Indonesia

Ex-Post Evaluation of ODA Loan Project "Multipurpose Dam Hydroelectric Power Plants Project"

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Field Survey : Feb. 2009 - Jun. 2009

1. Project Profile and Japanese ODA Loan

Map of Project Area

Distant view of Wonorejo Hydroelectric Power Plant

1.1 Background

This Project is to construct three hydroelectric power plants to cope with the growing electricity demand in corresponding power supply areas. The Project is implemented as a part of the master projects whose major components are multi-purpose dams to supply multiple public services comprising domestic and industrial clean water supply and irrigation in surrounding areas of the cities of Surabaya (East Java Province), Bandar Lampung (Lampung Province) and Makassar (South Sulawesi Province). The Project was formulated under the PT. PLN (Persero), a state-owned power company of Indonesia, combining the power plants portion of the multipurpose dam and their supporting projects under the Ministry of Public Works. The 6th Five-year National Development Plan under which the Project was formulated aimed at power development utilizing potential hydropower resources coupled with construction of coal-fired thermal power plants to supply base-load electricity demand.

1.2 Objective

The objective of this project is to construct 6.2MW (Java Bali System), 28MW (Wilayah IV <Lampung>) and 17.2MW (Wilayah VIII <South Sulawesi>) hydroelectric power plants aiming to meet growing electricity demand in each region, and thereby contributing to the regions' economic development and improvement of the people's standard of living.

1.3 Borrower/Executing Agency : Government of Indonesia／Directorate General of Water Resources, The Ministry of Public Works

1.4 Outline of the Loan Agreement

Approved Amount/Disbursed Amount	6,291million yen/4,044 million yen
End Notes Exchange Date/Loan Agreement Signing Date	December 1996 / December 1996
Terms and Conditions	Interest Rate: 2.7％（Consulting Service 2.3%） Repayment Period: 30 years Grace Period: 10 years Procurement: General Untied
Final Disbursement Date	March 2007
Main Contractor (over 1 billion yen)	Sumitomo Corporation (Japan)
Main Consultant (over 100 million yen)	PT. Kwarsa Hexagon (Indonesia) CTI Engineering, Co. Ltd. (Japan), Electric Power Development Co., Ltd (Japan)
Feasibility Studies, etc.	Brantas River Basin Development Master Plan, OCTA, 1973 (Wonorejo Dam) Engineering Service (E/S) for Wonorejo Dam, 1991 Feasibility Study (F/S) for Bili-Bili Dam, 1982 Engineering Service (E/S) for Bili-Bili Dam, 1988

Related Projects	Wonorejo Multipurpose Dam Construction Project Way Sekampung Irrigation Project (I) (II) (III) Bili-Bili Dam Project Bili-Bili Irrigation Project

2. Evaluation Results (Rating: A)

2.1 Relevance (Rating: a)

2.1.1 Relevance at Appraisal

The 6th Five Year National Development Plan (REPELITA VI, 1994~1998) aimed at improving power supply reliability and power development in line with the policy to get rid of the oil dependency based on regional resource endowment throughout the country. Volume of power consumption was growing with the annual rate of far more than 10%, and it was an urgent issue to develop potential hydropower resources coupled with construction of coal-fired thermal power plants to supply base-load electricity demand. It also urged restructuring of the power sector including private sector participation and organizational changes to achieve improved efficiency in power supply.

The following table articulately indicates the critical conditions of power supply against demand under such circumstances stated above.

Table 1: Power Supply-Demand Conditions in Indonesia

(Unit: Peak Load <MW>, Installed Capacity <MW>)

PLN Supply Area		1993	1994	1995	1996	1997	1998
Jawa -Bali	Peak Load	5,756	7,093	8,273	9,645	11,285	13,203
	Existing Capacity Installed	6,223	6,223	6,118	5,898	5,578	5,538
IV	Peak Load	301	343	374	416	483	561
	Existing Capacity Installed	571	566	565	545	538	511
VIII	Peak Load	176	194	215	239	286	342
	Existing Capacity Installed	349	348	347	319	300	296

Source: Appraisal Documents

Note: At the time of Appraisal in 1996, power supply areas of PLN were Jawa-Bali for Wonorejo, Area IV for Batutegi and Area VIII for Bili-Bili respectively. The PLN supply areas have been rearranged into

Wilayah (regional offices) which covers each responsible area assigned. (Cf. Table 2)

2.1.2 Relevance at Ex-Post Evaluation

The "Medium-Term National Development Plan (Rencana Pembangunan Jangka Menengah Nasional: RPJM-N) <2004-2009>", which announces the necessity of the development of the power sector for overall national development, puts continued emphasis on the development of alternative power resources including hydropower aiming for alleviating the dependency on oil as a main energy source. The growth of power demand has been also remarkable. The high rate of growth at 10% per annum in 1997 was once suspended by the economic crisis experienced in the same year, however, constant consumption with annual rate of 7.6% has been continuing afterwards. From the aspect of the diversification of power sources under the policy to alleviate oil dependency, hydroelectric power generation utilizing potential hydraulic resources is strengthened coupled with extended conversion to coal-fired thermal power generation for meeting base-load power demand. They occupy 39% and 11% respectively in total installed capacity, which turned to exceed the oil and gas fired generation that occupy 46%[1]. The potential capacity of hydroelectric power generation throughout Indonesia was estimated to be about 75,000MW ("Hydroelectric Power Potentiality Study," 1982), however, the total power volume developed up to the year 2008 amounts to 4,125MW, only 5.5% of the total potential.

PLN nominates areas whose peak-load demand can not be met with installed capacity of power generation as "Daerah Krisis (Critical Area)," and prioritize their power development in the Long-Term Power Development Plan (PUPTL, 2009~2018). South Sumatra (Batutegi) and South Sulawesi (Bili-Bili) are two of the 10 Critical Areas.

The power supply-demand conditions in respective supply areas of the three power stations[2] are critical. PUPTL forecasts 2 to 3-time increase in power demand represented by peak load in coming 10 years. To cope with this expanding power demand, estimated construction of needed power plants amounts to 57,442 MW (PLN, IPP inclusive) during the same period, among which hydroelectric power plant should occupy 4,740 MW, 3.8% of the capacity totally required (3,835, 10.9% for PLN only).The next table shows forecasted power demand of three regions to which the power stations of this Project belong.

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1 Geothermal 4%. All the figures are taken from RUPTL

2 At the time of Ex-Post Evaluation, Batutegi and Bili-Bili Powaer Plants are connected to the power grids of Sumatra and Sulawesi. Whereas, Wonorejo Power Plant which belongs to the Jawa-Bali System supplies electricity to a part of District Tulungagung District (Kabupaten) through Tulungagung Sub-station.

Table 2：Forecasted Power Demand and Peak Load in Three Supply Regions

Power Plant	Supply Area (Wilayah)	Power Demand (MWh)			Peak load (MW)		
		2008	2018 (Note)	In-crease (%)	2008	2018 (Note)	In-crease (%)
Won-orejo	East Java	22,219	48,623	119	3,681	7,842	113
Batutegi	Lampung	1,985	5,027	153	420	963	129
Bili-Bili	South/ Cen-tral Sulawesi	3,292	9,834	199	592	1,744	195

Source：RUPTL, 2009-2018

Note）：East Java show 2007 figures

Table 3：Total Necessary Capacity during 2008~18

(Unit: MW)

	Jawa-Bali	Sumatra	Sulawesi
PLN	27,042	3,668	1,754
(Hydroelectric Power)	2,984	262	505
IPP	13,910	5,477	1,488
(Hydroelectric Power)	140	631	257
Total	40,952	9,145	3,242
(Hydroelectric Power)	3,142	893	762

Source：RUPTL, 2009-2018

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

2.2 Efficiency (Rating: b)

2.2.1 Output

The Project is to construct the hydroelectric power plants portion of the multi-purpose dams implemented under a yen loan (Wonorejo in East Java, Batutregi in South Sumatra and Bili-Bili in South Sulawesi), and consists of equipment procurement for power plants and related transmission and sub-station facilities, civil works and consulting services (only for Bili-Bili Power Station). Actual output has no significant difference from the original plan except the following items.

(Major points of difference)

1. Substation Facilities of Batutegi

The originally designed transformer of the Batutegi Substation was 17,250kVA x 1 unit, but it was expanded up to 17.86MVA x 2 sets, 35.72MVA in total, to strengthen the system reliability.

2. Power plant and transmission facilities of Bili-Bili

Bili-Bili Power Plant additionally procured chromium-coated spare parts (about 300 million yen) in preparation to a possible damage on the turbine by impure water contaminated with earth and sand from the dam reservoir caused by the the large-scale landslide of Mt. Bawakaraeng upstream. Additionally, 2-kilometer double-circuit transmission lines connecting to the Rindam- Malino distribution lines were constructed to the upstream direction in addition to the 15-kilometer double circuit transmission lines (20kV) from the power plant to Borongloe in order to strengthen the system.

3. Consulting services for Bili-Bili

Bili-Bili Power Plant made a consulting contract with reduced man-month volume at 103.00 M/M for international consultants and 216.50 M/M for domestic consultants. Although the actual volume of man-month input turned out to increase up to 114.43 M/M due to the extension of the implementation period, the volume of the domestic consultants portion was saved up to 202.51 M/M partly replacing them with PLN engineers.

2.2.2 Project Period

Under the initial plan, the project period was from December 1996 to August 2003 (81 months), but the actual project period was from December 1996 to March 2007 (124 months) including 15-month extension of the loan disbursement period, which turned out 53.1% longer than planned. Major reasons of the implementation delay include (1) two-year delay in commencement of the consulting services due to the procedural delay affected by the economic crisis that attacked Indonesia in 1997 and succeeding political and administrative confusion, (2) one-year delay caused by prolonged contract negotiation with the second lowest bidder after terminating the negotiation with the lowest in the equipment procurement and (3) required additional one and a half years for additional procurement of coated spare parts (spray micronized chrome particles with high velocity oxygen-fuel thermal process) in preparation to a possible damage on the turbine runner portion of the generator by contaminated water from the dam reservoir caused by the inflow of

earth and sands from the large-scale landslide of Mt. Bawakaraeng upstream.

2.2.3 Project Cost

Planned project cost was 8,388 million yen (of which Japanese ODA loan was 6,291 million yen), and the total project cost at the time of ex-post evaluation was 4,922 million yen (of which Japanese ODA loan was 4,044 million yen), 41.3% smaller than planned. In spite of almost the same output performance compared to the original plan, the total project cost was much saved within plan. It is mainly due to the significant depreciation of Rupiah currency brought by the Asian currency crisis started in 1997, and transfer of a part of the Project to the Way Sekampung Irrigation Project which is funded under the budget of the Ministry of Public Works.

Although the project cost was held within the initial plan, the project period considerably exceeded the plan; therefore the evaluation for efficiency of this project is moderate.

Batutegi Hydroelectric Power Plant

The Ex-Post Evaluation Team is having a joint meeting with PLN officials for collective discussion on the Project performance.

2.3 Effectiveness (Rating: a)

2.3.1 Effectiveness Measurement with Operation and Effect Indicators

The following table summarizes the annual trend of the operation and effect indicators of the actual performance.

Table 4 : Annual Trend of Performance in Operation & Effect Indicators

No	Indicators	Unit	2002	2003	2004	2005	2006	2007	2008
Operation Indicators									
1	**Unplanned Outage Hours**								
	Wonorejo	hours/year	17.4	3.67	2.26	0.56	0.39	0	0
	Batutegi	hours/year	31.0	138.6	175.3	186.5	7.3	43.2	168.4

	Bili-Bili	hours/year	-	-	-	-	160	2	8
2	**Capacity Factor**	%							
	Wonorejo		29.83	30.96	31.81	29.67	32.24	36.39	40.43
	Batutegi		17.04	13.21	47.23	57.93	43.30	45.13	23.16
	Bili-Bili		-	-	-	-	40.8	53.5	53.9
3	**Annual Operating Hours**	hours/year							
	Wonorejo		3,260	4,565	4,946	4,588	3,519	3,939	4,535
	Batutegi		284	2,886	7,012	10,250	8,153	10,197	8,858
	Bili-Bili		-	-	-	-	10,326	11,551	11,501
4	**Planned Outage Hours**	hours/year							
	Wonorejo		108.77	0	73.25	0	80.75	103.33	79.33
	Batutegi		171.0	151.1	289.6	349.6	304.0	412.0	409.0
	Bili-Bili		-	-	-	-	208	112	110
5	**Maximum Water Use**	1,000m3/second							
	Wonorejo		28,160	29,429	30,094	28,178	29,995	34,005	38,187
	Batutegi		173,908	139,862	479,049	573,757	461,076	544,487	364,213
	Bili-Bili								
Effect Indicators									
6	Net Electric Energy Production	MWh/year							
	Wonorejo		16,000	16,721	17,099	16,010	17,043	19,321	21,697
	Batutegi		42,681	33,103	118,332	145,136	108,489	113,063	58,016
	Bili-Bili		-	-	-	-	70,897	92,334	93,189
7	Actual Maximum Output	MW							
	Wonorejo		6.3	6.3	6.3	6.3	6.3	6.3	6.3
	Batutegi								
	Bili-Bili								

Source：Questionnaire Answers from PLN

Note：Data for blank columns are not available in the PLN recording system.

All the power plants under the Project are to carry out generation which is one of the functions of the multipurpose dams, and the water use for generation is subordinate to the other uses for irrigation and clean water supply for domestic and industrial uses. Available volume of water for generation is subject to the volume of water supplied to other purposes, accordingly the plant capacity factors tend to be low and unstable in general.

Minor technical problems brought relatively long hours of unplanned outages at the initial stage of operation of Batutegi and Bili-Bil, however, proper remedies enabled prompt recovery and smooth operation up until the moment.

Temporary drop in Batutegi capacity factor (CF)[3] in 2008 is a result of the reduction of generation affected by the significant sinking of the reservoir's water level caused by the rainfall shortage in that year, however, it was recovered and

[3] CF = Annual Energy Production / (Maximum Power) x (Annual Hours)

returned to normal afterwards.

As a conclusion, all the hydroelectric power plants under the Project are generating electricity optimally and their operational conditions are favorable.

2.3.2 Results of Financial Internal Rate of Return

Update of the Financial Internal Return (FIRR) was attempted based on the same method of estimation at Appraisal and obtained the result as follows. The update for Bili-Bili Power Plant was unable due to the lack of accurate accounting record under unreliable project accounting system on disbursements from the state budget and annual amounts of disbursement of the total project cost at the time of Ex-Post Evaluation. Economic Internal Rate of Return (EIRR) for all the power plants under the Project was not possible either due to the lack of appropriate financial data necessary for the calculation.

Table 5：Assumptions & Results of FIRR Update

Project Life		50 years after commencement of project implementation
Cost		1. Investment Cost (Civil Works, Equipment Procurement, Consulting Services) 2. Operation & Maintenance (O&M) Cost (15% of total investment cost)
Benefit		Revenue from power sales
FIRR	Appraisal	Wonorejo: 18.9%, Batutegi: 10.4%, Bili-Bili: 12.8%
	Ex-Post Evaluation	Wonorejo: 16.1%, Batutegi: 25.0%

The main reason of the considerable increase in Batutegi FIPP is the drastic reduction in its total project cost.

2.3.3 Qualitative Effect

(1) Shares of Power Plants and Relevant Indicators

Connected power supply transmission systems and corresponding areas of power supply of each power plant of the Project are summarized in the following Table 6, and respective share of each power plant is shown in Table 7 as follows.

Table 6：Connected Systems & Power Supply Areas

Power Plant	Connected System or Substation	Power Supply Area of Connected System

Wonorejo	Tulungagung Substation	4 Sub-districts (Kecamatan) of Tulungagung District (Kabupaten)
Batutegi	South Sumatra System	Whole Sumatra Island
Bili-Bili	South, Southeast, West Sumatra System	Whole Sulawesi Island

Table 7：Capacity Share of Each Power Plant in Respective Supply Regions

(Unit: MW) 2007

Wonorejo（6.5 MW）				Share of Wonorejo
(Jawa Bali)	PLN Total	IPP	Total	
Hydropower	2,386	150	2,536	0.26%
Mini Hydro	0	0	0	
Steam	7,320	3,050	10,370	
Combined Cycle	6,143	0	6,143	
Gas	2,086	150	2,236	
Diesel	76	0	76	
Geothermal	360	515	875	
Jawa Bali Total	18,371	3,865	22,236	0.03%
Batutegi（28 MW）				Share of Batutegi
(Sumatra)	PLN Total	IPP	Total	
Hydropower	850			3.3%
Mini Hydro	13			
Steam	945			
Combined Cycle	818			
Gas	481			
Diesel	832			
Geothermal	40			
Sumatra Total	3,979	361	4,340	0.65%
Bili-Bili（20.1 MW）				Share of Bili-Bili
(Sulawesi)	PLN Total	IPP	Total	
Hydropower	172			11.69%
Mini Hydro	38			
Steam	25			
Combined Cycle	0			
Gas	123			
Diesel	440			
Geothermal	40			
Sulawesi Total	838	195	1,033	1.95%

Source：PUPTL 2009-2018

Note 1: Wonorejo belongs to Jawa Bali System, but supplies electricity only to 4 sub-districts of Tulungagung District via Tulungagung Substation. The share of Wonorejo is indicated only for reference.

Note 2: Due to the lack of classified data according to energy resources for IPP, the figures on shares of Batutegi and Bili-Bili in Sumatra and Sulawesi indicate the shares in PLN total.

While the generated electricity by Batutegi and Bili-Bili is supplied, being mixed with electricity from other power sources, to whole islands of Sumatra and Sulawesi respectively through intra-island power grids, electricity from Wonerejo under the Jawa-Bali power transmission system is distributed in a limited area of Tulungagung District via Tulungagung Substation being connected with the 20kV transmission lines. Although it is difficult to measure direct benefit derived from the power stations under the Project as stated above, except Wonorejo, due to their negligible shares among the corresponding areas of power supply, the "Electrification Ratio" and "Gross Regional Domestic Projects (GRDP)" are presented in the following tables just for reference.

Table 8: Annual Trend of Electrification Ratio

(Unit: %)

Power Supply System	2004	2005	2006	2007
Jawa Bali	62.3	63.1	63.9	66.3
Sumatra	54.9	55.8	57.2	56.8
Sulawesi	51.6	53.0	53.2	53.6
Indonesia Total	57.5	58.3	59.0	60.9

Source: RUPTL

Table 9: Annual Trend of GRDP

(Unit: billion Rupiah)

Power Supply System	2003	2004	2005	2006	2007
Jawa Bali	927,599	977,537	1,033,670	1,093,320	1,160,726
Sumatra	346,715	356,879	369,612	389,067	403,377
Sulawesi	65,961	69,714	74,079	79,212	84,662
Indonesia Total	1,538,655	1,604,036	1,690,229	1,777,994	1,878,019

Source: Statistics BPS (Central Bureau of Statistics)

(2) Relevant Indicators of Power Supply Area of Wonorejo Power Station

Tulungagung District consists of 19 sub-districts, and four sub-districts among those get electric supply from Wonorejo Power Station; namely, "Campurdarat," "Sumburgempol," "Boyolangu" and "Kedungwaru" Sub-districts. GRDP and number of business entities are shown in the following table.

Table 10：Annual Trend of Sectoral GRDP in Tulungagung District[4]

(Unit: billion Rupiah)

	2000	2001	2002	2003	2004	2005	2006	2007	2008	Growth Rate
Agriculture	984	1,002	1,026	1,047	1,071	1,096	1,121	1,149	1,188	21%
Mining	109	113	117	122	128	134	140	147	153	41%
Manufacturing	810	855	882	915	965	1,020	1,077	1,141	1,208	49%
Public Service	27	34	43	54	63	71	78	86	95	247%
Construction	108	109	111	113	115	117	124	126	131	22%
Commerce, Tourism	1,350	1,414	1,494	1,579	1,676	1,782	1,906	2,047	2,190	62%
Transportation	142	154	170	187	203	221	243	265	292	105%
Finance	547	585	608	637	674	710	749	789	836	53%
Other Services	609	624	640	658	684	715	752	794	831	36%
Total	4,686	4,891	5,091	5,312	5,579	5,865	6,187	6,543	6,924	48%

Source: Prepared from BPS Statistic “Tulungagung Dalam Angka” <Tulungagung in Figures>

The average growth rate of the public service sector including electric supply records the highest among others, but those of the manufacturing, commerce & tourism sectors exceeds the total average, which suggests that the contribution of the advent of power supply from Wonorejo Power Plant which started its operation in September 2002 could be significant.

Table 11: Growth Rates of Number of Business Entities in Tulungagung District

	Growth Rate (2000~2008)	
	4 Sub-districts, Consumers of Wonorejo	Tulungagung District Total
Large & Medium Size	78.0%	6.7%
Small Size	25.7%	4.8%

[4] Figures of 2000~2003 and 2004~2008 are expressed in 1993 price and 2000 price respectively. In order for both figures to be consistent, the former has been adjusted to the latter applying annual growth rates.

and Individual		

Source: BPS Statistic “Tulungagung Dalam Angka” (Tulungagung in Figures)

Rates of growth during 2000~2008 in four sub-districts being supplied with the Wonorejo electricity are remarkably higher than the rates of the total, which could indicate significant contribution of newly built Wonorejo Power Plant.

(1) Effect on Oil Consumption Saving

Effect on oil consumption saving and accompanied generation cost reduction is expected to the Project as a source of alternative energy to replace oil consumption. The value of oil consumption saving is estimated US$ 58 million based on the actual generation performance of the three power stations applying unit diesel price for generation cited in RUPTL 2009-2018.

(2) Result of Beneficiary Survey

As mentioned earlier, the generated electricity by Batutegi and Bili-Bili is supplied, being mixed with electricity from a great number of other power sources, to whole islands of Sumatra and Sulawesi respectively through intra-island power grids and their shares are small as indicated in Table 8. Therefore it is not possible to specify influenced beneficiaries, and no meaningful beneficiary survey can be executed. On the other hand, the beneficiary survey was conducted for Wonorejo Power Station which supplies electricity to limited area only covering 4 sub-districts by way of Tulungagung Substation.

a) Method

Interview survey was conducted using a questionnaire for business entities and individual households. For the business entities the 5 biggest customers and 9 other businesses were picked out as samples voluntarily without sectoral bias (totally 14 samples). For individual households, 101 samples were selected voluntarily also avoiding biased selection. The total population of the benefited area in 4 Sub-districts is approximately 275 thousand people, while total population of Tulungagung District is 1,020 thousand. Total number of customers using electricity from Wonorejo is about 30 thousand connections.

Wonorejo Hydroelectric Power Station

Residents being interviewed in the beneficiary survey in Tulungagung District.

b) Summary of Survey Result

Regarding the inquiry of general quality of power supplied, only 7% of business entities and 15% households evaluate the quality before the Project “Excellent” whereas 85% and 89% respectively answered that the quality became “Excellent” after the Project. About the frequency of power failure, 57% of business entities and 28% of households say “Scarcely happened” before the Project, but for the condition after the Project, 100% and 83% answer “Scarcely happens.” For the voltage stability, 79% of business entities and only 17% of households appreciate it “Very stable,” but the figures increased up to 100% and 73% on the condition after the Project.

The above result indicates that the conditions of power supply in the benefited area significantly improved in quantity as well as in quality in conjunction with the operation commencement of Wonorejo Power Plant.

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

2. 4 Impact

2.4.1 Impact on Natural Environment

The Project is to construct relatively small-scale power stations to be attached to the multipurpose dams which are the main component of the comprehensive master projects, and therefore do not impose heavy burden on natural environment. It is also under careful environmental monitoring during implementation and after operation, in which no significant adverse effect on the environment has been reported.

2.4.2 Impact on Social Environment

Same as above, no significant social impact has been reported. In the construction of the transmission lines from Batutegi Pawer Station to Pagalaran which is the only case where land acquisition took place, the process was smoothly executed without any serious problem. No relocation of residents was executed.

2.5 Sustainability (Rating: a)

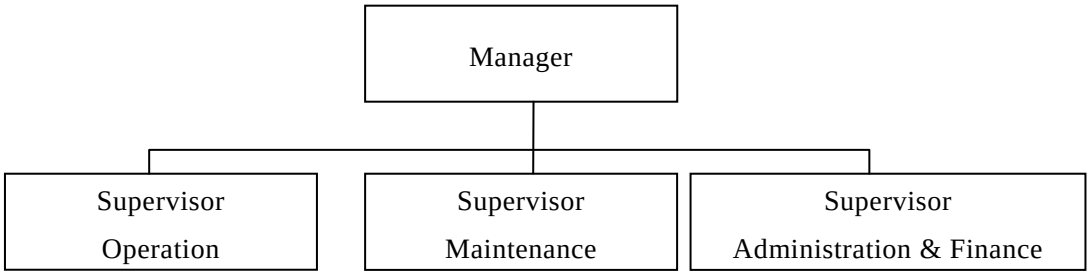
2.5.1 Structural Aspects of Operation and Maintenance

Each power station is operated and maintained under the layered responsibility of the relevant institutions under PLN as shown below.

Table 13：Institutional Structure of Operation & Maintenance (O&M)

Power Plant	Institutional Structure of O&M
Wonorejo	- PT PJB：Pembangkitan Jawa-Bali ＜Subsidiary of PLN＞ - Wonerejo Power Station
Batutegi	-PT PLN (PERSERO) Pembangkitan Sumatra Bagian Selatan -PT PLN (PERSERO) Sektor Pembangkitan Badar Lampung - Batutegi Power Station
Bili-Bili	- PT PLN (PERSERO) Wilayah Sulawesi Selatan, Tenggara & Barat - Sektor Bakaru - Bili-Bili Power Station

The organization of the power plants are simply structured basically as illustrated in the figure below with minor difference among the plants.



In Batutegi and Bili-Bili Power Plants under the direct management of PLN, three supervisors are assigned respectively in charge of “Operation,” “Maintenance” and “Administration & Finance.” In case of Batutegi, the operation department is further divided into four working teams. Numbers of assigned staff engineers are about 10 for operation, 3 for maintenance and one (excluding securities and cleaners) for administration & finance.

On the other hand, in Wonorejo Power Plant which is under management of PJB, a subsidiary company of PLN, totally 13 engineers are assigned under the Foreman (head of power station). Different from two other power plants, the O&M section is not segregated into operation and maintenance and staffed with relevant engineers with various expertise like “System Control,” “Mechanical Engineering,” “Electric Engineering,” “Equipment Management” and “Civil Engineering.”

2.5.2 Technical Aspects of Operation and Maintenance

Most of the staff assigned to the sections of operation and maintenance above have academic background of electrical or mechanical engineering at STM or other institutions of higher education. All follow technical training courses below specially prepared for the area of hydroelectric generation several times a year so as to continually upgrade their technical skills.

PLN makes much of staff education and training based on its internal regulation. The training is conducted systematically providing staff with such courses as below.

a. Freshman educational training
b. Professional training (Power generation, Transmission O&M, Distribution O&M, etc.)
c. Grade training (Managers, Strategic specialist, etc.)
d. Other supplementary training (Technical workshop, seminar, diffusion of knowledge, etc.)

Those training programs are carried out basically at PUSDIKLAT (Center of Education & Training) of PLN. Additionally courses especially focused on hydroelectric power generation are prepared in the training center in Padang, West Sumatra, and approximately 1,100 staff members were participated in more than 50 courses mainly on O&M and other technical training in 2008.

The engineers assigned to the three power plants under the Project were sufficiently trained following the special courses above. At the same time PLN applies a basic policy to assign staffs with enough experience in other power stations especially to new power stations. No technical problems or shortcomings were found considering well-prepared institutional arrangement and practices as well as the current good conditions of the facilities under operation.

2.5.3 Financial Aspects of Operation and Maintenance

Operation and maintenance budgets of power stations under direct management of PLN are formulated at each location based on their requirement for O&M activities and requested to the headquarters through relevant Sektors and Wilayah (regional office). The approved amount is provided from the recurrent budget of PLN headquarters. PLN's financial difficulty as shown below does not allow those budgetary requests to be fully met, however, no significant cash flow shortage for operation and maintenance is prevailing in the field. Also being supported by their significantly cheap cost of operation, the three power plants under the Project are well operated and maintained without any significant financial obstacle.

Table 14: Trend of Financial Performance of PLN on Consolidated Basis

(Unit: billion Rupiah)

	2002	2003	2004	2005	2006	2007	2008
Power Sales	39,018	49,809	58,232	63,246	70,735	76,286	84,250
Government Subsidy	4,739	4,097	3,470	12,511	32,909	36,605	78,577
Total Operation Revenue	44,183	54,430	62,273	76,543	104,726	114,042	164,209
Fuel & Lubrication Cost	17,957	21,478	24,491	37,355	63,401	65,560	107,783
Total Operation Cost	52,345	55,876	59,710	76,024	105,228	111,505	160,598
Operation Profit	-8,162	-1,446	2,563	519	-502	2,537	3,611
Foreign Exchange Profit / Loss	2,725	1,009	-1,523	-699	1,763	-858	-9,296
Total Profit	-6,060	-3,558	-2,021	-4,921	-1,928	-5,645	-12,304

Source: Annual Report, PLN

PLN is chronically supported by a big amount of government subsidy and is hardly operating as a financially independent corporation, but could be regarded as a direct government's business. That state of affairs is also implicitly represented by the attitude to categorize government subsidy as the company's operational revenue. One of the fundamental factors is a serious financial burden of fuel cost for generation. Especially in 2008, having been attacked by the soaring oil price, PLN received almost the same amount of gigantic government subsidy as the total power sales. PLN recorded a massive financial loss amounting to 12 trillion Rupiah in the same year incurring big foreign exchange loss caused by the significant depreciation of Rupiah currency, which could not be recovered even by the large scale government subsidy. That amount of PLN's loss occupied 83% of the entire amount of loss of all the state-owned companies incurred (23 companies, total 14.5 trillion Rupiah[5]). On the other hand, PJB, PLN's subsidiary company

[5] The company that suffered from the second biggest financial loss was Merpati Nusantara, state-owned airline company, whose amount of loss was 500 billion Rupiah which is only 5% of the PLN's. (KOMPAS <internet version>, May 14, 2009)

which operates Wonorejo Power Station has been enjoying favorable operational performance with positive operating and total profit in consecutive 5 years until 2006 (profit / sales ratio: 5~7%). Operation and maintenance of Wonorejo Power Plant is also running well with ample budget.

Thus PLN as a company faces a significant financial problem and much effort should be made in operation and management to improve the situation, however, it is the condition that the Indonesian power sector is under full financial support of the government with massive subsidy. The financial issue of operation and maintenance in the field belongs to a different dimension, and PLN's financial problem does not exercise direct influence at this stage on the power plants' cash flow for effective operation and maintenance.

2.5.4 Current Status of Operation and Maintenance

Constructed facilities of Bili-Bili Power Plant are well maintained and operated smoothly. The additionally procured spare parts of the generator in preparation to the possible damage by contaminated water have not been used yet and are kept in good condition, and smooth generation is going on with existing generators. In addition to the fact that the water inflow from the dam reservoir containing earth and sand has turned out to be not so serious as anticipated, the installation of a cyclone separator under a partially modified technical design, which removes the foreign substances and avoids their influx into the radiators, could effectively support the smooth operation. Wonorejo and Batutegi Power Plants are operated in good conditions under appropriate maintenance as well without any significant troubles. The two sets of governors of Batutegi Power Plant were facing a minor technical trouble in a part of their function, or life has been expired according to the engineer, but it does not affect at all the automatic operation which is currently going on. Their replacement cost (about 16 million yen) has been already budgeted.

Minor operational problems, such as Japanese indication on the governors' display and lost password and back-up programs of the HMI (Human Machine Interface), were prevailing in the field. Those deficiencies do not impede anything as long as the generators are under automatic operation, but will reveal problems once the generation has been changed to manual operation under some unusual conditions. Although it can not be objectively identified whether it was due to the acceptance of imperfect equipment or improper procedural treatment during the internal transfer to the field, it has been obviously derived from such weakness in internal management as lack of careful acceptance based on the supply contract or

predetermined procedural rules, miss-documentation after acceptance and so forth. An internal management system for careful inspection at acceptance should be strengthened in order to avoid such failures and secure transfer of perfect goods to the field of operation. The consulting services of Wonorejo and Batutegi Power Plants are provided under the corresponding multipurpose dam projects implemented by the Ministry of Public Works. Operation & maintenance manuals for power stations were prepared by the consultants within the said consultancy, however they are not delivered to the PLN's power stations concerned. In such a case that a part of project implementation is executed in a different agency, effective communication and collaboration are essential to maximize the project effect.

Although minor problems on equipment under unsatisfactory conditions and unused operational manual were found in the field, no major problem has been observed in the capacity of the executing agency nor its operation and maintenance system, therefore, sustainability of this project is high.

3. Conclusion, Lessons Learned and Recommendations

3.1 Conclusion

This Project has been highly relevant in line with the Indonesia's national policy to cope with the country's growing power demand concurrently aiming at alleviation of oil dependency, and consistent with the development needs. Although the efficiency of the Project is moderate with significant delay in its implementation, the effectiveness is high contributing to the improvement of prevailing insufficient power supply in respective power transmission systems and to activate regional economy and increase people's welfare through improved power supply in quantity as well as in quality. No major problem has been observed in the capacity of the executing agency nor its operation and maintenance system, therefore, sustainability of this project is high.

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

3.2 Lessons Learned

1. Cooperation among Implementing and Operating Agencies Involved

In case where multiple agencies are involved in project implementation and operation, achievement of sufficient project effect and sustainability are prevented without good cooperation among the agencies especially in the stage of transition from implementation to operation. (Cf. 3.3 Recommendations, Section 2 below)

2. Submission and Receipt of Accurate Project Completion Report (PCR)

In yen-loan projects, a project implementing agency is requested to prepare and submit a Project Completion Report (PCR) to JICA in accordance with the agreed format. However, what has been submitted to JICA is a completion report prepared by the consultant and submitted to PLN in accordance with their consulting contract, which is not the PCR officially requested by JICA based on the agreement reached in the Loan Agreement. Moreover, the completion report above is only for Bili-Bili and does not include contents on Wonerejo and Batutegi Power Plants whose consulting services are under the Ministry of Public Works. At any project completion in future, the PCR submitted to JICA should be the official one consistent with the prior agreement in L/A. JICA should also carefully inspect the contents on its acceptance.

3.3 Recommendations

1. Improvement of Management Practices

Internal management practices in PLN and inter-agency management arrangement among different implementation agencies should be improved. The internal management system should be totally strengthened in order to carry out implementation and operation of hardware facilities and to achieve sufficient operational results. The following are typical examples.

2. Issues of Operation & Maintenance Manuals

The consulting services of Wonorejo and Batutegi Power Plants are provided in “Wonorejo Multipurpose Dam Project” and “Way Sekampung Irrigation Project (I)” under the Ministry of Public Works. The operation & maintenance manuals for the portions of power stations were prepared by the consultants under the contracts with the Ministry of Public Works, however those manuals have not been delivered not only to the power stations in question but even not to the PLN side. In such a case that a part of project implementation is executed involving multiple agencies, effective communication and collaboration are essential for aiming for the achievement of maximal project effect. (In this connection, an operation & maintenance manual for Bili-Bili Power Plant was not prepared based on the agreement with PLN.) The manuals currently in the custody of the Ministry of Public Works should be promptly sent to PLN and to be delivered to the respective power stations. [to PLN]

3. Issues on Equipment Inspection at Acceptance

Minor operational problems, such as Japanese indication on the governors’

display and lost password and back-up programs of the HMI (Human Machine Interface), were prevailing in the field. Those deficiencies do not impede anything as long as the generators are under automatic operation, but will reveal problems once the generation has been changed to manual operation under some unusual conditions. Although it can not be objectively identified whether it was due to the acceptance of imperfect equipment or improper procedural treatment during the internal transfer to the field, it has been obviously derived from such weakness in internal management as lack of careful acceptance based on the supply contract or predetermined procedural rules, miss-documentation after acceptance and so forth. An internal management system for careful inspection at acceptance should be strengthened in order to avoid such failures and secure transfer of perfect goods to the field of operation. [To PLN]

Comparison of the Original and Actual Scope

Item	Original	Actual
1. Project Output	Wonorejo Power Plant (Installed Capacity: 6.3MW) ・Power Station 6.5MW ・Transmission & Substation Facility: Transmission Lines (20KV, 13km), Switchyard Batutegi Power Plant (Installed Capacity: 28MW) ・Power Station 28.9MW ・Transmission & Substation Facility: Transmission Lines (150KV, 30km), Switchyard, Transformer Bili-Bili Power Station (Installed Capacity: 17.2MW) ・Power Station 17.7MW ・Transmission & Substation Facility: Transmission Lines (20KV, 12km), Switchyard ・Consulting Services（IC：120MM, LC：239MM)	Wonorejo Power Plant (Installed Capacity: 6.5 MW) ・Power Station 6.5MW ・Transmission & Substation Facility: Transmission Lines (20KV, 13km), Switchyard Batutegi Power Plant (Installed Capacity: 28MW) ・Power Station 29.8MW ・Transmission & Substation Facility: Transmission Lines (150KV, 30km), Switchyard, Transformer Bili-Bili Power Station (Installed Capacity: 20.1MW) ・Power Station 20.1MW ・Transmission & Substation Facility: Transmission Lines (20KV, 17km), Switchyard ・Consulting Services（IC：114.43MM, LC：202.51MM)
2. Project Period L/A Signing Consultant Selection Consulting Service Procurement, Civil Works	December 1996~August 2003 (93 months) November 1996 November1996~October 1997 November 1997~August 2003 November 1996~February 2003	December 1996~March 2007 (124 months） December 1996 November 1999 January 2000~December 2006 December 2000 (Bili-Bili) ~2006/12
Project Cost Foreign Currency Local Currency Total Japanese ODA Portion Exchange Rate	 4,875 million yen 3,513 million yen 8,388 million yen 6,291 million yen US$1＝105.7 yen Rp.1= 0.046 yen (April 1996)	 4,922 million 4,044 million US$1＝115.3 yen Rp.1= 0.013 yen (Actual rates 1997~2005)