

Indonesia

Ex-Post Evaluation of Japanese Grant Aid Project
“Project for Rehabilitation of Gresik Steam Power Plant Units 3 and 4”

External Evaluators: Junko Fujiwara, OPMAC Corporation

1. Project Description



Project Location



Steam Turbine of Units 3 & 4

1.1 Background

Majority of the electricity power demand in Indonesia is concentrated in Java Island where the capital city Jakarta is the center of demand. The demand in the Java-Bali power system stagnated in terms of electricity sale volume in 1998 due to the economic crisis in 1997; however, thereafter, the demand had increased by 9.4% on average per year. On the other hand, the economic crisis had hindered the implementation of action plan for new power plant constructions by the State Electricity Corporation (PT PLN (Persero), hereinafter referred to as “PLN”) and Independent Power Producers (IPP). Thus shortage in power supply from 2003 to 2005 was anticipated. In 2003, the maximum power supply capacity was between 12,500 and 14,000MW, whereas the actual peak load in 2002 was 13,830MW. This implied that a shortage in power supply would be predicted even when including the electricity sale by private companies in addition to that of PLN.

The Gresik Thermal Power Plant is located in Gresik City, East Java Province, and is connected to the Java-Bali power system, and has largely contributed to the stable power supply not only in East Java but also to the whole of Java and Bali Islands. The plant consisted of four gas turbine power generation facilities (80.4MW in total), four units of steam turbine power generating facilities (600MW in total), and three blocks of gas turbine combined cycle power generation facilities (1,578.78MW in total).

Japan has provided ODA loans and grant aids to the Gresik Thermal Power Plant since the 1970s. Units 1 and 2 of steam turbine power generation facilities (200MW in total) started its operation in 1980 and 1981, and Units 3 and 4 (400MW in total) in 1988 whose construction cost were mostly covered under ODA loans. With respect to Units 3 and 4, in alignment with the national policy that promoted diversification of energy sources and reduction of dependency on oil, Japan provided another ODA loan to modify the generation facilities from oil-fired to both gas and oil-fired model.

The total output of the facilities constructed through Japanese ODA loan in Gresik Thermal Power Plant is 600MW, which contributed to the establishment of high credibility of the whole

power plant by securing stable supply of electricity, and the power plant supported the high economic growth of Indonesia.

Units 1 and 2 were rehabilitated through Japanese Grant Aid in 1999 to overcome its aged deterioration, which remarkably improved its availability factor as a result. 15 years of operation also put Units 3 and 4 under aged deterioration, and a need for recovering the maximum output, improving the thermal efficiency and durability for stable operation was confirmed, leading the two governments to decide the implementation of the targeted project.

1.2 Project Outline

The objective of this project is to recover the maximum output, improving the thermal efficiency and durability of Units 3 and 4 of steam turbine power generation facilities of the Gresik Thermal Power Plant, by rehabilitating their steam turbines, major steam valves, and turbine auxiliary system.

Grant Limit / Actual Grant Amount	1,985 million yen / 1,975 million yen
Exchange of Notes Date	July, 2004
Implementing Agency	PT PLN (Persero)
Project Completion Date	March, 2007
Main Contractor	Sumitomo Corporation
Main Consultant	Tokyo Electric Power Services Co., Ltd.
Basic Design	Basic design study report on the project for rehabilitation of Gresik Steam Power Plant units 3 and 4 in the Republic of Indonesia, Japan International Cooperation Agency and Tokyo Electric Power Services Co., Ltd. Dec 2003
Detailed Design	August 2004
Related Projects	“Engineering Services For Gresik Steam Power Plant Project” (L/A signed 14 Oct 1975): 276 million yen
	“Engineering Services For Gresik Steam Power Plant Project” (L/A signed 28 June 1977), 975 million yen
	“Gresik Steam Power Plant Project” (L/A signed 28 June 1977), 12,559 million yen
	“Engineering Services For Gresik Thermal Power Plant” (L/A signed 31 Mar 1981), 368 million yen
	“Gresik Thermal Power Plant” (Unit III And Engineering Services For Unit IV) (L/A signed 30 Apr 1982), 28,210 million yen
	“Gresik Thermal Power Plant” (Unit IV) Project (8 Mar 1984) 8,815 million yen
	“Gresik Thermal Power Plant” (Unit IV) Project (8 Mar 1984) 11,999 million yen
	“The Gas Firing Modification Works Of Gresik Steam Power Plant Units III And IV Project” (22 Dec 1989) 4,445 million yen
	“The Project for Rehabilitation of Gresik Steam Power Plant Units 1 and 2 (1/2)” (E/N dated 25 Mar 1999), 1,182million yen
	“The Project for Rehabilitation of Gresik Steam Power Plant Units 1 and 2 (2/2)” (E/N dated 29 Jul 1999), 1,134 million yen

2. Outline of the Evaluation Study

2.1 External Evaluator

Junko Fujiwara, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: October, 2009 – August, 2010

Duration of the Field Study: March 11, 2010 – March 20, 2010

2.3 Constraints during the Evaluation Study

Not specifically.

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

3.1 Relevance (Rating: a)

3.1.1 Relevance with the Development Plan of Indonesia

(1) Relevance with the National Development Program and Plan

At the time of basic design study implementation, the National Development Program Strategy (PROPENAS) from 2000 to 2004 had been implemented, to which this project was relevant. The PROPENAS placed great importance on the rehabilitation and betterment of existing infrastructure and ensuring all citizens' access to basic services.

The National Medium Term Development Plan (RPJMN) from 2005 to 2009, which was outlaid in January 2005 by the new government led by President S.B. Yudhoyono, had continuous focus on the power and energy sector along with other sectors' infrastructure development. In the same document, they pointed out that an extra 22,261MW power-generating capacity will be needed in the next five years in order to forestall a looming energy crisis.

(2) Relevance with National Power Development Plan

At the time of basic design study implementation, five high-priority issues in the power and energy sector were stated in the Power Sector Master Plan (RUKN) for the year 2003, namely: (a) reorganization of the power and energy sector and establishment of a competitive market; (b) reform of the tariff system; (c) adaptation of a policy for the use of generated electricity; (d) promotion of investment from the private sector, and; (e) reform of legal arrangements. With regard to the policy for the use of generated electricity, it is mentioned that 13,365MW will be needed in the Java-Bali area out of the extra 22,261MW of power-generating capacity needed for the whole of Indonesia. In this respect, the project was in alignment with this target and was relevant to the plan.

The current master plan, RUKN 2008 - 2027 published in November 2008, mentions that, as of 2008, the peak demand of the Java-Bali power system is 19,389MW out of the total national peak demand of 25,407MW. The necessary total installed capacity for power generation mentioned in the RUKN is 33,631MW for the entire country, which of that the Java-Bali power system needs 25,205MW, becoming nearly two times of the capacity that was anticipated at the time of 2003.

3.1.2 Relevance with the Development Needs of Indonesia

The total output of the Gresik Thermal Power Plant (2,259.18MW), which accounted for approximately 12% of the Java-Bali power system in 2003, and the total rated output of Units 3 and 4 (400MW), which are the target facilities of this project, supplied 2.1% to the system at that time.

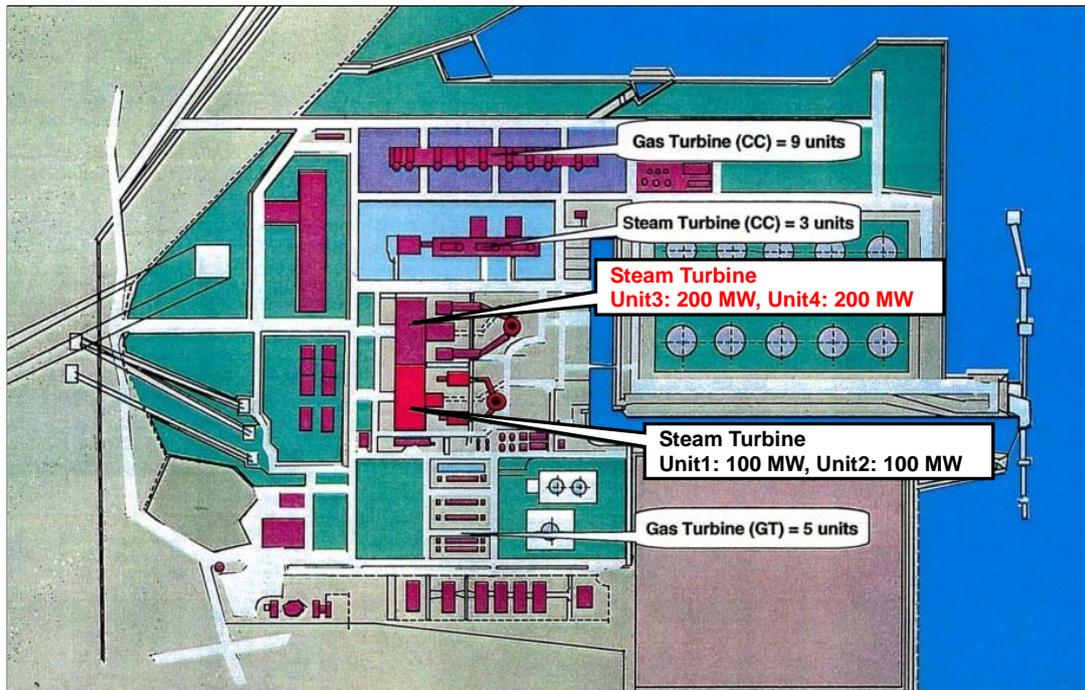


Figure 1: Grand Layout of Gresik Thermal Power Plant

As of 2009, the total installed capacity of the Gresik Thermal Power Plant makes up approximately as much as 10.2% (1.8% for Units 3 and 4) of the total capacity of the Java-Bali power system and still remains an important part of the system (Figure 1).

The peak load in 2002 for West Java Province, which contains the largest demand area including Jakarta, was 8,251MW, and when considering the reserve margin, a total supply of 10,310MW was needed. This was beyond the total installed capacity at the time of 9,848MW, thus electricity supply from East Java Province where reserve margin for electricity supply exists, was desired. Therefore, the project had the aim of contributing to tackle the problem of this predicted power demand.



Photo 1: Gresik Thermal Power Plant
(Note) Taller chimney belongs to Units 3 & 4

At the time of basic design study implementation, a 500kV transmission line connecting Eastern and Western Java on southern-route, in addition to the existing two lines on northern route, was under construction to ensure the stable function of Java-Bali power system. This project was thus planned before the extension of the southern-route transmission line to which the Gresik Thermal Power Plant was to be connected. This southern-route 500kV transmission line was completed in July 2006 and has been operating since August of that same year, meaning the project was completed before the installment of the transmission line.

The power-generating capacity in 2007 improved up to 19,980 MW and the maximum power demand reached 16,896MW, becoming twice of that of the year 2002. Additionally, according to the RUKN 2008 - 2027 (mentioned above), the power demand for Indonesia will grow at a rate

of 9.5% per annum (approximately 9.8% for the Java-Bali power system and 8.2% for the outer islands). Easing the pressure of electric power demand and supply is strongly aspired, and there still is a growing need of transmitting electricity from Eastern Java to Western Java where power demand is concentrated.

Reflecting the large increase in crude oil prices in recent years, two crash programs have been underway stipulated by the Presidential Decrees, with which electricity generation using coal and renewable resources such as geothermal and hydro, will be further accelerated (program one: 2006 - 2009 (later amended to - 2013), program two: 2009 - 2014). However, fuel usage shift is largely influenced by the progress of new power plant development in the country. The importance that the Gresik Thermal Power Plant possesses remains high when considering the necessity of ensuring the stable power supply through the existing power plants, applying the optimal power supply configuration using various kinds of fuels, and dealing with emergency.

Considering the above points, while the development of new power plants has been behind the scheduled timing since the initiation of this project until now, a project like this which quickly secured the stable power supply by rehabilitating the existing facilities, is at high priority and urgency.

3.1.3 Relevance with Japan's ODA Policy

The three focus areas within the Country Assistance Program for the Republic of Indonesia, published by the Ministry of Foreign Affairs in November 2004, are: (a) assistance to realize sustainable growth driven by private sector; (b) assistance to create a democratic and fair society, and; (c) assistance for peace and stability. The above (a) includes the aim of establishing economic infrastructure to improve the investment environment, which refers to the importance of assistance towards upgrading the power-generating capacity in the power and energy sector. Therefore the target project is also relevant to our country's aid policy towards Indonesia.

The Government of Japan has been supporting the Gresik Thermal Power Plant since 1975 through a series of ODA loans and grant aids. Units 3 and 4 were constructed and further modified to adapt plural fuel use (gas and oil) through ODA loans, and the assistance is longstanding. In relation with the Java-Bali power system, to which the Gresik Thermal Power Plant supplies its generated output, the assistance provided by the GOJ plays the core role as seen in the fact that a total of 15 ODA loan projects have been carried out since 1971. At the time of basic design study implementation, erosion and corrosion of the turbines and other facilities of Units 3 and 4 was evident, and a possibility of that resulting in a large-scale hazard, which would also largely influence the Java-Bali power system, was considerable. The necessity and urgency of this project was thus affirmed.

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

3.2 Efficiency (Rating: a)

3.2.1 Project Outputs

The output of this project was as planned. The details are explained in Table 1. As for the Indonesian side, part of the operation was allocated and carried out.

Table 1: Project Outputs

The Japanese side	
Plan (B/D)	Actual
Outputs related to Units 3 and 4 (rated output: 400MW) <ul style="list-style-type: none"> • <u>Steam turbine facilities</u> Complete replacement of moving blades, repair of high and intermediate pressure turbine rotor and low pressure turbine rotor, replacement and repair of nozzle diaphragm, replacement of all grand / nozzle packing rings • <u>Major steam valves</u> Replacement of internal parts, replacement of parts of hydraulic cylinders and replacement of parts of power cylinder • <u>Boiler feed-water pump</u> Repair and partial replacement of inner parts 	As planned
The Indonesia side	
Assigned works <ul style="list-style-type: none"> • Disassembly, check, and assembly of respective equipment and facilities • Supply of fuel and manpower at trial operation • Inland transportation of procured materials 	

(Note) B/D =basic design study

3.2.2 Project Inputs

3.2.2.1. Project Period

In the basic design study report, the project period was envisaged as the following. Total period: 21 months (from conclusion of E/N until trial operation and completion of performance test); detailed design: 3 months (including the preparation of the tender documents); tender: two months (from the tender notice to the tender evaluation); procurement and installation: 16 months (from contract to trial operation and completion of performance test).

The project execution in reality took 20 months (from July 2004 to February 2006) in total, which was shorter than expected (Table 2). It took 5 months (from August to December 2004) for the detailed design and the tender, and 15 months (from December 2004 to February 2006) for the procurement and installation.

Table 2: Project Period

Activities	Plan (B/D)	Actual
Total period (from conclusion of E/N until trial operation and completion of performance test)	21 months	20 months
detailed design including the preparation of the tender documents	3 months	5 months
Tender	2 months	
Procurement and installation	16 months	15 months

3.2.2.2. Project Cost

The actual expense covered by the Japanese government was 1,975 million yen, compared to the E/N limit of 1,985 million yen (99%), and was within the planned amount. Effort to reduce the construction cost was realized by adopting strategies such as contracting three local subcontractors out of the allotted six for procurement and installation.

Table 3: Project Cost

Activities	Plan (B/D)	Actual
Total amount of Grant Aid	1,985 million (E/N limit) yen	1,975 million yen
Material cost	1,637 million yen	1,911 million yen
Installation cost	286 million yen	
Design and procurement	65 million yen	64 million yen

(Note) Exchange rate: 1 rupiah = 0.0151 yen, 1 US dollar = 119.72 yen (as of August 2003)

Both project period and project cost were within the plan, therefore efficiency of the project is high.

3.3 Effectiveness (Rating: a)

3.3.1 Quantitative Effects

3.3.1.1 Results from Operational Indicators

There is less gas-fired power generation at Units 3 and 4 than described in the B/D study report and the oil-fired generation remains the main power source¹. However, the operation is going smoothly and stable power generation is secured. The expected residual life of the facilities is 20 years after construction as initially planned.

Along with the maximum output and the gross thermal efficiency that were described as the evaluation indicators to monitor the project achievement in the basic design report, the capacity factor, the planned outage hours and the unplanned outage hours are also confirmed as shown in Table 4. The gross thermal efficiency is above the target figure. The maximum outputs at the time of inspection after the one-year warranty period were confirmed as 197MW for Unit 3 (February 2007) and 195MW for Unit 4 (October 2006) for the oil-fired power generation. However, at the time of this evaluation, both Units 3 and 4 had an output of 195MW (20.4% of recovery) for gas-fired generation, and 187 to 190MW (Unit 3) and 180 to 190MW (Unit 4) for oil-fired generation. The maximum outputs are below the target figures since Units 3 and 4 mainly use oil for power generation. Nevertheless, it still surpasses the maximum output of oil-fired power generation before the implementation of this project (162MW for Unit 3, 172MW for Unit 4 as of 2003), and effectiveness of the project therefore is admitted.

Table 4: Operation Performance of Units 3 and 4

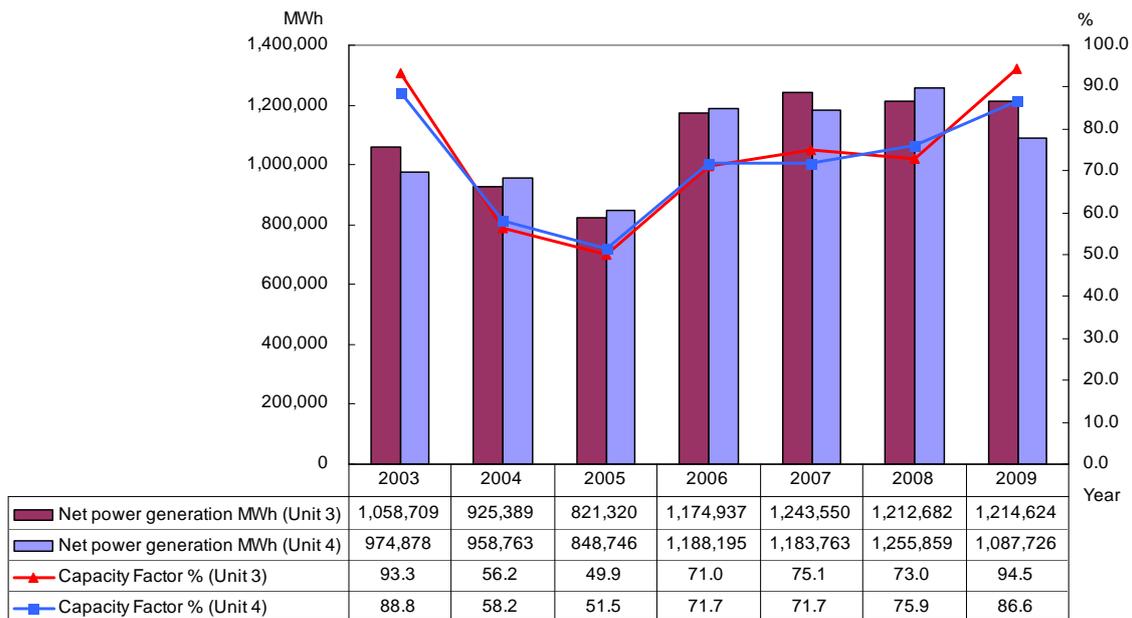
Indicators (unit)		Baseline	Target	Actual			
		2003	2006	2006	2007	2008	2009
Maximum output (MW)	Gas-firing (both Units 3 and 4)	-	200	195			
	Oil-firing	Unit 3 Unit 4	162 172	195	187 185	187 180	187 180
Gross thermal efficiency (%)	Unit 3	31.55 (35.48)	34.70	38.20	38.00	37.53	38.10
	Unit 4	31.48 (35.23)	34.60	36.70	36.64	36.77	36.97
Planned outage hours (hours)	Unit 3	399.34	-	370.52	720.34	765.10	411.89
	Unit 4	704.03	-	462.47	749.94	412.41	1,041.82
Unplanned outage hours (hours)	Unit 3	187.84	-	273.33	0	0	49.18
	Unit 4	269.382	-	0	154.29	0	0

(Source) Gresik Thermal Power Plant

(Note) Figures with blankets for the baseline of gross thermal efficiency are values from 1994 when the facilities were modified for both gas-firing and oil-firing.

¹ There is a severe shortage of gas supply throughout Indonesia, and blocks of gas turbine combined cycle power generation facilities are more prioritized to use gas delivered to the Gresik Thermal Power Plant since their thermal efficiency is higher than the rest facilities in the Plant.

As shown in Figure 2, the capacity factor is secured at approximately 70% to 90% for both Units 3 and 4. The net power generation after 2006 for Units 3 and 4 are both above the figures recorded before the project implementation in 2003 and is under smooth operation. The decline in net power generation admitted in some years after 2006 is because the Load Control Center (PT PLN (Persero) P3B) who overlooks the Java-Bali power system is requesting the Gresik Thermal Power Plant to restrict power generation of Units 3 and 4. The reason to this is because of their relatively high generating costs due to the recent rise in crude oil price, which they mainly use for power generation², and their aged facilities compared to other power plants after 20 years of its operation. Units 3 and 4 operate at full load during peak load hours and at its minimum output during base load hours.



(Source) Gresik Thermal Power Plant

(Note) Figures 2009 up to the third quarter of the year

Figure 2: Net Power Generation and Capacity Factor of Units 3 and 4

The planned outage hours were spent for periodic inspection. The reason that the planned outage hours rose in 2009 is because the serious inspection of every 4 years was scheduled and implemented (for schedule and records of each periodic inspection, refer to the article 3.5.4 *Current Status of Operation and Maintenance*). The main objective of having the unplanned outage hours was to resolve the defects in facilities that are found through the daily inspections. The pressure of the boiler furnace becoming too high, damage to the pipes, and leakage from the boiler tubes are mentioned as the main causes of the unplanned outage, and appropriate repair works have been done against them. Ever since the implementation of this project, a stable capacity factor has been secured, implying that these kinds of unplanned outage hours are relatively suppressed.

3.3.2 Qualitative Effects

Not specifically.

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

² Actual fuel cost (oil – gas) in 2009 was 96% - 4% for Unit 3, and 93% - 7% for Unit 4. Gross electric energy production for oil-fired and gas-fired is near 80% and over 20%, respectively, for both Units 3 and 4.

3.4 Impact

3.4.1 Intended Impacts

(1) Benefit to target region and residents

At the time of ex-ante evaluation of this project, the project was regarded to bring benefits to the region covered by the Java-Bali power system and their residents. It was regarded to contribute to the stable supply of electricity to the Java-Bali power system that includes residents in Java, Madura and Bali.

The power generated by Units 3 and 4 accounts up to approximately 20% of the whole power plant. Presently, among the power generation facilities of the Gresik Thermal Power Plant, the gas turbine combined cycle connected to the 500kV transmission line supplies electricity to a wide area including West Java. On the other hand, the generated electricity from Units 3 and 4 is transmitted to the WARU substation using the 150kV transmission line and supplied to Eastern Java.

Since the annual power generation is in general improved, it can be said that the project has considerably contributed to the power supply of the Java-Bali power system.

(2) Reduction on fuel cost

At the time of ex-ante evaluation of this project, through the improvement of the gross thermal efficiency of the target facilities, it was expected that a sum of approximately 700 million yen would be saved when gas-fired as a result of the fuel reduction effect at Units 3 and 4. From the completion of the project up to now, the actual operation using gas was 13% to 25% of the total power generation. KODECO, HESS and MKS are the gas suppliers to the Gresik Thermal Power Plant; however, the supply rate of all three companies was below the contracted amount. This is due to the gas shortage within the country and is inappropriate to assess the impact of fuel usage reduction and reduction of fuel cost realized through the gas usage by comparing the actual and predicted figures of the basic design study report.

(3) Impacts on the natural environment

Likewise the reduction of fuel costs, it is inappropriate to refer to the impact of the project has upon CO₂ reduction mentioned in the basic design study report. This was expected to be realized through the reduction of fuel usage resulting from the improvement of gross thermal efficiency by gas-firing; however, the operation by gas-firing is limited and it is thus not possible to assess the impact as for now.

As for the enforcement of the environmental monitoring for plant operation, it was confirmed, at the time of basic design study implementation, that concerned environmental management and monitoring reports had been submitted to the institution concerned every three months and they found no need of amendment of the environmental impact assessment, environment management plan and environmental monitoring plan of the target project facilities of Units 3 and 4.

No serious environment impacts caused by the operation of the Gresik Thermal Power Plant have been identified up to the time of this evaluation. First of all, regarding the quality of the oil used at the Gresik Thermal Power Plant, the ratio of C: H: N: S between 2006 to 2009 have been 80.12 - 84.79%: 0.21 - 11.9%: 0.51 - 0.685%: 1.22 - 2.07% and within the given standard by the government. Secondly, results from the two environmental monitoring of the levels of SO₂ from Units 3 and 4 in 2009 recorded by the authorities of the Provincial Government of East Java became far below the national standard although some reports in 2006 and 2008 showed that the level exceeded. The levels of NO₂ and floating particles also have been always below the national standard.

As for now, there are no plans by the PLN of taking countermeasures such as desulfurization / denitrification facilities.

(4) Land acquisition and resettlement

As initially foreseen in respect of land acquisition and resettlement, there was no need of any land acquisition or resettlement since the project aimed at rehabilitating the existing facilities.

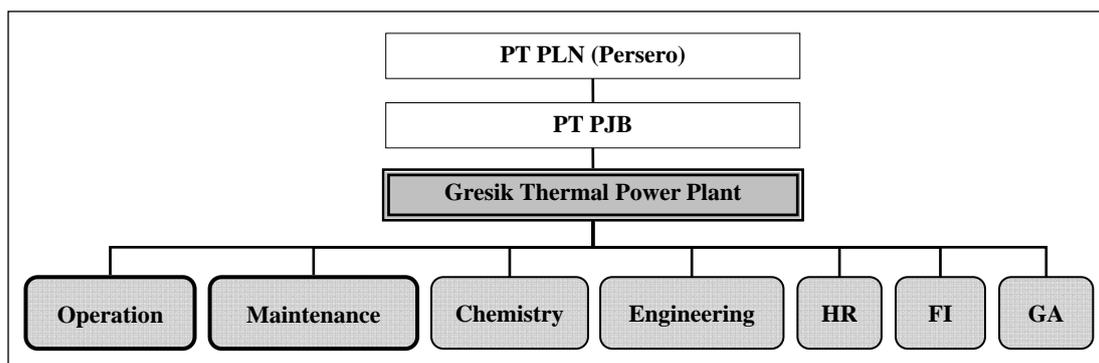
3.4.2 Other Impacts

Not specifically.

3.5 Sustainability (Rating: a)

3.5.1 Structural Aspects of Operation and Maintenance

The Java-Bali Power Corporation (PT PJB, hereinafter “PJB”), which is one of the two companies that have been formed through dividing PLN’s power generation department in charge of Java region, is the owner of the Gresik Thermal Power Plant. The Organization Chart of the Gresik Thermal Power Plant is as shown in Figure 3. Under the plant manager, there are deputy managers in charge of operation and maintenance, and working teams assigned for each boiler and turbine facilities work under them with each team appointed with a supervisor. The Environment Unit of the Chemistry Department carries out the environmental monitoring.



(Source) Adapted from Gresik Thermal Power Plant

Figure 3: Organization Chart of Gresik Power Plant

At the time of basic design study implementation, four teams consisting of 36 staff members who belonged to the PJB Generation Unit working in three shifts around the clock conducted the operation of Units 3 and 4 of the Power Plant. The PJB Maintenance Business Unit conducted the maintenance of the Power Plant and the number of members was increased from 15 to 143 by February 2003. Through this increase in working staff, they aimed at, other than to allocate more staff for breakdown maintenances, identifying points for future large-scale rehabilitation of facilities through preventive and monitored maintenance, and conducting repairing work necessary for periodic inspection. This kind of new structure change to the Maintenance Business Unit was adjudged appropriate from the point of view of lengthening of the expected residual life of equipment, prevention of deterioration of the facilities, and replacement of deteriorated facilities of Units 3 and 4.

There are no significant changes in the organizational structure of the Operation Maintenance Unit after the completion of the project. The team that is in charge of Units 3 and 4 is the same one in charge of the Gresik Thermal Power Plant's operation and maintenance indicated in Figure 3. The current number and arrangement of the operation and maintenance staff is as shown in Table 5. Four 10-man teams are assigned for the daily operation and working in three

shifts around the clock. There are no problems concerning the organizational structure of operation and maintenance and can be adjudged appropriate.

Table 5: Operation and Maintenance Staff of Gresik Power Plant

Unit	Planned		Actual		
	Number of staff	License level	Number of Staff	License level	Of that Nr. of engineers
Operation	120	3	120	3	12
Maintenance	130	3	130	3	10

(Source) Gresik Steam Power Plant

(Note) Level 3 refers to the national license holders who possess a certain level of knowledge operation and maintenance in Indonesia

3.5.2 Technical Aspects of Operation and Maintenance

Members who are engaged in operation and maintenance are those who hold Level 3 of national license. Level 3 license holders have attained knowledge on such as, thermodynamics, water quality management, combustion theory, boiler operation, steam turbine operation, electrical power system, alternators, control system, various efficiency and steam turbine power plant operation.



Photo 2: Inside of Steam Turbine of Unit 3 (Steam Valve)

Additionally, regular technical trainings are held within PJB. The main courses intended for the training of the workers at the Plant, where experts in boilers and turbines are invited from external training institutions, are shown in Table 6. As for other training courses such as for nondestructive testing (NDT), is done through the dispatching of staff members to external training facilities.

The technical level of staff members in charge of operation and maintenance are considered to be sufficient for routine inspections conducted daily and annually.

Table 6: O&M Trainings for Staff of Gresik Thermal Power Plant

Contents	Objective	Trainee	Instructor	Frequency	Period
Boiler inspection	Improving skills of boiler operation and maintenance	10	1	Every quarter	2 weeks
Turbine inspection	Improving skills of turbine operation and maintenance	10	2	Every quarter	2 weeks
Nondestructive testing (NDT)	Improving engineering skills of condition monitoring	10	3	Every quarter	2 weeks
Pumps/auxiliary engine	Improving skills of pump and auxiliary maintenance	10	1	Every quarter	2 weeks

(Source) Gresik Thermal Power Plant

3.5.3 Financial Aspects of Operation and Maintenance

PLN is mandated to approving the budget plan submitted by the Gresik Thermal Power Plant through PJB. As in Table 7, the actual repairing costs for Units 3 and 4 accounted as much as 14.15% (2007) of that of the whole Power Plant and stable budget is secured for the two Units

since 2006.

Table 7: Operation and Maintenance Cost: Gresik Power Plant vs. Units 3 & 4

(Unit: million rupiah)

Item	2006	2007	2008	2009
(1) Plant	200,626	139,241	143,981	201,295
(2) Units 3 and 4	13,097	19,697	18,863	20,443
(2) / (1) (%)	6.53%	14.15%	13.10%	10.16%

(Source) Gresik Thermal Power Plant

The repairing costs of Units 3 and 4 from 2006 to 2010 that PJB presented at the time of basic design study implementation averaged at 21,872 million rupiahs (330 million yen³), and when comparing that with the actual costs between 1998 and 2002, which averaged at 7,548 million rupiahs (114 million yen), it has become 2.9 times larger and measures for lengthening the facility life was well underway.

Comparison of the annual planned and actual expenditure of maintenance budget for Units 3 and 4 are shown in Table 8. The actual expenditure has not reached the planned figure apart from the year 2008; however, speedy repair is undertaken when problems with facilities are found through the periodic inspections and even daily inspections. No problems stemming from the lack of budget could be observed and it can be said that necessary coverage of budget has been secured and is spent efficiently.

Table 8: Units 3 & 4 Operation and Maintenance Budget (Plan and Expenditure)

(Unit: million rupia)

	2006	2007	2008	2009
Planned	17,110	23,085	18,764	30,545
Actual	13,097	19,697	18,863	20,443

(Source) Gresik Thermal Power Plant

3.5.4 Current Status of Operation and Maintenance

In the site visit at the time of this evaluation, the operation conditions were inspected and was confirmed that the operation and maintenance was conducted without major problems.

With regards to maintaining the operating condition, PJB has adopted the Maintenance Optimization Program (MOP) since July 2003 and has increased the rate of preventive, corrective and predictive maintenance in order to reduce the accident rate. In the site inspection at Gresik Thermal Power Plant, pervasion of preventive maintenance could be observed and handling of issues was done on demand according to the situation.

In addition to the daily inspections, there are three kinds of periodic inspections carried out: simple inspection (18 days/every two years), mean inspection (30 days/every 4years) and serious inspection (45days/every 4 years). The schedule for periodic inspections for Units 3 and 4 are shown in Table 9. It takes around 432 hours, 720 hours, 1,080 hours for the simple, mean and serious inspections, respectively. When comparing the schedule for periodic inspections on Table 9 with the planned outage hours in Table 4, the initial planned outage hours for 2008 and 2009 becomes close to the actual time for periodic inspections, whereas it was not necessarily reflected in 2006 and 2007 when the units were stopped due to the project implementation and inspection after completion.

³ 1 rupiah=0.0151 yen (December 2003)

Table 9: Periodic Maintenance Schedule of Units 3 & 4

Unit	2006	2007	2008	2009	2010 (plan)
Unit 3	Serious	Simple	Mean	Simple	Serious
Unit 4	Simple	Mean	Simple	Serious	Simple

(Source) Gresik Thermal Power Plant

No major problems have been observed in the operation and maintenance system, therefore sustainability of the project is high.

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The target project has contributed to the stable power supply in the Java-Bali power system by assisting the large-scale rehabilitation of Units 3 and 4 of the Gresik Thermal Power Plant, caused by aged deterioration. Relevancy of the project has been affirmed in the situation of the power sector in Indonesia. Since the enhanced performance of Units 3 and 4 is realized and maintained, effectiveness and sustainability are high as a result. No problems were observed concerning the efficiency of the execution of the project.

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

4.2 Recommendations

4.2.1 Recommendations to Executing Agency

If oil-fired power generation remains to be the main source of power generation at Units 3 and 4, the effect on facilities and the results of environmental monitoring should be carefully assessed, and when problems such as emission figures continuously exceeding the environmental standards, countermeasures such as the installation of denitrification / desulfurization facilities should be considered as future potential actions.

4.2.2 Recommendation to JICA

Not specifically.

4.3 Lessons Learned

Considering the past ODA loans for construction of Units 3 and 4 and modification works for both gas- and oil-firing use, this Grant Aid project is an example of a well-timed and effective execution of a cross-schematic assistance by the Government of Japan.

A shortage of gas supply still remains in Indonesia, and since Units 3 and 4 can operate at both gas- or oil-fired, it makes it possible to contribute to the stable power supply in Eastern Java by providing a flexible option with its fuel usage. For further assistance towards the power and energy sector, it is recommended to consider points such as, following-up of completed projects, countermeasures against environmental impacts, future repair plans, various rehabilitation programs, lengthening of facility life, and effective project processing.

(End)