as shown in the increased rate of return on total assets since turning profitable due to the rise in electricity prices in 2015. Although, as it is in its 50 percent level, the current ratio showing the ability to pay is low, the equity to assets ratio is improving annually thanks to the annual increases of capital stock by the government of Haryana. In order to sustain this trend, electricity tariffs must be increased according to the HVPN investment plan.

Table 15: HVPN' Financial Data

Unit: 10 million rupees

Item	FY 2014/15	FY 2015/16	FY 2016/17
(1) Total Assets	989,352.02	1,022,684.66	1,043,657.52
(2) Current Assets	58,561.55	50,703.49	82,426.99
(3) Current Liabilities	115,424.12	126,711.20	149,435.36
(4) Capital	193,671.57	214,877.57	234,877.58
(5) Sales	137,764.15	169,746.45	169,823.13
(6) Net Profit	-842.01	15,285.58	6,925.69
Rate of Return on Total Assets (%) [(6) / (1) x 100]	0.99	1.49	0.66
Return on Sales (%) [(6) / (5) x 100]	-0.61	9.00	4.08
Total Assets Turnover (times) [(5) / (1)]	0.14	0.17	0.16
Current Ratio (%) [(2) / (3) x 100]	50.74	40.02	55.16
Equity to Assets Ratio (%) [(4) / (1)x100]	19.58	21.01	22.51

Source: HVPN

As for the power transmission tariff, the HPVN makes an application to the HERC which approves the new electricity tariff after careful examination. The HERC has approved the multi-year electricity tariff for the 3 years (including price adjustments every year) since 2015. The HERC compares the Annual Revenue Requirement[9] submitted by HVPN with its actual record, and makes the adjustment every year. In this case, the HERC is evaluating the benchmark of the HVPN performance achievement rate (system availability and transmission loss for power transmission) which is set in advance, and providing incentives to HVPN such as provision of additional funds equivalent to a certain percentage of its sales once the benchmarks are achieved. Tariff review has been conducted every year since 2015.

Therefore, no major issues have been observed in terms of the financial aspects of operation and maintenance.

3.4.4 Status of Operation and Maintenance

Site surveys were carried out on the four 220 kV substations completed by the project (Basta substation, Samalkha substation, Sector 20 substation and Sector 72 substation). It was found that the facilities were operated and maintained based on the predetermined manual, and that the operation and maintenance records such as log books were appropriately recorded and managed. There was no issue found in the storage and management status of the spare parts. There was no issue found in the equipment conditions or the operation status. No issue was observed in the procurement of spare parts as the GIS manufacture is also in India.

In light of the above, no major problem has been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, sustainability of the project effects is high.

[9] Annual income that is necessary to provide appropriate services to the customers, cover the operation costs to include staff expenses and investment costs, and obtain appropriate profits.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of this project was to ensure a stable power supply to meet rapidly growing power demand by developing an intra-state transmission and substation system in India's northern state of Haryana, thereby contributing to economic growth and improvement of living conditions in the region. The relevance of the project is high, as the objective was consistent with India's development policies and development needs as well as with Japanese ODA policies. The efficiency of this project is fair, as although the project cost was within the plan, the project period significantly exceeded the plan.

Regarding the operation and effect indicators of this project, such as the capacity operation rate of transmission lines and transformers and system availability, system availability mostly achieved its target values in 2017 (the project completion year). On the other hand, data could not be obtained by the executing agency for the capacity operation rate of transmission lines and transformers and therefore it was difficult to verify the level of achievement. However, the average capacity operation rate in 19 substations of the project was 72% in 2017 (the project completion year), which was verified to be lower than the target value of 75%. This means that the project substations were operated within their installed capacity and with enough remaining capacity. After the implemenation of this project, improvements such as increase in power supply time, stabiliztion of voltage fluctuation, and reduction in power outage hours and frequency were observed in the project target areas. For this reason, it was judged that the project objective of ensuring a stable power supply had been achieved. Also, this project had a certain positive impact on regional economic development through the reduction of operation and maintenance costs for backup power generators as well an increase in productivity and services for bulk electricity users in Gurgaon. Furthermore, there was an improvement of living standards in villages of the central part of Haryana state. No negative impact on the natural environment was observed, and land acquisition was appropriately executed in accordance with the related domestic laws and regulations of India. No resident resettlement was executed. Therefore, the effectiveness and impact of this project are high. Meanwhile, no major problem has been observed in the institutional, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

In light of the above, the project is evaluated to be highly 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) Setting a Project Period that is Appropriate for the Project Contents and the Ability of the Executing Agency

In this project, the actual project period was 108 months against a planned project of 30 months (ratio against the plan: 360%). There was an additional output where the procurement package was increased from a planned package of 10 to the actual package of 14 (total of 18 packages to include the split of the existing packages). There were many individual factors affecting the delay. Especially, delay accompanying the acquisition of land and the Right-of-Way, and performance of contractors were common factors of delay for many packages. Meanwhile, there were many procurement packages in the project, and no consultant was hired to support procurement and construction supervision as such no requirement for same was felt by HVPN. HVPN hires the consultants on need basis. In addition, the executing agency was planning to implement a World Bank project in parallel with this project. Considering the above circumstances, the planned project period set at the appraisal seems rather unrealistic.

The executing agency has a tendency not to hire consultants for implementation support of development projects in India's power sector unless there is a special exception. For a project in which employment of consultants is not expected, it would be ideal for JICA to plan a realistic project implementation schedule that can be carried out within the capacity and systems of the executing agency without hiring a consultant. This should be achieved through a sufficient discussion not only of the project implementation capacity of the executing agency, but also bearing in mind the project's characteristics, the number of packages, the implementation risks, and the impacts of on-going or planned development projects by the executing agency when formulating the project.

(2) Establishing Indicators to Measure the Individual Performance of Project Facilities

The capacity operation rate and system availability were set as the operation and effect indicators for the substations of this project. However, these baseline and target values were for the entire state of Haryana, and no operation and effect indicators were set for individual substations. The project facilities are equivalent to 4.5% of the total number of substations and 5.6% of the total power transmission lines in HVPN, and therefore the scale of the project in the

entire HVPN transmission system is limited. In general, if there is a statewide capacity operation rate and system availability, the performance of an individual substation is considered to be comparable. However, it would be ideal to establish operation and effect indicators for individual substations if possible in order to support the overall trends of data.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
(1) Project Outputs (a) Procurement and installment of power transmission lines, transmission towers, and related facilities	Total length of transmission lines: 492 km	Total length of transmission lines: 582.7 km
(b) Procurement and installation of transformers and substation related facilities (circuit breakers, switching, current transformers, arresters, insulators, etc.)	220 kV Substations: 14 locations	220 kV Substations: 13 locations 132 kV Substations: 6 locations
(2) Project Period	March 2008 - August 2010 (30 months)	March 2008 - February 2017 (108 months)
(3) Project Cost Amount Paid in Foreign Currency	21,287 million yen	385 million yen
Amount Paid in Local Currency	5,077 million yen (1,781 million rupees)	18,147 million yen (10,026 million rupees)
Total	26,364 million yen	18,532 million yen
ODA Loan Portion	20,902 million yen	11,809 million yen
Exchange Rate	1rupee = 2.85 yen (As of October 2007)	1 rupee = 1.81 yen (Average between 2008-2016)
(4) Final Disbursement	March 2016	