Indonesia

Ex-post Evaluation of Japanese ODA Loan Project
"Sipansihaporas Hydroelectric Power Project (E/S)"
"Sipansihaporas Hydroelectric Power Plant Project"
"Sipansihaporas Hydroelectric Power Plant Project II"

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1. Project Description

Project Site

Sipansihaporas Hydroelectric Power Plant

1.1 Background

Sipansihaporas Hydroelectric Power Plant is located along the Sipansihaporas River, which runs approximately 10 km in the east of the city of Sibolga, North Sumatra Province, on the Sumatra Island. The project provided two conduit-type hydropower stations, with a combined output of 50MW from Power Station No. 1 (33MW) and Power Station No. 2 (17MW), and related transmission lines.

North Sumatra Province, at the time of the project reparation, was faced by an urgent need to meet the rapid increase of power demand (peak load) in and out of its capital city Medan, and was in need of aggressive power development. The city of Sibolga, the project site, was also expected to see an increase in peak load when the ongoing regional development projects, such as construction of new factories and hotels, would be completed. In the meantime, efficient peak-load power stations were lacking in the region.

The Sixth Five-Year National Development Plan, under which the project was formulated, stipulated a steady power development in order to accommodate the growing power demand. Specifically, it focused on a goal of decreasing the country's oil dependence through increasing the shares of alternative energies and developing renewable energies. The construction of Sipansihaporas Hydroelectric Power Plant was expected as an important and vital renewable, clean energy source, from the standpoint of well-balanced power development.

1.2 Project Outline

The objective of the project is to meet the increasing power demand in North Sumatra Province by constructing hydropower plants with pondage, with an installed capacity of 50MW that respond to peak load on a daily basis on the middle reaches of the Sipansihaporas River running near Sibolga, North Sumatra Province, and thereby contributing to the economic development and the enhancement of living standard in the said area.

	E/S	Phase I	Phase II
Approved Amount / Disbursed Amount	820 million yen/ 580 million yen	2,978 million yen/ 2,699 million yen	8,408 million yen/ 6,760 million yen
Exchange of Notes Date / Loan Agreement Signing Date	November, 1992/ November, 1992	December, 1995/ December, 1995	December, 1996/ December, 1996
Terms and Conditions	Interest Rate: 2.6% Repayment Period/Grace period: 30years/10years Partially Untied	Interest Rate: 2.5% Repayment Period/Grace period: 30years/10years General Untied Consultant: Interest Rate: 2.3% Repayment Period/Grace period: 30years/10years General Untied	Interest Rate: 2.7% Repayment Period/Grace period: 30years/10years General Untied
Borrower / Executing Agency	The Government of Indonesia / PT. PLN (Persero)		
Final Disbursement Date	E/S: December, 1996 Phase I and II: October, 2005		
Main Contractor (Over 1 billion yen)	Kumagai Gumi Co., Ltd (Japan)・PT. Wijaya Karya (Indonesia) (JV)		
Main Consultant (Over 100 million yen)	PT.Trimitra Nusa Engineering(Indonesia)・PT. Gurmilang Pancang Kvetama(Indonesia)・Tokyo Electric Power Services Co., Ltd. (Japan) (JV) / PT. Jaya CM Manggala (Indonesia)・PT. Tata Guna Patria(Indonesia)・PT. Trimitra Nusa(Indonesia)・Tokyo Electric Power Services Co., Ltd. (Japan) (JV)		
Feasibility Studies etc.	July, 1990 JICA F/S		

2. Outline of the Evaluation Study

2.1 External Evaluator

Masumi Shimamura (Mitsubishi UFJ Research and Consulting Co., Ltd.)

2.2 Duration of Evaluation Study

Duration of the Study: April, 2010-December, 2010
Duration of the Field Study: 6-19, June, 2010, 22-28 August, 2010

2.3 Constraints during the Evaluation Study

None.

3. Results of Evaluation (Overall Rating: A)

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Policies of Indonesia

At the time of appraisal, the Government of Indonesia identified, in its Sixth Five-Year National Development Plan (REPELITA VI: 1994-1999), one of its primary development goals as an enhancement of power supply reliability together with power development in line with the petroleum policy, which considers oil as a foreign currency source (i.e., "oil-free power source policy"). It aimed at developing power sources and constructing transmission lines commensurate with the resource reserves in individual regions. Furthermore, there was an apparent projection for a high growth in power demand and recognition of a necessity for aggressive power development in the country at that time. The project under review was consistent with the Government of Indonesia's strategies, described in the Sixth Five-Year National Development Plan, to increase the reliability of power supply and develop hydropower resources, which would provide a clean and regional energy based on a renewable resource.

At the time of ex-post evaluation, the Government of Indonesia remains to be committed to the oil-free power source policy and an improvement of energy mix through power development, in its Medium-Term National Development Plans (RPJMN 2004-2009 and 2010-2014). RPJMN 2010-2014, aiming to enhance use of renewable energies, such as hydro and geothermal powers, targets at an output of 2,000MW in 2012 and 5,000MW in 2014. Also, the Government's RUKN (National Electricity Global Planning 2008-2027) for the power sector clearly calls for further utilization of renewable energies. Moreover, PLN's RUPTL (PLN Electricity Supply Plan 2010-2019) sets a goal of increasing the household (rural) electrification rate across the country to 91% by 2019, and aims to improve standard of living of the nation and to alleviate disparities among regions.

The following tables show inter-annual changes in the power source composition and the amount of power sold in Indonesia.

Table 1: Energy Consumption Ratio by Energy Source in Indonesia (%) (Energy Mix)

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Oil	18.8	18.4	21.0	14.6	23.5	24.9	29.9	30.6	27.7	25.5	27.7
Natural Gas	34.6	34.8	30.4	25.0	20.8	18.6	14.3	12.7	13.0	13.5	14.2
Coal	30.2	31.7	34.5	28.9	27.1	28.2	25.9	26.1	28.8	29.3	27.6
Geothermal	3.5	3.4	3.2	2.9	2.9	2.6	2.6	2.4	2.4	2.2	2.3
Hydro	13.0	11.7	10.9	10.5	8.2	7.5	7.4	7.7	6.6	7.5	7.2
Purchase				13.1	17.6	18.2	19.9	20.5	21.5	22.0	20.9

Source: PLN Annual Report (2002-2008) (Total figures do not become 100% due to rounding error)

Table 2: Power Sales in Indonesia

	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008
Power Sales (GWh)	65,261	71,332	79,165	84,520	87,089	90,441	100,097	107,032	112,609	121,246	129,019
Power Sales Growth Rate (%)	1.5	9.3	11.0	6.7	3.9	3.8	10.7	6.9	5.2	7.7	6.4
GDP Growth Rate (%)	-13.1	0.7	4.9	3.8	4.3	4.7	5.0	5.6	5.5	6.3	6.1

Source: Power Sales and Power Sales Growth Rate: PLN Annual Report (2002-2008)

Note: GDP Growth Rate (Real growth rate (based on the prices in 2000)): Ministry of Energy and Mineral Resources (ESDM) Handbook (2006, 2007, 2008)

3.1.2 Relevance with the Development Needs of Indonesia

At the time of appraisal, the power demand growth in North Sumatra Province was 14% in 1993 and was projected as approximately 15% per annum for the ensuing decade. It was therefore essential to secure a certain level of supply margin in order to maintain the reliability of power supply. The Government of Indonesia considered hydropower resources as a clean, regional energy based on a renewable resource and attached high priority to the development of hydroelectric generation. In addition, a construction of efficient peak-load power stations was expected as such facilities were lacking in the area included in the project. The project under review involved the development of power sources, contributing to the development of an oil-saving, clean and regional energy source and an efficient supply of electricity while managing the increasing power demand in the region. Thus, the necessity for and priority of the project were deemed high.

At the time of ex-post evaluation, the power demand in North Sumatra Province continues to show high growth. The growth in peak load increased 2.2-fold from 541.96MW to 1,170.70 MW during the 14 years between 1995 and 2009 (Table 3). North Sumatra Province remains to be categorized as a “Critical Area” in terms of power supply, and is designated as a priority area for developing power installations in PLN’s RUPTL (PLN Electricity Supply Plan 2010-2019). The peak-load hydropower stations provided by the project supply additional power to the North Sumatra region, but are not yet sufficient to satisfy the high power demand. A further development of power generation facilities is a pressing need.

Table 3: Power Demand in the Province of North Sumatra (GWh)

	1995	2000	2005	2006	2007	2008	2009
Energy Sales: Residential	880.80	1,527.29	1,989.34	2,119.94	2,196.17	2,458.13	2,657.31
Industrial	1,111.00	1,507.76	1,635.37	1,737.18	1,823.13	1,902.34	2,069.15
Commercial	203.70	388.36	609.11	675.39	694.83	895.22	960.75
Public	157.40	222.95	379.55	408.36	449.31	502.17	550.02
Total Growth rate (%)	2,352.90 15.88	3,646.35 7.00	4613.37 3.91	4,940.87 7.10	5,163.44 4.50	5,757.85 11.51	6,237.23 8.33
Total Production	3,005.46	4,142.87	5,476.01	5,616.17	5,908.60	6,469.15	6,881.32
PLN Use	110.28	0	0	0.35	0	0	0
Energy Requirement	2,895.18	3,881.31	5,476.01	5,615.82	5,908.60	6,469.15	6,881.32
Transmission & Distribution Losses (%)	18.73	11.98	15.09	11.32	11.88	10.18	9.36
Peak Load (MW)	541.96	865.00	970.00	1,021.00	1,052.00	1,113.00	1,170.70

Source: Results from questionnaire surveys to PLN

3.1.3 Relevance with Japan's ODA Policy

The objective of the project was consistent with the Government of Japan’s assistance policies at the time of appraisal. The Ministry of Foreign Affair of Japan’s 1999 ODA White Paper identified five priority areas of Japan’s assistance for Indonesia. For the “development of industrial infrastructure (economic infrastructure)” area, one of the five priority areas, (i) power, (ii) water resource development, (iii) transport and (iv) communications were specifically recognized as essential. Since the onset of the project, there has been no change in the assistance policies of the Government of Japan or JICA, which might affect the direction of the project. Thus, the consistency of the project with the Japanese assistance policies is still maintained.

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: b)

3.2.1 Project Outputs

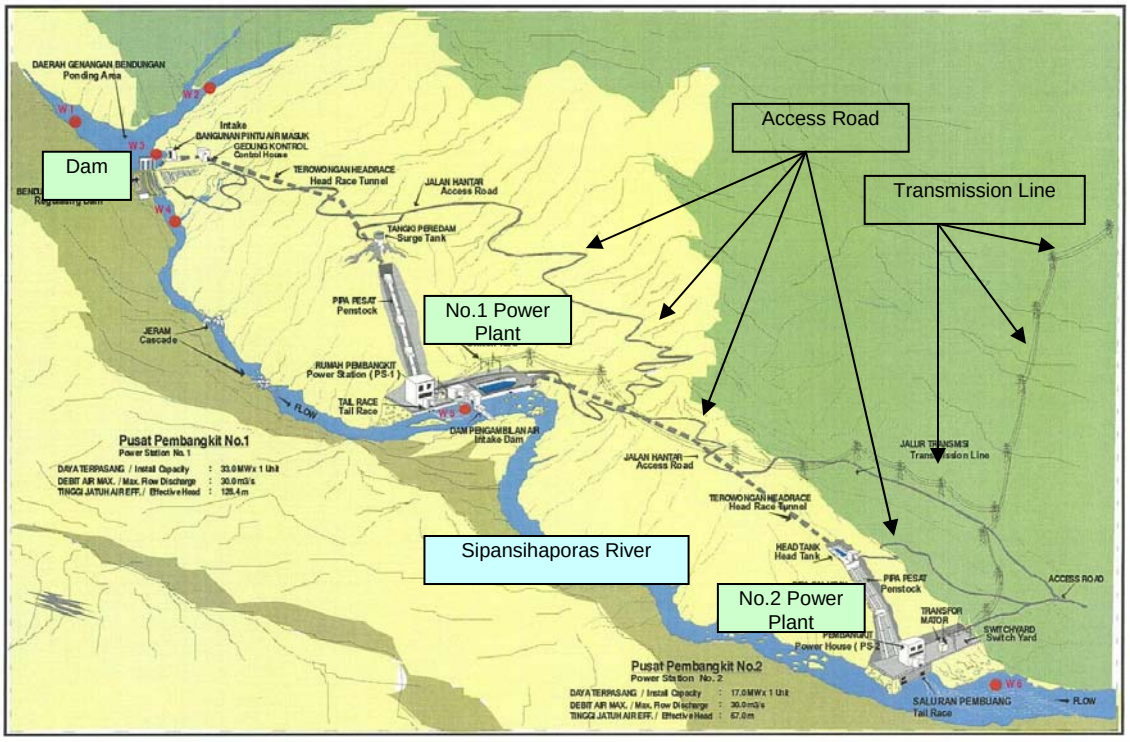
The review hereof considers the engineering service (E/S), first phase (Phase I) and second phase (Phase II) collectively as one project. The details of each subproject are as given in Table 4 below.

Table 4: Phasing and Each Content of Project

	Project Name	Major Contents
E/S	Sipansihaporas Hydroelectric Power Project (E/S)	Consulting Services (F/S, D/D, support for bidding process etc.)
Phase 1	Sipansihaporas Hydroelectric Power Plant Project	1. Construction of lower access road and base camp 2. Consulting Services (supervision for civil works, metal works, generator works and access road construction)
Phase 2	Sipansihaporas Hydroelectric Power Plant Project II	1. Civil works and discharge warning system 2. Metal Works 3. Turbine 4. Generator 5. Transmission Line

Source: PLN

All subprojects yielded the outputs planned at the time of appraisal with no change.



Source: PLN

Figure 1: Layout of the Project Site

As shown in Table 5 below, the inputs for the consulting services during E/S and Phase I were modified. As far as E/S is concerned, the input of foreign consultants was reduced whereas that of local consultants was increased, resulting in an increase of 23M/M overall. The reasons for the change included (i) bad weather which delayed the schedule, hence requiring additional engineers to facilitate the process and (ii) additional topographical surveys.

As for the consulting services in Phase I, the inputs of foreign and local consultants significantly increased by 844M/M in total. The reason for the increment was basically prolonged construction supervision, necessitated in association with the delay in the implementation schedules for metal works and civil works in Phase II (to be discussed later).

Table 5: Comparison of Planned and Actual Consulting Service (M/M)

	E/S		Phase I	
	Planned	Actual	Planned	Actual
Foreign	169	151	515	766
Local	91	132	630	1,223
Total	260	283	1,145	1,989

Source: Information from JICA, results from questionnaire surveys to PLN and interview survey results during field survey

Substation

Penstock

3.2.2 Project Inputs

3.2.2.1 Project Period

The overall project period, covering E/S, Phase I and Phase II, was planned as 165 months as opposed to 207 months including the extended loan period in reality, representing an expansion to 125.5% of the initial plan (See Table 6 for breakdowns). Due to the delay in the schedule, the project involved extension of the loan disbursement period for both Phase I and Phase II, in December 2003. The loan disbursement deadlines were extended to October 2005 for the two phases.

Table 6: Comparison of Planned and Actual Project Period

	Planned	Actual	Comparison
E/S	Sept. 1992* − Apr. 1995 (32 months)	Nov. 1992* − Oct. 1995 (36 months)	Delayed by 4 months
Phase I	Oct. 1995* − Oct. 2001 (73 months)	Dec. 1995* − Jan. 2005**	Delayed by 38 months
Phase II	Nov. 1996* − Oct. 2001 (60 months)	Dec. 1996* − Jan. 2005**	

Note 1: * At the time of Loan conclusion

Note 2: ** Project completion is considered at the time when project effect has generated in January, 2005.

The delay in the implementation schedule was caused mainly by the following factors:

① The local subcontractor undertaking the metal works in Phase II went into serious financial difficulties and failed to perform the obligation. It took some time for the prime contractor, contractually liable for the default, to make up for the local part.

② The soil at the site was unexpectedly too soft (volcanic ash clay layer) for civil works, such as the construction of the head race tunnel for Power Station No. 1 in Phase II, which slowed the progress of the works.

③ The site surveys, such as topographical survey, geological survey and geophysical exploration, were delayed in consequence of bad weather for E/S.

3.2.2.2 Project Cost

The total project cost, covering E/S, Phase I and Phase II, was initially estimated at 15,782 million yen, of which Japanese ODA loan would cover 12,206 million yen, consisting of 820 million yen for E/S, 2,978 million yen for Phase I and 8,408 million yen for Phase II. In actuality, Japanese ODA loan provided a total of 10,039 million yen—580 million yen for E/S, 2,699 million yen for Phase I and 6,760 million yen for Phase II—resulting in a lower amount than the initial estimate (82.2% of the planned amount).

There is no reliable evidence to confirm the actual project cost spent; because the amounts invested from the government and PLN budgets were not properly recorded in project accounting under imperfect project accounting system of PLN.

Despite the delay in the schedule and the increase in the outputs, the amount of Japanese ODA loan decreased mainly because (i) the international and local competitive biddings generated price competition, which held down the total project cost, and (ii) the Asian currency crisis, which occurred during the project implementation period, caused the local currency, Indonesian Rupiah, to depreciate against the Japanese yen.

Although the yen loan portion of the project cost was held within the initial plan, the project period was longer than planned, therefore the efficiency of the project is fair.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operation and Effect Indicators

No operation and effectiveness indices were set at the time of appraisal. Table 7 below summarizes the results of unplanned outage hours, capacity factor, planned outage hours for inspection and repair, net electric energy production (power output) and maximum output, after the start of operation, based on data available at the time of ex-post evaluation. Incidentally, PLN does not measure the sedimentation condition in the ponding area in numerical values.

Table 7: Operation and Effect Indicators

Indicators (Unit)	Target at appraisal	Actual Performance				
	2005	2005	2006	2007	2008	2009
Operation Indicators						
Unplanned outage hours (hr/year)	NA	0.09	-	0.21	50.26	-
Capacity factor (%)	NA	38.31	41.68	47.01	20.90	26.88
Planned outage hours (hr/year)	NA	0.99	1.11	0.09	0.08	2.21
Annual total volume of inflow to the reservoir (m^3/Year)*	NA	NA	NA	NA	NA	290,236,923
Effect Indicators						
Net electric energy production (GWh/Year)	NA	167.78	182.54	205.92	91.54	117.74
Maximum output (MW)	NA	50	50	50	50	50

Source: Results from questionnaire surveys to PLN

Note: * Total inflow from Natolbak and Paramaan river to the reservoir of PLTA Sipansihaporas Dam site.

The operation from the start to 2007 was successful and the annual power output steadily increased. The unplanned outage jumped to 50.26 hours in 2008 because of a failure to the generator at Power Station No. 1 (End of March 2008 to June 2009). Consequently, years 2008 and 2009 saw a decline in both the capacity factor and the net electric energy production (power output), but the operation returned to normal when all the repair works was completed in June 2009.

PLN pointed out that the failure to the generator was caused by improper installation of the generator during the construction[1]. They also noted the reasons for taking such a long time to resume the operation as that (i) (as the incidence was covered by the defect warranty) the contractor needed to obtain approval of the insurance company and (ii) the coils had to be reassembled at the time of the repair work.

Both Power Stations No. 1 and 2 were working and generating power in good shape at the time of ex-post evaluation. The performance in 2010 is expected to surpass the pre-failure level in 2007.

3.3.1.2 Results of Calculations of Internal Rates of Return (IRR)

Based on the cost[2] and benefit data obtained from PLN, the financial internal rate of return (FIRR) was recalculated using the same method employed at the time of appraisal. On the other hand, the economic internal rate of return (EIRR) was not analyzed in the ex-post evaluation, considering that the assumption of EIRR calculation at the time of appraisal was unknown.

Table 8: Assumption and Results of FIRR Recalculation

	At time of Appraisal	At time of Evaluation
FIRR	10.89% (Figure at the time of Phase I appraisal) 12.35% (Figure at the time of Phase II appraisal)	12.80%
Benefit	Revenue for power sales related with the project	Revenue for power sales related with the project (Assumed the power rate growth as 1.56%** in real terms after 2010)
Cost	Construction cost, Consulting service cost, Land acquisition cost, Tax, General administration cost, Contingency and O&M cost (excluding price escalation)	Construction cost, Consulting service cost, Land acquisition cost, O&M cost (excluding price escalation)
Project Life	50 years after project completion	

Note: ** Utilized the same assumption with those at the time of appraisal

The FIRR assessed at the time of ex-post evaluation was slightly higher than that at the time of appraisal. This was primarily because:

① the figures used as the cost did not include administrative cost, tax and interest, considering that the total project cost was uncertain; and

② the annual amount of electricity generated at the power stations turned out to be above the level planned at the time of appraisal (183GWh), with the highest output since the start of operation being 205.92GWh (2007). The performance in and beyond 2010 will expectedly continue to exceed this level.

3.3.2 Qualitative Effects

(1) Increased power supply to North Sumatra Province

As shown in Table 9, the quantitative contribution of Sipansihaporas Hydroelectric Power Plant to incremental power supply to the coverage area of the plant has been very limited with a

[1] Two places where coils were not properly installed were found when the generator was disassembled for the repair.

[2] Since the accurate figures for the total project cost and annual expenditure were unavailable, the data obtained from PLN, except administration cost, tax and interest, were referred to.

share in North Sumatra Province being 3.11% and that in the entire Sumatra Island being 0.55%, in terms of installed capacity.

On the other hand, from the viewpoint of increasing the electrification rate in the coverage area, the project electrified some villages, demonstrating particular benefits brought about by power supply. (See below.)

Table 9: Share of Sipansihaporas Hydroelectric Power Plant

	Installed Capacity (MW)	Share of Sipansihaporas Power Plant
North Sumatra total	1,608	3.11%
Sumatra total[3]	9,145	0.55%
Hydroelectric power station total in Sumatra	893	5.60%

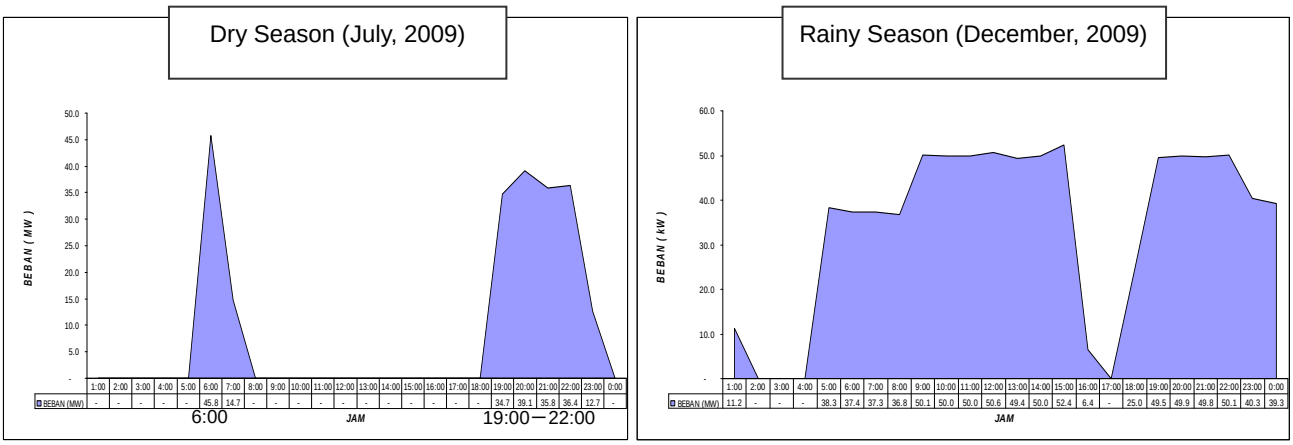
Source: Results from questionnaire surveys to PLN

(2) Increased electrification rate in the coverage area

The interviews with local residents[4] around the project site during the field visits found that Sihaporas Village, with a population of approximately 50 households, was electrified anew after the completion of the project. The villagers became able to use rice cookers, washing machines, TV units and the like and enjoy a enhanced standard of living.

(3) Creation of significance as an efficient peak-load hydropower plant

Sipansihaporas Hydroelectric Power Plant becomes operational during peak load hours (from 19 to 22 o'clock and 6 o'clock) in both the dry season (April to September) and the rainy season (October to March). It serves as a plant to accommodate peak load. During the rainy season when a sufficient flow rate can be obtained, the plant also operates during off-peak hours, thereby contributing to supplying incremental electricity (Figure 2).



Source: Results from questionnaire surveys to PLN

Figure 2: Sipansihaporas Power Plant's common operation hours and power outputs

[3] All grids in Sumatra had been connected at the time of ex-post evaluation. Rantau Prapat − Bagan Batu were connected on August 14, 2007; this in turn connected the North Sumatra grid and the Central-South Sumatra grid, which had existed independently, establishing the whole Sumatra grid.

[4] A total of five (5) interviewees from Sibuluan Village and Sihaporas Village.

(4) Increased transport capacity and enhanced standard of living for the local residents due to the construction of access roads

An interview survey regarding the access roads[5] (one accessing the power plant for maintenance work and one connecting with the water intake point) was conducted targeting users of the roads, namely local residents, manager and staff of the hotel, managers of the nursing school and shopkeepers along the roads. Their response is summarized below.

Table 10: Interview Results with the Local Residents and Workers along the Access Roads

Interviewees	Responses
Local residents in Sibuluan Village and Shihaporas Village	・ It has become easier to transport farm products and food stuff by using the access road ・ It has become easier to go to Sibolga City because of the newly established public bus system along the access road ・ Quality of life has improved because school, mosque, church etc. were newly constructed along the access road ・ Socialization between Sibulan Villagers and Shihaporas Villagers has been facilitated after the construction of the access road (travel time between the two villages has reduced from 3-4 hours on foot to 10 minutes by bicycle)
Hotel manager and staff along the access roads	・ Hotel was newly opened after the access roads were constructed － with the expectation of economic benefits because the area had potential for leisure places (hiking, fishing, bathing etc.) ・ Income level has increased after opening the hotel and shops
Managers at the nursing school	・ Nursing school has moved in from Sibolga City after the access roads were constructed ・ Employment opportunities for students are expected to increase in the local areas after students graduate from the school
shopkeepers along the access roads	・ Shop was newly opened two years ago (after the access roads were constructed) － with the expectation of economic benefits ・ Local employment opportunities have increased and income level has risen – enjoying better living ・ Many shops have newly operated around the area and economic activities have increased

As evident above, the interviewed local residents and people engaged in economic activities along the roads all benefit from the project, and they are specifically satisfied with the economic benefits and appreciative of the project.

[5] The access roads are two-way two-lane, paved roads with a total length of approximately 5 km, connecting Sibuluan Village, Sihaporas Village and the project site.

Access road constructed under the project

Hotel along the access road

(5) Job creation associated with the construction works under the project

All local residents interviewed pointed out the effect of job creation during the construction. Most of the villagers, men and women, in Sibuluan and Sihaporas, were employed in the preparation and assistance work for constructing the access roads for six years. The construction under the project provided them with a new revenue source.

In this way, Sipansihaporas Hydroelectric Power Plant has created significance as an efficient peak-load hydropower plant (not assumed for base load power source), while the FIRR figure is at sufficient level when compared against the net electric energy production (power output) assessed at the time of appraisal. Furthermore, local residents and people engaged in economic activities in the area unanimously acknowledge the benefits brought about by the project.

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

3.4 Impact

3.4.1 Impacts generated: Benefits to the area and people included in the project

As previously mentioned, the share of Sipansihaporas Hydroelectric Power Plant in the power supply to its coverage area is so minimal that it is difficult to measure its direct impact based on the changes in regional indicator values.

As a matter of fact, the changes in industrial power demand in North Sumatra Province (Table 11) do not indicate a clear correlation between the growth of industrial GRDP and the operation of the power plant.

Table 11: Industrial GRDP Growth and Power Demand in North Sumatra Province

	1995	2000	2005	2006	2007	2008	2009
Industrial GRDP Growth Rate (%)	9.21	3.54	4.76	5.47	5.09	2.92*	2.76*
Growth Rate for Power Demand (%)	-	-2.22	0.93	6.23	4.95	4.34	8.77
Growth Rate for PLN Power Supply (%)	-	6.74	3.63	2.56	5.21	9.49	6.37

Source: Industrial GRDP: BPS-Statistics of Sumatra Utara Province (* estimated figures)

Note: Growth Rate for Power Demand and Growth Rate for PLN Power Supply: Results from questionnaire surveys to PLN

The electrification rate in North Sumatra has steadily been increasing (Table 12); therefore, though the share of the plant in incremental power supply is limited, it is thought that the project

has contributed to an increased electrification rate[6].

Table 12: Power Demand in North Sumatra Province

	1995	2000	2005	2006	2007	2008	2009
Total Population(1,000)	11,062.7	11,642.0	12,326.7	12,643.5	12,833.2	13,042.3	13,248.4
Population Growth Rate (%)	1.52	0.47	1.68	2.57	1.50	1.63	1.58
Electrification Rate (%)	51.01	65.05	74.04	73.48	74.29	75.53	77.60
GRDP Growth Rate (%)	9.09	4.98	5.48	6.20	6.00	6.00	6.00

Source: Results from questionnaire surveys to PLN

There is no clear correlation between the trend in foreign direct investment (FDI) as well as domestic investment in North Sumatra Province and the operation of the power plant (Table 13). While there might be a very slight contribution, it is difficult to measure the impact of the power plant based on the changes in regional indicator values.

Table 13: FDI and Domestic Investment to North Sumatra Region

	1995	2000	2005	2006	2007	2008	2009
Amount of New FDI (U$1,000,000)	670.67	69.66	107.94	606.02	246.87	74.05	0.50
New FDI Project	15	20	12	12	17	3	2
Amount of New Domestic Investment (IDR1,000,000,000)	249.02	65.59	599.40	797.26	1,855.44	117.41	688.90
New Domestic Investment Project	11	6	6	3	7	6	1

Source: BPS-Statistics of Sumatra Utara Province

3.4.2 Other Impacts

(1) Impacts on the natural environment

No negative impact of the project on the natural environment has been observed during and also after the implementation of the project. During the hearing survey with two local NGOs, knowledgeable of the area included in the project, and five local residents, they did not mention any negative impact on the natural environment resulting from the implementation of the project. Incidentally, according to PLN, Sipansihaporas Hydroelectric Power Plant is certified by the National Standard of Safety and Health Condition and ISO 14000.

The Environmental Impact Assessment (AMDAL) was reapproved by the Central Committee of the Ministry of Energy and Mineral Resources on July 3, 1996. During the implementation of the project, an environmental monitoring was conducted every three months. Monitoring activities after the plant was put into service include water quality analysis (four times a year), monitoring of impact on flora and fauna (twice a year), and monitoring of impact on local residents (once a year). The results of individual monitoring items are summarized in Table 14 below. The contents of the environmental monitoring activities by PLN during the implementation of the project as well as after the plant was put into service are deemed as satisfactory in terms of frequency and management. In addition, there was no particular impact of the unexpectedly soft ground on the land features in the vicinity of the project site.

[6] A record taken at the time of appraisal states “electrification of 50,000 households” but the rationale for this figure cannot be obtained from Table 12. Theoretically, 74,074 households were electrified as a result of the implementation of the project.

- ➔ A half of the newly electrified households use 450w of electricity and the other half 900w: =Average per household: 675w
- ➔ Each household uses electricity for 12 hours/day.
- ➔ Maximum output (50MW)

Table 14: Environmental and social monitoring activities by PLN in association with the project

Monitoring results during the implementation of the project	
Air pollution	Monitoring on the access roads found the dust and exhaust gas levels below the standard.[7]
Noise	Monitoring around the plant found the noise level slightly above the standard.[8]
Water quality	Water samples taken at an upstream side and downstream side of the dam, intake point and cascade points were found as good.[9]
Impact on flora and fauna in the protected forests and basins	Monitoring based on the Red Data Book (1990)[10] issued by the International Union for Conservation of Nature and Natural Resources (IUCN) found the distribution and diversification as good.[11]
Impact on flora and fauna underwater	Monitoring based on the Shannon-Wiener Diversity Index at the above-mentioned monitoring points for water quality found no particular contamination.[12]
Impact on soil functions	Monitoring on the vegetation distribution around the project site found no particular impact.
Monitoring results after the plant was put in service	
Water quality	Monitoring based on the same water quality monitoring criteria as those used during the implementation of the project found 23 items, including the total suspended substance (TSS), biochemical oxygen demand (BOD), and dissolved oxygen (DO) as below the standards.
Impact on flora and fauna	Monitoring based on the abovementioned criteria found the distribution and diversification as good.
Impact on local residents	Interview and other surveys targeting local residents found no particular adverse impact. Positive impacts[13], such as enhancement of economic and social activities, were identified.

PLN autonomously strives to fulfill its corporate social responsibility (CSR) by supporting forestation activities and NGOs' environmental activities. To this end, PLN also makes a continuous effort to improve the sustainability of the project. As part of its education and advocacy activities, they organized a seminar by an environmental expert for the villagers of Sipan and Sihaporas in 2009; the lecturer explained the importance of forest preservation and its relationship with the Sipansihaporas Hydroelectric Power Plant. Another such activity is a forestation program called "One Man One Tree". PLN's activities to preserve forests and environment like these help protect water resources, indispensable for hydroelectric power generation, and also build and maintain a good relationship with local residents and NGOs. These initiatives and considerations contribute to improving the sustainability of the project and draw attention as a good practice.

(2) Impact of land acquisition and relocation of residents

As initially planned, the project did not involve relocating local residents. The land acquisition process was properly carried out based on the governing Indonesian regulation (Presidential Degree No.55-1993). The public hearings and consultation with the residents duly

[7] (1) Standard and (2) Actual data as follows (Unit: $\mu g/m^3$). Dust: (1) 260, (2) 49.25～76.30, NOx: (1) 92.5, (2) 29.20～38.15, Sox: (1) 260, (2) 46.65～89.90, CO: (1) 22,600, (2) 547～1149, H2S: (1) 42, (2) 1.02～3.98

[8] (1) Standard and (2) Actual data as follows (Unit: dBA). (1)70, (2)50～82

[9] (1) Standard and (2) Actual data as follows. TDS(mg/L): (1)1,000, (2) 16.80～20.60, pH: (1)5～9, (2) 6.54～7.45, Cl(mg/L): (1) 600, (2) 2.98～4.21, SO4(mg/L): (1)400, (2) 1.00～5.08, Fe(mg/L), (1) 5.0, (2) 0.11～2.01, DDT(mg/L): (1) 0.042, (2)N.A., Coliform(MPN/100mi): (1) 10,000, (2) 30～185 etc.

[10] Data book that describes endangered wildlife.

[11] Birds (9, 8 and 6 species), mammals (7, 3 and 5 species), amphibian (2, 2 and 2 species), reptiles (3, 4 and 3 species) were observed at the respective monitoring points.

[12] Two benthic organisms, planktons (11, 11 and 23 species) and five fish species were observed at the respective monitoring points.

[13] Promoting exchange among villagers, improving livelihood and quality of life, etc. in Sibuluan and Sihaporas.

held did not see any opposition or resistance from the residents against the plan, including the amount of compensation[14]. The table below compares the initial plan and the actual land acquisition.

Table 15: Comparison of Areas of Land Acquisition

Status of land acquired	Plan	Actual
Public land	71.1ha	21.23ha
Private land	45.4ha	67.14ha
Total	116.6ha	88.37ha

Source: Results from questionnaire surveys to PLN

According to PLN, the area of public land decreased from the plan while that of private land increased because some residents, knowing that the land prices were high up due to the implementation of the project, started to claim and demand ownership of the land.

Although there was no special measure put in play by PLN to recover and improve the residents' livelihood, they constructed a mosque, church, storage, public water supply point, and others along the access roads, as part of their CSR activities. These have led to enhancement of the social activities of the residents, which further raised the level of acceptance of the project among the local residents[15].

(3) Other impacts: Impact on the river use of residents living downstream

According to the results from the hearing survey with local residents, the status of their use of the Sipansihaporas River has not changed because of the implementation of the project. They continue to use the river for fishing, bathing, laundry, washing dishes and so forth without feeling any negative impact of the power plant.

Also, they mentioned that the discharge warning system was properly functioning: an alarm 20 minutes before discharge. The residents were well informed of different alarm patterns telling different messages, and hence there has been no particular accident.

Thus, the project is deemed as to have yielded a significant number of positive impacts while curbing negative impact on the natural environment and so on.

Local residents using the Sipansihaporas River

Structure with discharge warning system

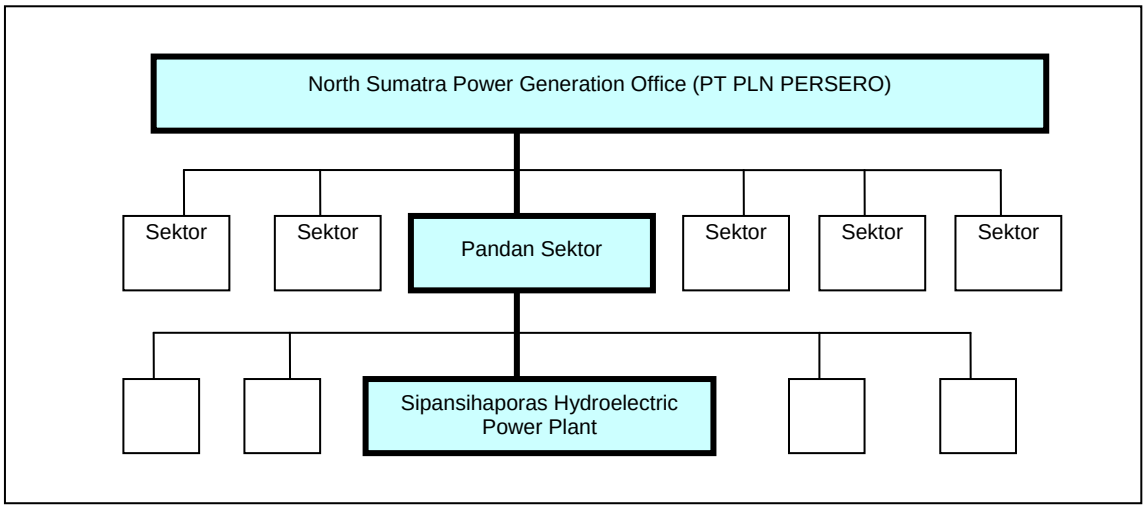
[14] For the residents who were affected by the land acquisition, the project provided monetary compensation but no other particular measures for recovering their livelihood.

[15] PLN continues to support activities at the mosque and the church even after the completion of the project.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

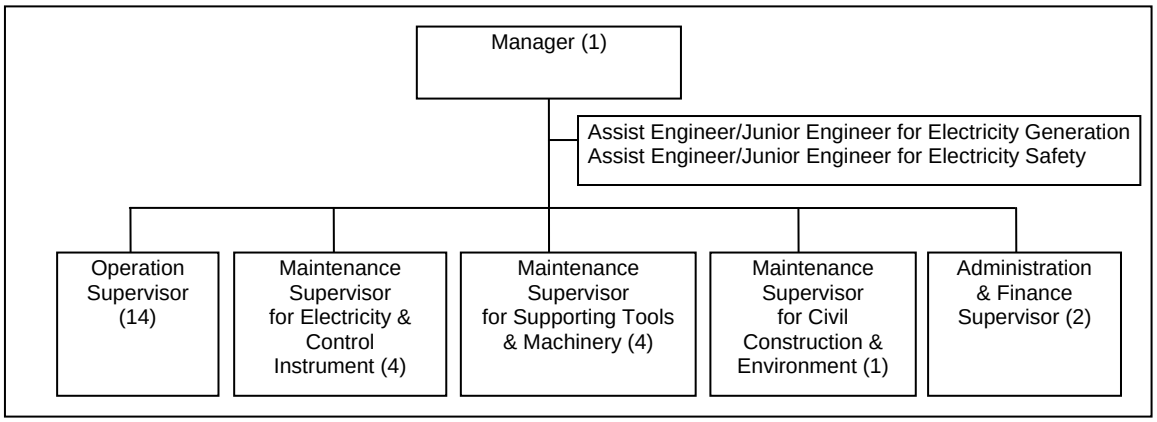
The operation and maintenance of the project is undertaken by PLN's North Sumatra Power Generation Office (PT PLN (PERSERO) Pembangkitan Sumatra Bagian Utara) in Medan, North Sumatra Province. As of June 2010, approximately 1,400 people are working at power offices (Sektors) and other units under the supervision of the Office. There are six Sektors, as of June 2010, under the North Sumatra Power Generation Office. Of these, Pandan Sektor (about 200 employees) is responsible for the operation and maintenance of Sipansihaporas Hydroelectric Power Plant (Figure 3).



Source: Results from questionnaire surveys to PLN and interview surveys during field survey

Figure 3: Institutional Structure of Operation & Maintenance (O&M)

The organizational structure of Sipansihaporas Hydroelectric Power Plant is illustrated in Figure 4 below. It was restructured in this way after April 2008, until when (i) electricity and control instrument, (ii) supporting tools and machinery, and (iii) civil construction and environment had been sub-units of one department (former Maintenance Supervisor). PLN pointed out that the division of the former Maintenance Department into three units led to faster decision-making, more profound expertise and higher organizational efficiency of Pandan Sektor.



Source: Results from questionnaire surveys to PLN and interview surveys during field survey
Note: * Number of PLN staffs in parentheses (There are additional staffs (non-regular member of staffs) engaged in each position.)

Figure 4: Simplified Organizational Structure of Sipansihaporas Hydroelectric Power Plant

The numbers of staff members (regular and non-regular) in charge of Sipansihaporas Hydroelectric Power Plant at Pandan Sektor are provided in Table 16 below.

Table 16: Number of Staffs Engaged in Sipansihaporas Hydroelectric Power Plant and its O&M Staffs

Year	Number of Staffs	Of these, Number of Staffs in Charge of O&M	Percentage of O&M Staffs
2005	73	21	28.8%
2006	88	18	20.5%
2007	92	21	22.8%
2008	91	19	20.9%
2009*	74	17	23.0%

Source: Results from questionnaire surveys to PLN and interview surveys during field survey
Note: * Figures in 2009 is the data at the beginning of the year

The total number of employees at PLN as of June 2010 is roughly 45,000. PLN reshuffled its organization in December 2009 and kicked off with the new organization at the beginning of February 2010. The organization used to be siloed into (i) construction and (ii) sales and administration according to the responsibility to be borne by the board members. The verticals were then reorganized into three regions: (i) Java-Bali, (ii) Western Indonesia (Sumatra, Kalimantan, Batam, Bangka), and (iii) Eastern Indonesia (Sulawesi, eastern islands, Irian), each with four positions, a. power generation, b. power transmission, c. power distribution/sale, and d. construction management and IPP.

PLN pointed out that the regional division is expected to contribute to an assurance of consistency from planning to procurement, construction, generation, transmission, distribution and sales, thereby achieving more efficient operation. At the time of ex-post evaluation, however, the organization was still in the transition phase to the new system and no tangible change or effect could be ascertained. It was also pointed out that there was no particular impact of the restructuring of PLN on the operation and maintenance structure of Sipansihaporas Hydroelectric Power Plant.

3.5.2 Technical Aspects of Operation and Maintenance

Training sessions and seminars necessary for the operation and maintenance of the power plant were provided during the implementation of the project, after the completion and before the start of operation, and after the start of service.

During the implementation of the project, the consultant and the makers of generators and transformers provided training on maintenance and administration to a total of 50 PLN staff members (two sessions in Indonesia and two sessions in Japan, including a visit to a hydropower plant in Japan).

23 PLN personnel undertook training on maintenance and management of the generators, electricity and machinery between the completion of the project and the start of operation. The breakdown of trainees is given in Table 17 below.

Table 17: Number of Staffs Receiving Training in the Transition Period (After project completion and before the operation)

Areas for Training	Number of PLN staffs
Generator	5 staffs
Mechanic	2 staffs
Electricity	16 staffs

Source: Results from questionnaire surveys to PLN and interview surveys during field survey

Since the start of service at the power plant, the following personnel from Pandan Sektor have participated in PLN's cross-sectional training sessions (Table 18). (PLN's training sessions typically take place at PLN Training Center in Jakarta, but trainings related to hydropower are conducted intensively at the training unit in Padang, West Sumatra Province.)

Table 18: Number of Staffs Receiving Training at PLN Training Center during Operation Stage (Number of Staffs participated from Pandan Sektor)

2006	1 staff
2007	5 staffs
2008	9 staffs
2009	16 staffs
2010	4 staffs
Total	35 staffs

Source: Results from questionnaire surveys to PLN and interview surveys during field survey

For information purpose, Tables 19 and 20 below outline the academic background and the number of years of experience of the personnel in charge of the operation and maintenance of Sipansihaporas Hydroelectric Power Plant at Pandan Sektor.

Table 19: Academic Background for O&M Staffs

Year	University graduates or higher	High school graduates	Secondary school graduates
2005	10%	90%	0%
2006	0%	100%	0%
2007	10%	90%	0%
2008	16%	84%	0%
2009	18%	82%	0%

Source: Results from questionnaire surveys to PLN and interview surveys during field survey

Table 20: Number of Years of Experiences for O&M Staffs

0-5 years	6-10 years	11 years or more
7 staffs	5 staffs	7 staffs

Source: Results from questionnaire surveys to PLN and interview surveys during field survey
Note: * Figures as of June, 2009

In view of this operational structure and the current favorable operation and maintenance conditions, there is no particular problem observed in the technical aspect.

3.5.3 Financial Aspects of Operation and Maintenance

The operation and maintenance costs associated with Sipansihaporas Hydroelectric Power Plant are first estimated by Pandan Sektor. The estimation will be reviewed by the North Sumatra Power Generation Office in Medan and then the PLN headquarters in Jakarta. Once approved, the budget is drawn out from the headquarters' ordinary budget and allocated to the Sektor through the Power Generation Office. Generally, 70 to 80% of the requested budget is allocated to the operation and maintenance costs. According to PLN, with regard to predictive maintenance and regular maintenance, the full amount is secured without a problem (provided that, for maintenance work other than that of generators, such as repainting of the power houses, the requested amount may not necessarily be secured in full.) In case of an emergency action, which requires additional cost, the Power Generation Office provides an additional budget

allocation. Table 21 shows the annual operation and maintenance budgets associated with Sipansihaporas Hydroelectric Power Plant. On the whole, the amount of budget has been slightly increasing.

Table 21: Annual O&M Budget for Sipansihaporas Hydroelectric Power Plant

2005	IDR 4,550,042,351
2006	IDR 4,273,080,227
2007	IDR 7,667,106,018
2008	IDR 5,284,503,474
2009	IDR 7,683,897,066

Source: Results from questionnaire surveys to PLN and interview surveys during field survey

The overall financial situation of PLN (Table 22) indicates that the organization is supported by a massive amount of government subsidy[16] and suggests that it is virtually a service provided by the state. The factors behind the high-cost structure are identified as the high financial burden for fuels and lubricants necessary for power generation, inefficient operation, low electricity rate[17], and so on[18]. Incidentally, the financial situation of PLN as a whole and the operation and maintenance of the power plant should be discussed at different levels; PLN's overall financial conditions have no direct impact on the project.

Table 22: Trend of Financial Performance of PLN on Consolidated Basis

Unit: billion IDR

	2005	**2006**	**2007**	**2008**	**2009**
Power Sales	63,246	70,735	76,286	84,250	90,172
Government Subsidy	12,511	32,909	36,605	78,577	53,720
Other Income	786	1,082	1,152	1,382	1,330
Total Operation Income	76,543	104,726	114,043	164,209	145,222
Fuel & Lubricant Cost	37,355	63,401	65,560	107,783	76,235
Maintenance Cost	6,511	6,629	7,269	7,620	7,965
Personnel Cost	5,508	6,720	7,064	8,344	9,758
Other Cost＊	26,650	28,478	31,612	36,851	41,318
Total Operation Cost	76,024	105,228	111,505	160,598	135,276
Operation Profit	519	-502	2,537	3,611	9,946
Non-operating Profit and Loss**	-2,694	1,547	-5,635	-15,802	2,257
Tax	2,746	2,973	2,547	112	1,848
Total Profit	-4,921	-1,928	-5,645	-12,304	10,356

Source: PLN Annual Report
Note 1: Partial inconsistency of figures exists due to rounding error
Note 2: * Power Purchase, Depreciation of Fixed Assets etc.
Note 3: ** Tax Revenue and Cost, Foreign Exchange Profit and Loss etc.

[16] The government subsidy for PLN is stipulated as a Public Service Obligation (PSO) by Article 66 of the Law on State Enterprises of 2001 (financial compensation for state-owned enterprises).

[17] The Government of Indonesia raised the electricity rate on July 1, 2010, for the first time in the seven years since 2003. (A revision of the electricity rate requires approval of the national parliament.)

[18] PLN aims to reduce government subsidies, raise the electricity rate, increase the self-financing ratio, and introduce private fund aggressively, in order to improve its financial and management conditions. To achieve its objectives, however, there are various hurdles to overcome, particularly in the aspect of electricity pricing, as it involves politically sensitive elements.

3.5.4 Current Status of Operation and Maintenance

The generation equipment was kept in good shape, in general, at the time of ex-post evaluation, posing no particular concern. (As formerly stated, the generator of Power Station No. 1 went down at the end of March 2008 and was out of service until it was repaired in June 2009; since then it has been in nominal operation.)

The access roads were partially damaged (for a few meters) in consequence of flooding and were under repair work at the time of the site visit.

There was no particular problem observed in terms of regular maintenance: daily, weekly and monthly maintenance activities were duly performed. When the accumulative number of operation hours exceeds 20,000 and 40,000, in the future, extraordinary maintenance work will be performed.

PLN monitors the state of sedimentation in the ponding area using the depth sounder, instead of taking numerical measurements. In 2008, they removed sand and gravel sediments using an excavator near the generator of Power Station No. 1. Furthermore, they open the spillway gate (every six months) to discharge sediments together with water into the main stream. There was no particular problem identified at the time of ex-post evaluation, but a comparison against photos taken in 2008 reveals a steady increase of deposited silt. It is essential to continue monitoring so that appropriate measures will be taken before the sedimentation adversely effects the operation of the plant.

No major problem has been observed in the operation and maintenance structure, technology and finance, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

Although the implementation schedule was extended, the project was highly consistent with policies and yielded many positive effects and impacts both quantitatively and qualitatively. Thus, the project is evaluated to be highly satisfactory as (A).

4.2 Recommendations

4.2.1 Recommendation to Executing Agencies

[Managing deposited silt in the ponding area]

While there was no particular problem in managing deposited silt in the ponding area at the time of ex-post evaluation, certain measures will likely be needed in the future. Currently PLN does not measure numerical data on sedimentation status but monitors the situation using the depth sounder. Because it is possible to measure numerically the sedimentation situation when using the depth sounder, PLN should record its data and manage them appropriately in order to make careful planning and necessary action to remove/flush or dredge deposited silt.

4.3 Lessons Learned

The forest preservation and environmental conservation activities that PLN carries out autonomously as part of their CSR efforts are noteworthy as they set a good practice case. PLN has established and maintains good relations with local residents and NGOs. Their continued efforts with consideration given to environmental protection have also contributed to the improvement of sustainability of the project. Thus, it is worth consideration to include such activities as part of project components, as a means to support the executing agency or other related organizations.

End

Comparison of the Original and Actual Scope of the Project

Item	Plan	Actual
1. Project Outputs		
	Dam	Same as planned
	Intake Dam	Same as planned
	Spillway	Same as planned
	Hydroelectric Power Plant (No.1 and No.2 P/S: Total installed capacity of 50MW)	Same as planned
	Access road	Same as planned
	Discharge Warning System	Same as planned
	Transmission Line	Same as planned
	Consulting Service (F/S, D/D, Support for bidding process) 260M/M	Consulting Service (F/S, D/D, Support for bidding process) 283M/M
	Consulting Service (Supervision for civil works, metal works, generator works and access road construction) 1,145M/M	Consulting Service (Supervision for civil works, metal works, generator works and access road construction) 1,989M/M
2. Project Period	E/S: September, 1992－April, 1995 (32 months) Phase I: October, 1995－October, 2001 (73 months) Phase II: November, 1996－October, 2001 (60 months) Total: 165 months	E/S: November, 1992－October, 1995 (36 months) Phase I: December, 1995－January, 2005 Phase II: December, 1996－January, 2005 Total: 207 months
3. Project Cost Foreign currency	9,372 million yen	Amount of total project cost was not available at Ex-post Evaluation.
Local currency	6,410 million yen	
Total	15,782 million yen	
Japanese ODA loan portion	12,206 million yen	10,039 million yen
Exchange Rate	E/S: 1IDR＝0.064 yen (April 1992) Phase I: 1IDR＝0.045 yen (April 1995) Phase II: 1IDR＝0.046 yen (April 1996)	1IDR＝0.0102 yen (Average for 1998)

Third Party Opinion on Sipansihaporas Hydroelectric Power Project

Prof. Dr. Usman Chatib Warsa, Ph.D, University of Indonesia

The rapidity of ongoing regional development in North Sumatra Province has lead to soaring demand for electricity supply. The Sipansihaporas Hydroelectric Power Project was expected to be a vital renewable resource in response to the above urgent need in addition to contribute to the economic development and the living standard improvement of the coverage area.

In terms of Relevance, the conclusion that the reviewed project was highly relevant seems reasonable. At the appraisal, the project was predetermined by the Indonesian's REPELITA VI: 1994-1999 to increase the use of hydropower plant as a renewable and reliable resource. The policy, in which, the Government of Indonesia remains to be committed. It was also catalyzed by the increasing power demand in North Sumatra Province. Even during ex-post evaluation, the province need of power supply stays critical with the Government's priority for power installation development. The project area is one of the five priority areas of Japan's assistance for Indonesia; therefore the project remains consistent with Japan's ODA policy.

When it comes to Effectiveness, it is fair to say as highly effective. Quantitatively, while the data shows a significant output drop in 2008-2009 due to generator failure, it also shows that in 2007 the plant generated power above the planned level; a level in which expected to exceed in the future. The FIRR value is considered acceptable, however the accurate total project cost and annual expenditure were unavailable; hence the figures were referred to. In the future, it is recommended that such data to be obtainable. Qualitatively, although currently the plant contribution is very limited, it serves efficiently in accommodating peak-load in both dry and rainy seasons. It also has improved the electrification rate in the reporting area. Additionally, local residents also benefited from the access road and enjoyed job creations associated with the project.

Finally, there are several positive impacts to highlight in addition to electricity supply and economic activities brought about by the project. It is mentioned that a nursing school has moved in to the area; this surely has affected the healthcare awareness for the locals. And with electrification, people were exposed to technology; this would inspire future generations to have a higher education.

(End)