# Ex-Post Project Evaluation 2014: Package III-1 (Indonesia)

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**JAPAN INTERNATIONAL COOPERATION AGENCY**

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Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan
"Railway Double Tracking of Cikampek-Cirebon Project (II)"
External Evaluator: Kenichi Inazawa, Octavia Japan Co., Ltd.

## 0. Summary

This project assisted the formation of a double-track between Cikampek and Cirebon on the North Line and rehabilitated Cirebon Station, with an aim of increasing the line capacity and the frequency of trains, making railway transportation safe, rapid and punctual, and reducing delays. At the time of the ex-post evaluation, the Medium-Term Development Plan calls for increasing transportation capacity and developing transportation infrastructures. There continues to be a development need for double tracking along the Java South Line and others. In addition, the project is consistent with Japan's ODA policy as it is in line with the "Country Assistance Plan for Indonesia". Thus, the relevance of this project is high. The project cost exceeded the plan, and the project period was significantly longer than planned; thus, efficiency is low. The line capacity and the frequency of trains between Cikampek and Cirebon increased as initially planned. Railway transportation has become safe and punctual, and delay time has reduced. The number of people who use Cirebon Station has been increasing since the rehabilitation of the station. Additionally, it has been confirmed through a beneficiary survey that the double-tracking works have led to an improvement in convenience of railway transportation and that the rehabilitation of Cirebon Station has contributed to the growth of the regional economy. Thus, effectiveness and impact of this project are high. No major problems are observed in the institutional, technical and financial aspects of the operation and maintenance of this project; thus, sustainability is high.

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

## 1. Project Description


Project location

Railroad bed developed by this project
(track laid with Indonesian funds)

### 1.1 Background

In the late 1990s, trains in Indonesia only existed on Java and Sumatra. On Java, railway networks covered almost all areas of the island. The main three lines were the North Line, connecting Jakarta with Surabaya, the South Line and the Bandung Line, connecting Jakarta with Bandung. Of these, the North Line is still the main railway that connects the capital city of Jakarta with Surabaya, the country's second largest city. Before the project was commenced, it was only between Bekasi and Cikampek (57 km) that the North Line was double-track. All the other sections were single-track; however, trains were operated exceeding the line capacity, especially between Cikampek and Cirebon (135 km), and congestion was experienced frequently. Thus, there was a need to increase the line capacity, and it was an urgent task to realize safe, rapid and punctual railway transportation. The Japan International Cooperation Agency (JICA) assisted the double-tracking of Cikampek and Haurgeulis (approximately 54 km), through an ODA project whose loan agreement was signed in 1994, as the first phase of the double-tracking project between Cikampek and Cirebon. Subsequently, this project was implemented to construct double-track mainly between Kadokangabus and Cirebon (approximately 63 km) and to conduct accessory works as the second-phase project.

### 1.2 Project Outline

The objective of this project is to increase the line capacity and train frequency on the North Line connecting Jakarta, the capital, with Surabaya, the second largest city, realizing safe, rapid and punctual railway transportation and reducing delays by assisting the double-tracking works mainly between Kadokangabus and Cirebon, part of the Cikampek-Cirebon section of the line, thereby contributing to the development of the regional economy.

| | |
|---|---|
| Loan Approved Amount/ Disbursed Amount | 8,748 million yen / 8,742 million yen |
| Exchange of Notes Date/ Loan Agreement Signing Date | January 1998 / January 1998 |
| Terms and Conditions | Construction: Interest Rate 2.7%, Repayment Period 30 years (Grace Period 10 years), General Untied<br>Consulting Services: Interest Rate 2.3%, Repayment Period 30 years (Grace Period 10 years), General Untied |

| | |
|---|---|
| Borrower / Executing Agency(ies) | Government of the Republic of Indonesia / Directorate General of Land Communications, Ministry of Communications (DGR) |
| Final Disbursement Date | August 2012 |
| Main Contractor (Over one billion yen) | PT. Wijaya Karya (Indonesia) / Tokyu Construction Co., Ltd. (Japan) (JV), PT. Modern Surya Jaya (Indonesia) / Tekken Corporation (Japan) (JV) |
| Main Consultant (Over 100 million yen) | PT. Rayakonsult (Indonesia) / PT. Dardela Yasa Guna (Indonesia) / PT. Jaya CM (Indonesia) / Pacific Consultants International (Japan) / Japan Transportation Consultants, Inc. (Japan) (JV) |
| Feasibility Studies, etc. | "Sector Review", JICA, October 1993 |
| Related Projects | (ODA Loan)<br>・North Java Line Track Rehabilitation Project (1989)<br>・Rehabilitation of Bridges for Java North Line (1) (2) (1992, 1995)<br>・Construction of Railway Double Tracking of Cikampek-Cirebon (1) (1994)<br>・Railway Double Tracking on Java South Line (3) Engineering Service (E/S) (2007)<br>・Railway Double Tracking on Java South Line (3) (2008)<br>Note: The years shown above indicate when the loan agreement was signed. |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Kenichi Inazawa (Octavia Japan Co., Ltd.)

### 2.2 Duration of Evaluation Study

Duration of the Study: September 2014-July 2015

Duration of the Field Study: November 22-December 6, 2014 and March 15-21, 2015

### 2.3 Constraints During the Evaluation Study

As will be explained in section 3.2 under Efficiency, the double-tracking works (construction

of railroad bed and tracks and installation of signal facilities) were carried out in this project targeting only a part of the section of the railway with an ODA loan; the remaining section was implemented previously with the Indonesian funds (Acceleration Program[1]). Because of this situation, it is difficult to evaluate effectiveness and indicators of quantitative effects (e.g., line capacity and train frequency) unless we observe the entire section, i.e., both the section covered by this project and the sections implemented by the Acceleration Program. In addition, data could be obtained only for the entire section between Cikampek and Cirebon (Figure 1) during the field survey of this evaluation study; thus, it is only possible to evaluate the project effects of the section targeted by this project (Kadokangabus-Cirebon) based on the data of the entire section.

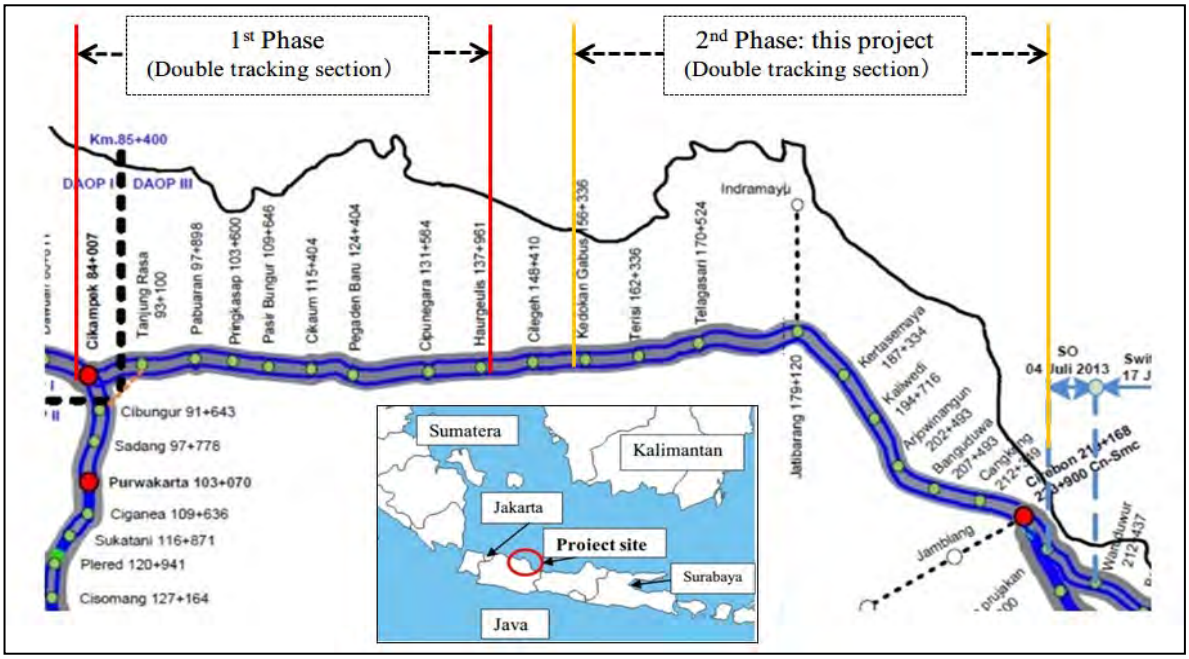



Figure 1: Project Locations
(The second section was the main target of this project. The first section was implemented by a previous project[2].)

[1] Although details are unknown, the total budget of this program is estimated at approximately 40 billion rupiah. As part of the Acceleration Program, the Indonesian government first decided to carry out the construction of the Telagasari-Cirebon section (see Figure 1) out of Cikampek-Cirebon on the North Line by Lebaran toward the end of 1999.

[2] "Construction of Railway Double Tracking of Cikampek-Cirebon (1)"

## 3. Results of the Evaluation (Overall Rating: B[3])

### 3.1 Relevance (Rating: ③[4])

#### 3.1.1 Relevance to the Development Plan of Indonesia

At the time of the appraisal, the government of Indonesia formulated the "Sixth Five-Year Plan" (1994-1998). This plan included rehabilitation of tracks (840 km) and construction of new lines including double-tracking (350 km) in order to respond to the increasing railway demand. This project was part of the construction of new lines (350 km) and thus was considered important in the national development plan.

At the time of the ex-post evaluation, the government of Indonesia formulated the "Medium-Term Development Plan" (2010-2014), which placed importance on increasing transportation capacity and developing transportation infrastructures. With regard to the railway sector, rehabilitation of tracks (239 km), restoration of disused railroads (534 km), construction of new lines including double-tracking (954 km), and introduction of late-model train cars were planned, with the aim of improving safety and reliability and expanding networks.

The development and promotion of the railway sector were therefore viewed as important in Indonesia at the time of the appraisal and this continues to be the case at the time of the ex-post evaluation. Thus, this project is consistent with the country's policies in terms of national and sector plans.

#### 3.1.2 Relevance to the Development Needs of Indonesia

Before the commencement of this project, railway networks existed across almost all parts of Java. The main three lines were the North Line, connecting Jakarta with Surabaya, the South Line and the Bandung Line, connecting Jakarta with Bandung. While only 57 km between Bekasi and Cikampek on the North Line was double-track, all the other sections were single-track. Trains were operated beyond the line capacity, especially between Cikampek and Cirebon (135 km). As of 1996, 74 trains were operated during regular hours and 89 trains during peak hours, as compared to the line capacity of 70. Congestion was apparent, and there was an urgent need to increase the line capacity. Additionally, the railway facilities were not sufficiently maintained or managed and were becoming old. There was therefore an urgent need to rehabilitate the tracks and bridges, to modernize security facilities such as communication systems for signals, to procure vehicles for the improvement of transportation capacity, and to

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

build double-tracks in order to realize safe, rapid and punctual railway operations. The number of passengers on the North Line, which is the main line on Java, increased by 6% per year on average before the project's commencement (1988-1994). At that time it was expected that the number of passengers would increase by 3.8-4.3% per year between 1996 and 2011[5]. It was perceived to be important to increase the line capacity in order to respond to this situation.

At the time of the ex-post evaluation, the construction of double-track is on-going along the North and South Lines. The Directorate General of Land Communications, Ministry of Communications (hereafter referred to as "DGR"), the executing agency of this project, completed the double-tracking of all lines on the North Line at the end of 2013; DGR has a plan to make the rest of the lines on Java double-track by 2030. For example, there are plans to make the following sections double-track after 2015: Solo-Madiun, Madiun-Surabaya and Surabaya-Gembel-Banyuwangi. On Java, while the majority of railway traffic has traditionally been passenger transportation, freight transportation has been increasing in recent years. Thus there is a continued need for double-tracking and renewal of signal facilities in order to improve transportation capacity and reduce congestion. Table 1 and Table 2 show the changes in passenger and freight transportation on the North and South Lines over the last several years, being to show the development needs.

Table 1: Changes in Passenger Transportation on the North Line and South Line

(Unit: person)

| | 2011 | 2012 | 2013 | 2014* |
|---|---|---|---|---|
| North Line | 7,137,633 | 6,547,848 | 7,147,813 | 9,213,222 |
| South Line | 9,264,891 | 13,037,746 | 13,270,584 | 14,919,846 |

Source: PT Kereta Api Indonesia

Note*: The 2014 figures were estimated by calculating the monthly average from the data up to the end of October (North Line: 7,677,685 people, South Line: 14,919,846 people) (divided by 10), and multiplying it by 12 months.

Table 2: Changes in Freight Transportation on the North and South Lines

(Unit: ton)

| | 2011 | 2012 | 2013 | 2014* |
|---|---|---|---|---|
| North Line | 28,125 | 50,158 | 174,242 | 261,672 |
| South Line | 19,720 | 120,354 | 182,270 | 346,704 |

Source: PT Kereta Api Indonesia

Note*: The 2014 figures were estimated by calculating the monthly average from the data up to the end of October (North Line: 218,060 ton, South Line: 288,920 ton) (divided by 10), and multiplying it by 12 months.

In conclusion, passenger and freight transportation is on the increase on the North and South

[5] On the other hand, the demand for freight transportation was expected to grow by 4.2-6.6%.

Lines at the time of the ex-post evaluation. In addition, there is a continued need for double-tracking of tracks and modernization of signal facilities. Therefore, this project is consistent with the development needs before the project's commencement and also at the time of the ex-post evaluation.

### 3.1.3 Relevance to Japan's ODA Policy

The government of Japan agreed with the government of Indonesia on the "Country Assistance Policy for the Republic of Indonesia" in February 1994 before the commencement of this project. The following five priority areas were identified: (1) the balanced development across the country through ensuring equity; (2) the improvement of the educational level and the development of human resources to strengthen competitiveness; (3) the countermeasures against environmental problems associated with rapid development; (4) the sound macroeconomic management and industrial restructuring for broad-based economic development; and (5) development of industrial infrastructures for continuous inflows of investment. This project is relevant to the last of these points, (5) the development of industrial infrastructures for continuous inflows of investment: the double-tracking of railway is expected to lead to economic growth. Thus, the project is consistent with the Assistance Policy of Japan.

This project has been highly relevant to Indonesia's development plan and development needs, as well as Japan's ODA policy. Therefore its relevance is high.

## 3.2 Efficiency (Rating: ①)

### 3.2.1 Project Outputs

Table 3 shows the planned and actual outputs of this project.

Table 3: Planned and Actual Outputs of this Project

| | (Initial) Plan Before the Project's Commencement | Actual Results After the Project's Completion |
|---|---|---|
| 1) Railroad Bed Construction | Double-tracking of Arjawinangun-Cirebon (22.73 km). | → Mostly as planned (*except that the box culvert was installed with Indonesian funds (through the Acceleration Program). |
| | Siding between Kadokangabus and Arjawinangun (45.7 km). | → Only Arjawinangun-Cangkring (approx. 10 km) and Jatibarang-Kertasemaya (approx. 2.9 km). (*The other sections were implemented using Indonesian funds |

| | | |
|---|---|---|
| | | (Acceleration Program)). |
| 2) Track Construction | The double-track sections between Arjawinangun and Cirebon (22.73 km). | → Implemented by Indonesian funds (Acceleration Program). |
| | Siding between Kadokangabus and Arjawinangun (45.7 km). | →Only Arjawinangun- Cangkring (approx. 10 km) and Jatibarang-Kertasemaya (approx. 2.9 km). (*The other sections were implemented with Indonesian funds (Acceleration Program). |
| | Replacement of track materials for the double-track section between Haurgeulis and Arjawinangun (58.47 km). | → Implemented with Indonesian funds (Acceleration Program). |
| | Replacement of track materials of the existing track between Cipunegara and Jatibarang (except for 8 km out of 47.57 km). | → Cipunegara-Cilegeh and Kadokangabus-Kertasemaya (approx. 39 km), Haurgeulis-Jatibarang (approx. 37 km). |
| 3) Construction of Bridges | Six bridges between Telagasari and Arjawinangun. | → Implemented with Indonesian funds (Acceleration Program). |
| | Seven bridges between Arjawinangun and Cirebon. | → Implemented with Indonesian funds (Acceleration Program). |
| 4) Signaling system | Signaling system and CTC function between Telagasari and Cirebon (six stations). | → Signaling system and CTC function between Haurgeulis and Cangkring (10 stations). |
| | Establishing of CTC connection between Cikampek and Telagasari (12 stations). | → CTC connection established between Tanjungrasa and Cangkring (16 stations). |
| | Installation of optical fiber cable between Haurgeulis and Cirebon (81.2 km). | → Installation of optical fiber cable between Cikampek and Cirebon (approx. 135 km). |
| 5) Consulting Services | Review of the design, assistance to the bidding process, and supervision of construction (International: 220M/M, Local 644M/M). | → Review of the design, assistance to the bidding process, and supervision of construction (including the supervision of the rehabilitation of Cirebon Station) (International: 312.53M/M, Local 922.59M/M). |
| 【Additional Outputs】 | | → Rehabilitation of Cirebon Station (rehabilitation of the station building, platforms, vehicle repair shop, track maintenance base, signaling system and switching device, changing of tracks inside the station, installing controlling equipment for the control room, and construction of staff housing). |

Source: Document provided by JICA (initial plan), Project Completion Report and answers to the questionnaire (actual).

As shown in Table 3, there are increased/reduced, canceled and additional outputs in this project. Below are the reasons:

1) Railroad Bed Construction, 2) Installation of Tracks, 3) Bridge Construction

Many outputs in these areas were implemented by the Indonesian side with its own funds: the government of Indonesia decided to implement the "Acceleration Program" infrastructure development program in April 1999 after the commencement of this project. The Indonesian government commenced implementation of 1), 2) and 3) using its own funds before construction began as part of this project (ODA loan). The Acceleration Program was implemented as an urgent measure to address post-Asian currency crisis problems such as unemployment (employment promotion) toward the end of the 1990s. Although the actual outputs of this project differ from the initial plan, it can be said that the government of Indonesia had compelling reasons.

4) Construction of Signaling System

The actual outputs were more ambitious than those specified in the initial plan because the number of facilities where the construction of signaling system was required to be developed and installed for the double-tracking were recalculated during the detailed design study.

5) Consulting Services

In addition to the extension of the project period, the actual work volume increased than suggested in the initial plan because of the rehabilitation of Cirebon Station, as explained below.

6) Additional Output

Cirebon Station was rehabilitated as an additional output. This station actually consists of two stations: Prujakan Station and Kejaksan Station; "Cirebon Station" is the umbrella term. Before the commencement of this project, the line capacity nearly reached its limit at the two stations[6]. Thus, there was a need to improve the line distribution. In addition, there were some safety issues concerning the structure of the station. There were operational problems such as trains at grade intersections going in the wrong direction, and accidents happened frequently. At that time, the government of Indonesia had been aware that Cirebon Station needed to be rehabilitated, as it was located at the branching point of the North Line and the South Line. However, the government had been planning to rehabilitate the station with their own funds after the completion of this project, prioritizing the double-tracking of the North Line

[6] The problem was particularly serious for Kejaksan Station because express trains and high-class trains on the North Line and all trains on the South Line would stop at this station.

(Cikampek-Cirebon)[7]. The rehabilitation of the station was thus not included in the initial plan as an output. In 2001, after the commencement of this project, however, a crash occurred at this station[8], which emphasized the need to improve the safety of train operations, as well as to realize punctuality and to reduce delay time. The improvement of the safety of train operations, realization of punctuality and reduction of delay time were recognized as urgent matters. The Cirebon station became big obstacles in order to respond to the expansion of rail capacity for the safe train operation, which resulted in the recognition. Thus, the rehabilitation of this station was implemented as an additional output of this project. This change was judged appropriate as it had become urgently required.

Photo 1: Rehabilitated Prujakan Station

Photo 2: Rehabilitated Kejaksan Station

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total project cost initially planned was 11,665 million yen (of which 8,748 million yen was to be financed by ODA loan). However, the actual project cost was 12,318 million yen (of which 8,742 million yen was borne by ODA loan), which was slightly more than planned (106%). As explained above, the Indonesian government implemented most parts of the section targeted by this project with its own fund (Acceleration Program), and the project scope reduced from the initial plan. The reduction in project scope left some project budget unutilized. Therefore, although the Indonesian side and the JICA side agreed to allocate the unutilized budget for the rehabilitation of Cirebon Station, as a result, the actual project cost slightly exceeded the initial plan.

[7] Before the commencement of this project, it is thought that the Indonesian government did not have sufficient budget to implement a project with multiple outputs and thus needed to implement in accordance with the priority.
[8] It left 39 people dead and 64 people injured. What caused the accident is not known because the train driver died. However, it is suspected that the signal mal-operation coincided with miscommunication between the CTC Center (old facility and equipment which was in use before the commencement of this project) and the operation command.

Since the project scope was changed after the commencement, the initial cost's plan also changed during the implementation. In other words, due to the influence of the Acceleration Program, the comparison between the project's output and input became not easy, it was thus necessary to analyze it taking the change of cost plan into consideration. As shown in Table 4, the initial project cost planned before the construction of this project (at the time of the signing of the loan agreement), the planned project cost after the decision to implement the Acceleration Program, and the actual project cost after the completion of construction are compared, in order to trace the transition as much as possible. With regard to the actual cost, approximately 8,200 million yen about the construction as remaining part associated with the initially planned project scope and the consulting services exceeded the estimated budget (126 % increase at maximum) after the decision on the Acceleration Program (approximately 6,500-7,300 million yen). Through the review of existing documents and inquiries to the DGR during this evaluation study, it was not possible to identify the exact reasons of the increase in cost of the actual cost compared to the estimated budget. However, it was presumably because of the increase in the prices of construction inputs (labor cost, materials, etc.) throughout the project period, the increase in consulting service costs due to the extension of the project period, and the fluctuation of exchange rates. On the other hand, the additional cost for the improvement of Cirebon Station was approximately 4,100 million yen[9].

In any case, the total actual amount exceeded the initial plan. Therefore, it can be judged that the efficiency of project cost is fair.

Table 4: The Initially Planned Project Cost, Planned Project Cost after the Decision on Acceleration Program (Estimate), and Actual Cost

| Item | Before Construction | | After Construction |
|---|---|---|---|
| | Initial Plan (Before Project's Commencement: 1997) | Planned Project Cost After Acceleration Program was implemented *Note (Estimate: around 2000) | Actual |
| 1) Civil Engineering Work | 8,754 million yen | Approx. 4,500-5,000 million yen | Approx. 8,200 million yen |
| 2) Contingency | 876 million yen | Approx. 700-800 million yen | |
| 3) Tax | 1,060 million yen | Approx. 500-600 million yen | |

[9] Through the survey, it was confirmed that this actual amount was the almost same as the one estimated before the modification.

| | | | |
|---|---|---|---|
| 4) Consulting Services | 975 million yen | Approx. 800-900 million yen | |
| Total | 11,665 million yen | Approx. 6,500-7,300 million yen | Approx. 8,200 million yen |
| 5) Additional Output (Rehabilitation of Cirebon Station) | | | Approx. 4,100 million yen |
| | | Total: | 12,318 million yen |

Source: JICA's document and estimates based on data provided in JICA's documents (before the construction), and DGR (after the construction)
*Note: With regard to "Planned Project Cost After Acceleration Program was implemented", since the data about the planned project cost recalculated after Acceleration Program was implemented is not available, this amount was presumably estimated from the actual amount after the project completion, throughout the survey.

3.2.2.2 Project Period

Table 5 presents a comparison between the planned and actual project periods for each output of this project. At the time of the project appraisal, the project period was planned to be five years and four months (64 months), from January 1998 to April 2003. The actual period was 13 years and nine months (165 months), from January 1998 to September 2011, i.e., 258% of the plan. As explained earlier, some double-tracking works were implemented using Indonesian funds (Acceleration Program) before this project. Both Japanese and Indonesian sides confirmed the status and process each other and made an effort to prevent further delay. Then, the both side made clear the project scope (ODA loan) again. Based on the clarification, the remaining double-tracking works (constructions related to railroad beds, tracks and signal facilities, etc.) were commenced[10] and completed in August 2007. After the completion of the double-tracking works, the rehabilitation of Cirebon Station began. Bidding, selection and procurement/contracting of contractors were conducted and the construction began; it was completed in September 2011. Regarding the double-tracking works of this project, the project took 181% longer than the initial plan. As for the rehabilitation of Cirebon Station, the project took 258% longer than planned. Thus, the project period was significantly longer than planned in any case, which the efficiency of project period is low.

[10] The construction by the Japanese side was commenced late (November 2004) because: there was a delay in bidding/selection/procurement and contracting; the project scope was changed and it required time to confirm and discuss such changes as a result of the above-mentioned Acceleration Program; and the Indonesian currency crisis in the late 1990s mixed up the society and economy, and the government went through frequent restructuring, as a result of which the government function stagnated and decisions on this project could not be made in a timely manner.

Table 5: Initially Planned and Actual Project Period

| | Initial Plan | Actual |
|---|---|---|
| Entire Project | January 1998 – April 2003 (64 months) | January 1998 – September 2011 (165 months) |
| Assistance for Double-Tracking | | |
| Selection of Consultant | January 1998 – April 1998 | January 1998 – October 1998 |
| Consulting Services | May 1998 – April 2003 | February 1999 – September 2011 |
| Bidding and Contracting | September 1998 – February 1999 | June 1998 – May 2004 |
| Civil Engineering Works | March 1999 – April 2003 | November 2004 – August 2007 |
| Additional Construction | | |
| Bidding and Contracting | - | December 2007 – March 2010 |
| Civil Engineering Works | - | February 2010 – September 2011 |

Source: JICA's document (initial plan), Completion Reports and answers to the questionnaires (actual)

### 3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

At the time of the appraisal of this project, the Financial Internal Rate of Return (FIRR) was calculated to be 1.89%, using fare incomes as a benefit, construction costs and maintenance expenses as a cost, and a project life of 40 years. In addition, the Economic Internal Rate of Return (EIRR) was calculated as 21.47%, using the reduction in time-associated cost as a benefit, construction costs as a cost, and a project life of 40 years. On the other hand, the project expenses significantly differed from the initial plan because the Indonesian side implemented Cikampek-Cirebon section using its own fund (Acceleration Program) prior to this project and the rehabilitation of Cirebon Station was additionally implemented by this project. The accurate construction cost of this section financed by the Acceleration Program was not clear, and benefits and costs associated with the rehabilitation of Cirebon Station were also unclear; thus, the internal rate of return was not recalculated.

The project cost exceeded the plan, and the project period significantly exceeded the plan. Therefore, efficiency of the project is low.

### 3.3 Effectiveness[11] (Rating: ③)

3.3.1 Quantitative Effects

1) Line Capacity and Number of Trains

As shown in Table 6, the line capacity[12] between Cikampek and Cirebon on the North Line after the completion of double-tracking works is 136 trains at the time of the ex-post evaluation. As can be seen from Table 7, the number of trains has generally been increasing in recent years, and the same holds true for the freight trains. Thus, it can be judged that double-tracking works increased the line capacity and the number of trains, thereby realizing less congested railway operation within the line capacity. Although the main section for which this project implemented double-tracking works was between Kadokangabus and Cirebon, the only data obtained during this evaluation study were for the entire section of Cikampek-Cirebon; thus, the evaluation was done based on the data for the entire section.

Table 6: Line Capacity between Cikampek and Cirebon on the North Line

(Unit: No. of trains per day)

| Item | 1998 (Before Project's Commencement) | 2013-14 (At the Time of Ex-Post Evaluation) |
|---|---|---|
| Line Capacity | 70 (single-track) | 136 (after double-tracking) |

Source: Answers to the questionnaire

Table 7: Changes in the Number of Trains Operating between Cikampek and Cirebon (Recent Years)

(Unit: No. of Trains per day)

| Type of Train | | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|---|
| Passenger | Cirebon Express | 15 | 15 | 15 | 17 | 18 |
| | Executive/Business Class | 22 | 23 | 24 | 27 | 20 |
| | Economy Class | 12 | 12 | 12 | 6 | 20 |
| Freight Trains | | 9 | 11 | 15 | 21 | 32 |
| Total | | 58 | 61 | 66 | 71 | 90 |

Source: Answers to the questionnaire

2) Improvement of Punctuality

Table 8 shows delay times between Cikampek and Cirebon on the North Line after the commencement of double-tracking works (the average of up and down lines per one operating train).

[11] Sub-rating for Effectiveness is to be put with consideration of Impact.
[12] It refers to the number of trains that can operate on a line in a given time.

Table 8: Train Delay Time between Cikampek and Cirebon on the North Line
(Average of Up and Down Lines per One Operation Train)

(Unit: Minutes)

| 2004 | 2005 | 2006 | 2007 | 2008 |
|---|---|---|---|---|
| 8.71 | 11.33 | 11.68 | 3.69 | 2.94 |
| 2009 | 2010 | 2011 | 2012 | 2013 |
| 2.81 | 3.95 | 0.68 | 0 | 0 |

Source: DGR (2004-2008), the third district office (DAOPIII) (from 2009 onwards)

Presented above are data on delay times for the past ten years; one can notice that delay has been diminishing ever year and became zero in 2012. This is thought to be because the double-tracking works made the plan and actual railway operation more relaxed. As shown in Table 7, there is no delay time despite the fact that the number of trains has been increasing. Thus, it can be judged that the completion of the double-tracking works has contributed to the reduction in delay times[13].

3) Effects of the Rehabilitation of Cirebon Station

As described in "3.2.1 Project Outputs" under Efficiency, Cirebon Station was rehabilitated as an additional output of this project. Table 9 shows the changes in the number of Cirebon Station users for the past three years.

Table 9: Changes in the Number of Cirebon Station Users

(Unit: No. of people)

| Cirebon Station | 2011 | 2012 | 2013 |
|---|---|---|---|
| Kejaksan Station | 785,905 | 633,668 | 656,790 |
| Prujakan Station | 120,391 | 244,044 | 299,979 |

Source: DAOPIII
Remark: The rehabilitation of Cirebon Station was completed in September 2011

According to the third district office (hereafter referred to as "DAOPIII"), which operates and maintains the Cikampek and Cirebon section on the North Line, with the rehabilitation of Cirebon Station and the improvement of convenience and service standards of railway, people have shifted from other methods of transportation such as from automobiles to trains. As a result the number of people who use the station has been increasing[14]. On the other hand, the number of Kejaksan Station users decreased between 2011 and 2012. Before 2011, many people without

[13] Although 2014 data could not be obtained, according to the third district office (DAOPIII), which is under the Indonesian Railways Co. (PT.KAI) and responsible for the operation and maintenance of the Cikampek and Cirebon section on the North Line, there was some delay time that year. At the time of the ex-post evaluation, the double-tracking work is on-going from Kejaksan Station toward the South Line (ODA Loan, "Railway Double Tracking on Java South Line Project (III)"), which is apparently creating some delay.

[14] The number of station users in 2014 certainly increased from the previous year for both stations, according to DAOPIII.

seat reservation tickets would stand on the train passing through this station and there were safety issues. Thus, the Indonesian Railways Co., responsible for railway operation on Java (hereafter referred to as "PT.KAI"), decided to make all seats reserved, starting in 2012, with the intention of reducing the number of standing passengers.

It has been confirmed that those who did not commute by train before the rehabilitation of Cirebon Station (i.e., residents who used to take automobiles, motorbikes and buses) now use this station more frequently. Such residents commented when interviewed, "Commuting by train allows us to reach the destination most probably on time without getting affected by traffic congestion, which is the case for automobiles and motorbikes." Additionally, they also commented, "Before the rehabilitation of the station, there was a difference in height between the platform and train door and we needed to use removable stairs (steel), and safety during boarding and alighting was a concern. Now, after the station was rehabilitated, there is no need to worry." Thus, it can be observed that concerns about safety are decreasing. Taking such comments into consideration, it can be judged that the rehabilitation of Cirebon Station is responding to the increased number of railway users and is contributing to improved safety.

Photo 3: Kejaksan Station before Rehabilitation (safety issues were prominent: the platform was low and people would enter inside the track to sell various things.)

Photo 4: Inside the Kejaksan Station after Rehabilitation

4) Improvement of Safety

Table 10 shows the number of incidences of railway accidents before the commencement of this project (1995) and after the completion of this project (2011 onwards) between Cikampek and Cirebon on the North Line.

Table 10: Incidences of Railway Accidents between Cikampek and Cirebon on the North Line

(Unit: No. of persons)

| Timing | | Category | | | | | Total | Dead | Injured |
|---|---|---|---|---|---|---|---|---|---|
| | | Train-to-Train Collision | Train-to-Automobile Collision | Derailment and Rollover* | Flooding and Land Slide | Other | | | |
| Before Commencement | 1995 | 0 | 10 | 4 | 1 | 2 | 17 | 3 | 5 |
| After Completion | 2011 | 0 | 4 | 4 | 0 | 0 | 8 | 3 | 7 |
| | 2012 | 0 | 2 | 0 | 0 | 0 | 2 | 4 | 0 |
| | 2013 | 0 | 5 | 2 | 0 | 0 | 7 | 4 | 0 |
| | 2014 | 0 | 5 | 2 | 0 | 0 | 7 | 35 | 18 |

Source: JICA document (before commencement), answers to the questionnaire (after completion)

*Note: There is no information which indicates that derailment and rollover occurred as a result of the implementation of this project.

Since the project was completed, there has not been any "train-to-train collision" or "flooding and land slide". The number of accidents has generally been decreasing as compared to 1995, before the project's commencement. There are relatively many cases of "train-to-automobile collision"; however, there is no information which indicates that it has been caused by the double-tracking works of this project. According to DAOPIII, the main problem is that vehicles cross a railway recklessly (e.g., they try to cross even when the crossing gate is closed) and that it is not attributed to the level of maintenance, technology and railway operation management of DAOPIII. In 2014 many casualties are recorded because one bus tried to cross the railway by force and collided with the oncoming train. Nevertheless, it is thought necessary that the railway operator take some measures to prevent accidents as such. Currently, DAOPIII is frequently holding workshops and presentations for the local communities and residents. They also distribute brochures that call for preventing accidents (Photo 6), thereby making efforts to improve residents' understanding of safety issues.

Photo 5: Passenger Train in Action


Photo 6: Brochure to Call for Prevention of Accidents

### 3.3.2 Qualitative Effects (Other effects)

1) Improvement of Convenience, Punctuality and Safety of Railway Transportation

As part of this evaluation study, users of Cirebon Station and Arjawinangun Station, where double-tracking works were carried out, were interviewed using a questionnaire (beneficiary survey). For both stations, the target of the survey was those who have been using the station for more than 15 years since before the project's commencement[15]. As shown in Figure 2 and Figure 3, many respondents indicated that the railway operation has improved, delays have been reduced and travel time has become less; thus, it can be thought that the double-tracking works have achieved the outcomes as initially expected. As shown in Figure 4, a large proportion of respondents indicated that many people have shifted from automobiles/motorbikes/bus to trains. Figure 5 shows that a large proportion of people think the comfort on trains has been improving. Therefore, it can be thought that the level of users' satisfaction with the railway services has generally been improving[16]. As shown in Figure 6, many respondents indicated that the project has improved the punctuality of train arrival and departure times; thus, it can be judged that the punctuality of railway transportation has also been achieved.

[15] By doing this, it was intended to measure the effects and impact appropriately (comparison of before and after the project). It turned out that the number of station users and the number of shops are less for Arjawinangun Station; the sample size was adjudged to be 70 for Cirebon Station users and 30 for Arjawinangun Station users (total: 100). Samples were drawn using the random sampling method, and the survey was conducted using questionnaires. The quantity of valid responses was 100.

[16] According to the interviews with PT.KAI and DAOPIII, an increasing proportion of people who used to take cars/motorbikes/bus for commuting have shifted to trains and the level of convenience has improved. Their reasons were as follows: (1) they do not get affected by traffic congestion, which is often the case for automobiles, as today there are more trains operating and fewer delays, making railway an advantageous method of commuting; (2) trains are comfortable with air conditioning; and (3) Cirebon Station has clean and attractive facilities with many shops and restaurants. It is observed that railway transportation is more attractive to commuters because of its punctuality and capacity for mass transportation.

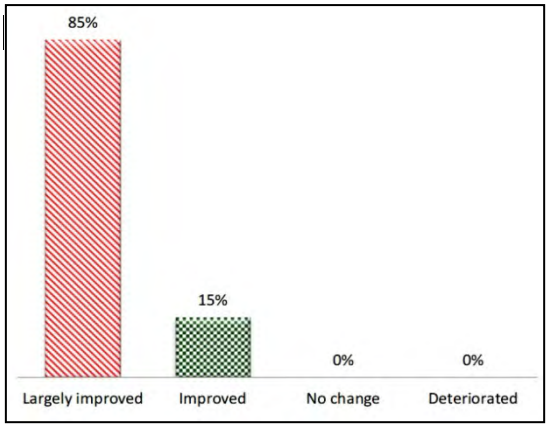



Figure 2: Do you think the railway operation has improved with less delay after double-tracking works?

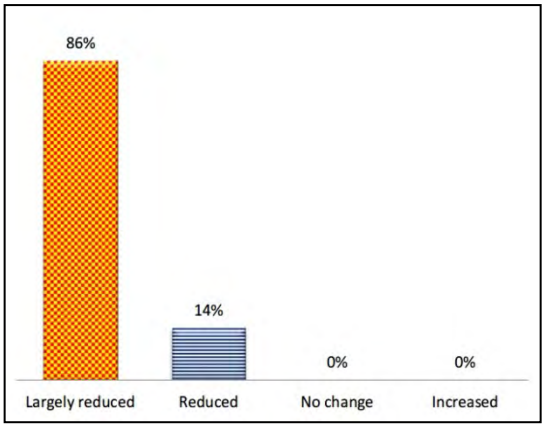



Figure 3: Do you think the time required to reach destinations has reduced after the double-tracking works?

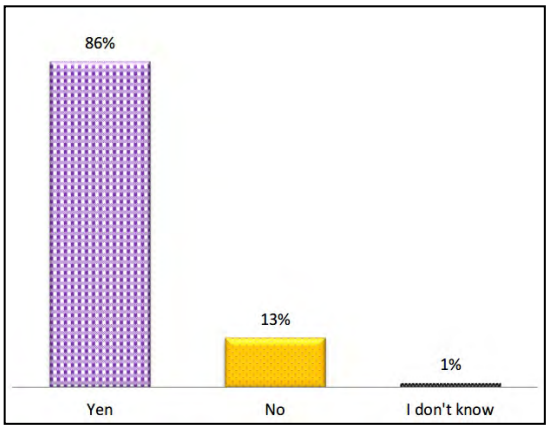



Figure 4: Do you think many people have shifted from cars/motorbikes/public bus to trains after the double-tracking works?

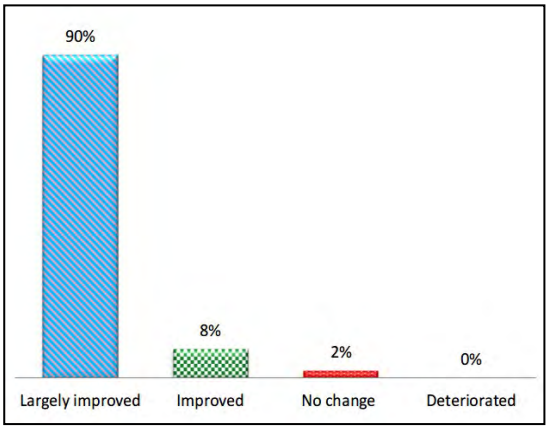



Figure 5: Do you think the comfort level on trains has improved after the double-tracking works?

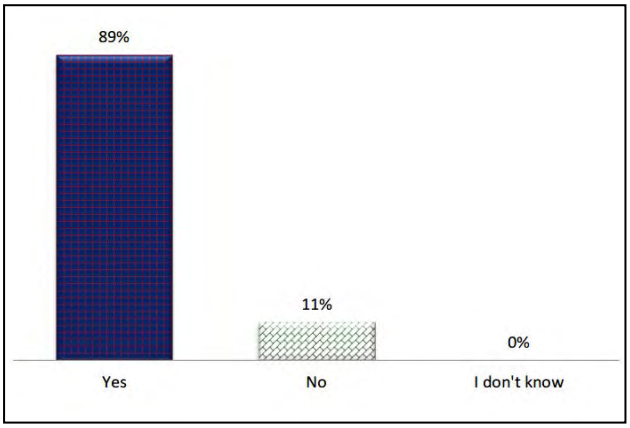



Figure 6: Do you think the punctuality of departure and arriving times has improved after the double-tracking works?

In line with the above beneficiary survey results, it can be judged that this project has contributed to the improvement of convenience, punctuality and safety of railway transportation between Cikampek and Cirebon.

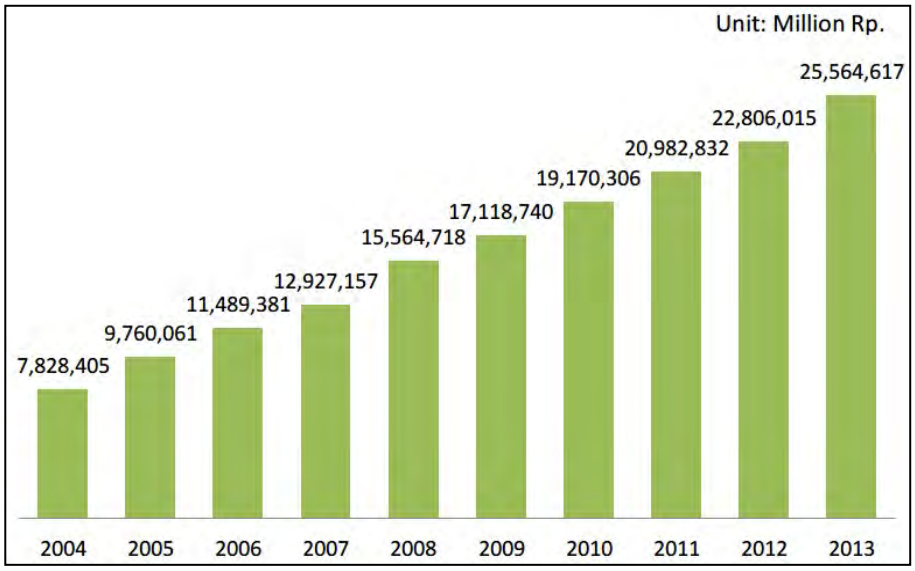
### 3.4 Impacts

#### 3.4.1 Intended Impacts

##### 3.4.1.1 Contribution to the Development of Regional Economy

Figure 7 shows the changes of the Gross Regional Domestic Product (GRDP) of Cirebon City (population: more than 300,000[17]), which is the major town between Cikampek and Cirebon on the North Line. It has been increasing for the past 10 years. As can be seen from the beneficiary survey results[18] shown in Figure 8 and Figure 9, many respondents answered that economic activities of Cirebon City and the retail and food industries[19] around the station have been vitalized. In addition, as shown in Figure 10, many respondents confirmed the improvement in employment opportunities. Residents and shop owners around the station and DAOPIII staff members who were interviewed commented, "The number of passengers has been increasing every year, and accordingly, we think the number of people who visit Cirebon City has been increasing. We find the rehabilitation of the station and the increase of passengers and visitors are favorable to the vitalization of the regional economy." Based on such beneficiary survey results and residents' comments, it can be presumed that the development of railway infrastructures such as double-tracking and rehabilitation of stations supports the increasing population, expansion of city functions and economic vitalization for the entire city.

[17] The number varies depending on the data source: approx. 298,000 people in 2010 (source: national population census), approx. 329,000 people in 2011 (source: the Population Administration Information System (SIAK), approx. 369,000 people in 2014 (source: Cirebon municipal government). The population has been increasing in recent years.
[18] The sample size of the beneficiary survey relating to this impact was 70.
[19] According to the data provided by the city, the number of companies increases by 50-60 every year.




Source: Cirebon City Statistics

Figure 7: Changes in the Gross Regional Domestic Product (GRDP) of Cirebon City

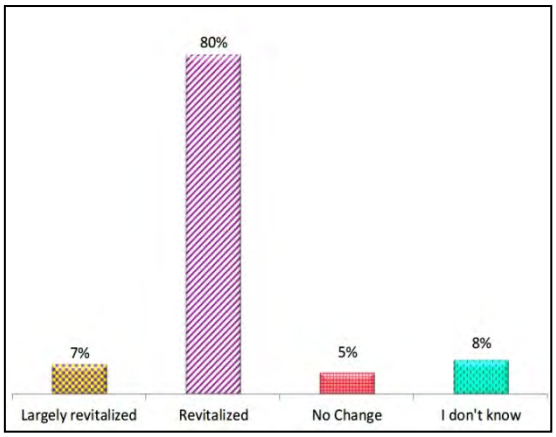



Figure 8: Do you think the economy in and around Cirebon City has been vitalized after the double-tracking works and the rehabilitation of Cirebon Station?

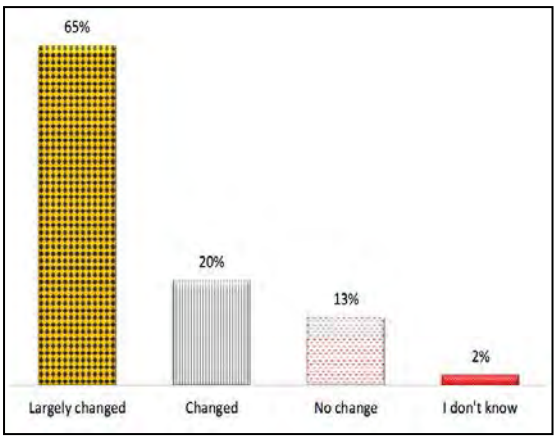



Figure 9: Do you think the retail and food industries around the station have been vitalized after the double-tracking works and the rehabilitation of Cirebon Station?

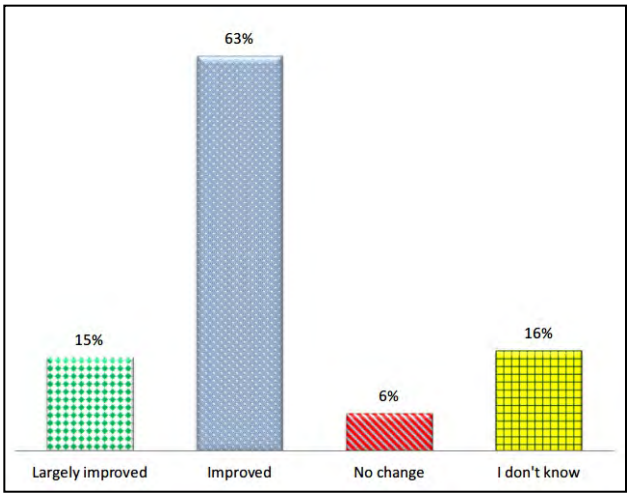



Figure 10: Do you think there is an improvement in employment opportunities after the double-tracking works and the rehabilitation of Cirebon Station?

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

Since this project was mainly about laying a new track next to an existing track, its impact on the natural environment was thought to be little. Thus, the Environmental Impact Assessment (EIA) was not required before the project's commencement. All in all, no major environmental issue arose concerning the Cikampek-Cirebon section during the project implementation or at the time of the ex-post evaluation[20].

#### 3.4.2.2 Land Acquisition and Resettlement

The land needed for this project belonged to the Indonesian government before the commencement of this project. Thus, no new land was acquired and no resettlement was needed in association with this project.

This project has largely achieved its objectives. Therefore effectiveness and impact of the

[20] On the other hand, residents and commuters complained about dust, vibration and noise around Arjawinangun Station. There are an increasing number of heavy-duty vehicles transporting cement from this station to other areas on Java, creating dust along the way. According to the interviews with residents and commuters conducted during the beneficiary survey, there was no indication that this is associated with health issues in particular. However, it is recommended that transporters of cement take some measures to prevent dust from spreading (e.g., make sure that all vehicles have covers on truck boxes) while paying attention to the hours of transportation with a view to minimizing noise. It is also thought necessary that the local government should take some actions to regulate the cement manufacturing companies regarding this issue.

project are high.

### 3.5 Sustainability (Rating: ③)

#### 3.5.1 Institutional Aspects of Operation and Maintenance

PT. KAI, a national company fully owned by the Indonesian government, is responsible for the operation and maintenance of the country's railway infrastructures, including that of this project[21]. PT.KAI is responsible for track maintenance works, such as repairing of tracks, signal facilities, wires, bridges and crossings and replacement of crossties. DAOPIII, which is under PT.KAI, is doing the actual operation and maintenance work on the ground for the Cikampek-Cirebon section on the North Line. In addition to the track maintenance works, DAOPIII also operates and maintains Cirebon Station. DAOPIII has 213 employees at the time of the ex-post evaluation (as of November 2014). In recent years the number of staff has been increasing[22]. This is because PT.KAI is faced with the need to improve its railway services and maintenance works in order to respond to the increasing volume of passengers and freight transportation.

In the light of the above, no particular problems are observed concerning the institutional aspects of the operation and maintenance of this project.

#### 3.5.2 Technical Aspects of Operation and Maintenance

DAOPIII has many experienced staff members. It has been confirmed through the field survey that they are sufficiently aware of the importance of operation and maintenance of tracks, bridges, and signal facilities. The PT.KAI headquarters is in charge of the training for operation and maintenance staff. Recently, 529 DAOPIII staff attended a workshop for understanding railway operations (one course lasted eight days), and 20 attended a training course on practical maintenance of signal and telegraphic facilities (three days). Also, on-the-job training (OJT) is given to newly recruited staff as needed at the training facility inside PT.KAI's headquarters. During the implementation of this project, four of the DAOPIII staff attended oversea training to learn about operation plans of signals (about one month).

In addition, deterioration of facilities due to lack of maintenance was not observed. Furthermore, staff members in charge of operating control equipment at the traffic control room

[21] The two-tiered system is applied to the operation and maintenance of Indonesia's railway infrastructures.
[22] There were 67 staff members one year and two months ago (September 2013) according to the record.

of Cirebon Station received three-month training[23]. Thus, it has been confirmed that training system is in place.

In light of the above, it is thought that there are no major problems with the technical aspect of the operation and maintenance of this project.

### 3.5.3 Financial Aspects of Operation and Maintenance

The operation and maintenance budget of DAOPIII is allocated by PT.KAI headquarters. Table 11 shows the operation and maintenance costs for the past three years. According to DAOPIII, "While 100% of what we request is not approved, we have necessary budget allocated." Thus, it is thought that there are no particular concerns about maintenance budget shortage.

Table 11: DAOPIII's Operation and Maintenance Costs

(Unit: thousand rupiah)

| | 2011 | 2012 | 2013 |
|---|---|---|---|
| Operation Cost | 19,846,896 | 21,975,240 | 26,579,598 |
| Maintenance Cost | 61,134,045 | 63,066,940 | 53,323,377 |

Source: PT.KAI
Remark: one thousand rupiah = approx. 10 Japanese yen (exchange rate of November 2014)

Table 12 is the profit-and-loss statement (P/L) of PT.KAI, and Table 13 shows the changes in consolidated financial positions[24]. With regard to the P/L, since the gross operating income, which is sales minus the cost of goods sold, has been increasing every year, so is the current net profit. With respect to the changes in consolidated financial positions, it is thought there is no problem for the time being as assets have been exceeding liabilities. Judging from the overall financial situation of PT.KAI, it is presumed that there are no major problems with the allocation of operation and maintenance budgets for district offices, including DAOPIII.

Table 12: PT.KAI's Profit-and-Loss Statement (P/L)

(Unit: million rupiah)

| | 2011 | 2012 | 2013 |
|---|---|---|---|
| Sales(A) | 6,094,095 | 6,966,237 | 8,600,972 |
| Cost of goods sold(B) | 4,675,846 | 5,024,796 | 5,920,554 |
| Gross operating income(C=A-B) | 1,418,249 | 1,941,441 | 2,680,418 |
| Operating expenses(D) | 1,277,860 | 1,243,802 | 1,620,304 |

[23] The training was mainly about operating control equipment.
[24] The P/S and changes in consolidated financial positions are those of the entire PT.KAI.

| | | | |
|---|---|---|---|
| Non-operating profit and loss(E) | 157,661 | -101,735 | -270,808 |
| Profit before tax(F=C-D+E) | 298,050 | 595,904 | 789,306 |
| Current net profit (After tax of F) | 201,244 | 425,104 | 560,716 |

Source: PT.KAI
Remark: one million rupiah = approx. 10,000 Japanese yen (exchange rate of November 2014)

Table 13: PT.KAI's Consolidated Financial Positions

(Unit: million rupiah)

| | 2011 | 2012 | 2013 |
|---|---|---|---|
| Current assets(A) | 1,823,431 | 2,540,813 | 4,137,883 |
| Fixed assets(B) | 4,242,979 | 6,420,248 | 11,120,887 |
| Total assets (C=A+B) | 6,066,410 | 8,961,061 | 15,258,770 |
| Current liabilities(D) | 1,237,591 | 2,176,655 | 4,258,534 |
| Non-current liabilities(E) | 880,623 | 1,460,994 | 4,877,985 |
| Liabilities (F=D+E) | 2,118,214 | 3,637,649 | 9,136,520 |

Source: PT.KAI
Remark: one million rupiah = approx. 10,000 Japanese yen (exchange rate of November 2014)

### 3.5.4 Current Status of Operation and Maintenance

For the railroad bed and track between Cikampek and Cirebon, DAOPIII spreads ballast, repairs crossties, tightens bolts and does a regular check every month. They renovate the steel on the upper parts of bridges, repaint the bridges and protect the abutments once a year. Maintenance and inspection are also carried out for the signal facilities. At Cirebon Station, the control equipment installed in the control room is operating well; no particular problems were observed in the status of other facilities inside the station (platform, track maintenance base, etc.); and there is no problem with the railway operation. The station is cleaned daily. Additionally, it has been confirmed through interviews that there is no particular problem with the status of procurement and storage necessary for spare parts needed for the facilities developed by this project. Furthermore, it has also been confirmed that maintenance and operation manuals are kept at each facility and that each staff member refers to the manuals as needed in order to carry out maintenance activities.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effects is high.

Photo 7: Installed Signal Equipment

Photo 8: Developed Control Tower and Operation Control Device

## 4 Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project assisted the formation of a double-track between Cikampek and Cirebon on the North Line and rehabilitated Cirebon Station, with the aim of increasing the line capacity and the frequency of trains, making railway transportation safe, rapid and punctual, and reducing delays. At the time of the ex-post evaluation, the Medium-Term Development Plan calls for increasing transportation capacity and developing transportation infrastructures. There continues to be a development need for double tracking along the Java South Line and others. In addition, the project is consistent with Japan's ODA policy as it is in line with the "Country Assistance Plan for Indonesia". Thus, the relevance of this project is high. The project cost exceeded the plan, and the project period was significantly longer than planned; thus, efficiency is low. The line capacity and the frequency of trains between Cikampek and Cirebon increased as initially planned. Railway transportation has become safe and punctual, and delay time has reduced. The number of people who use Cirebon Station has been increasing since the rehabilitation of the station. Additionally, it has been confirmed through a beneficiary survey that the double-tracking works have led to an improvement in convenience of railway transportation and that the rehabilitation of Cirebon Station has contributed to the growth of the regional economy. Thus, effectiveness and impact of this project are high. No major problems are observed in the institutional, technical and financial aspects of the operation and maintenance of this project; thus, sustainability is high.

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

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

・Although it is not necessarily linked to the double-tracking works of this project directly, there are cases of vehicle-to-train collisions between Cikampek and Cirebon caused by vehicles (automobiles, motorbikes and buses) trying to cross tracks recklessly. While DAOPIII, which is carrying out the operation and maintenance on the ground, has been making efforts to educate residents and local communities about accident prevention, it is recommended that they continue making efforts to reduce accidents by advocating, distributing brochures and utilizing media such as television and radio.

・At the time of the ex-post evaluation, residents and commuters are complaining about the dust, vibration and noise around Arjawinangun Station. This is due to the increasing number of heavy-duty trucks transporting cement to the station. It is recommended that PT.KAI who is responsible for the railway operations request the cement manufacturing companies to take necessary measures (measures to minimize dust, efforts to minimize noise and attention to vibration while driving) with due consideration of the environment around the station.

### 4.2.2 Recommendations to JICA

・None.

## 4.3 Lessons Learned

(Necessity to Make Efforts to Avoid Project Delays)

It is preferable to omit risks of project delay as much as possible. In the case of this project, the project period was extended because the outputs planned initially of this project were affected by the implementation of the Acceleration Program by the government of Indonesia. The Acceleration Program was implemented prior to this project as an emergency response to the unemployment problem following the Asian currency crisis (employment promotion). Other factors include the delay in bidding/selection and procurement contracting and the slow decision-making process concerning this project because the government function stagnated when it was affected by the social and economic chaos following the currency crisis of the late 1990s. In reality, both Japanese and Indonesian sides were making an effort to confirm the project process and obstacle elements each other in order not only to avoid the delay of the project continuation after the Acceleration Program came up, but also to prevent any further delay. Considering future similar projects, if such obstacle elements are produced, the executing

agencies should always be prepared for various risks of project delay, throughout the mutual confirmation.

Comparison of the Original and Actual Scope of the Project

| Item | Plan | Actual |
|---|---|---|
| 1. Project Outputs | 1) Railway Bed Construction<br>◆ Double-tracking of Arjawinangun-Cirebon (22.73 km).<br>◆ Siding between Kadokangabus and Arjawinangun (45.7 km). | 1) Railway Bed Construction<br>→Mostly as planned (*except that installation of box culvert was implemented by the Acceleration Program).<br>→ Only Arjawinangun-Cangkring (approx. 10 km) and Jatibarang-Kertasemaya (approx. 2.9 km). (*The other sections were implemented by the Acceleration Program.) |
| | 2) Track Construction<br>◆ The double-track sections between Arjawinangun and Cirebon (22.73 km).<br>◆ Siding between Kadokangabus and Arjawinangun (45.7 km).<br>◆ Replacement of track materials for the double-track section between Haurgeulis and Arjawinangun (58.47 km).<br>◆ Replacement of track materials for the existing track between Cipunegara and Jatibarang (except for 8 km out of 47.57 km). | 2) Track Construction<br>→Implemented by the Acceleration Program<br>→Only Arjawinangun- Cangkring (approx. 10 km) and Jatibarang-Kertasemaya (approx.2.9 km). (*The other sections were implemented by the Acceleration Program.)<br>→Implemented by the Acceleration Program.<br>→Cipunegara-Cilegeh and Kadokangabus-Kertasemaya (approx. 39 km), Haurgeulis-Jatibarang (approx. 37 km). |
| | 3) Bridge Construction<br>◆ Six bridges between Telagasari and Arjawinangun.<br>◆ Seven bridges between Arjawinangun and Cirebon. | 3) Bridge Construction<br>→Implemented by the Acceleration Program.<br>→Implemented by the Acceleration Program. |
| | 4) Signaling Facilities<br>◆ Signaling system and CTC function between Telagasari and Cirebon (six stations).<br>◆ Establishing CTC connection between Cikampek and Telagasari (12 stations).<br>◆ Installation of optical fiber cable between Haurgeulis and Cirebon (81.2 km). | 4) Signaling Facilities<br>→Signaling system and CTC function between Haurgeulis and Cangkring (10 stations).<br>→ CTC connection established between Tanjungrasa and Cangkring (16 stations).<br>→ Installation of optical fiber cable between Cikampek and Cirebon (approx. 135 km). |
| | 5) Consulting Services | 5) Consulting Services |

| | | |
|---|---|---|
| | ◆ Review of the design, assistance to the bidding process, and supervision of construction (International: 220M/M, Local 644M/M). | →Review of the design, assistance to the bidding process, and supervision of construction (including the supervision of the rehabilitation of Cirebon Station) (International: 312.53M/M, Local 922.59M/M). |
| 2. Project Period | January 1998 – April 2003 (64 months) | January 1998 – September 2011 (165 months) |
| 3. Project Cost Amount paid in foreign currency | 6,528 million yen | 5,189 million yen |
| Amount paid in local currency | 5,137 million yen | 7,129 million yen |
| Total | 11,665 million yen | 12,318 million yen |
| Japanese ODA loan portion | 8,748 million yen | 8,742 million yen |
| Exchange rate | One Japanese yen = 0.052 rupiah (As of April 1997) | One Japanese yen = 0.011 rupiah (Average of the project period: source IMF and IFS) |

Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Water Resources Existing Facilities Rehabilitation and Capacity Improvement Project"

External Evaluator: Hirofumi Tsuruta, Octavia Japan Co., Ltd.

## 0. Summary

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen the operation and maintenance (hereinafter referred to as "O&M") system by assisting the capacity development of O&M agencies[1] through the rehabilitation of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the rehabilitation of the river facilities in Brantas River basin, and the recovery of Ular River irrigation that were highly emergent and needed. Because the project is consistent with Indonesia's National Medium Term Development Plan to prioritize the development, management and infrastructure improvement of water resources, Indonesia's national needs and Japan's aid policy, the relevance of the project is high. On the other hand, although project costs were within budget, the project period was significantly longer than had been planned. Thus, the efficiency is fair. The effectiveness and impact are high, because alleviation of flood suffering in the upper Solo and Brantas River basins and increased rice production in the Ular River irrigation have been observed, as well as because living standards of neighboring residents have been enhanced. The sustainability of the project is fair as minor institutional, technical, and financial problems arose: although the facilities and equipment rehabilitated by the project had been for the most part properly operated and maintained, the demarcation of responsibilities among O&M agencies was somewhat unclear and O&M agencies had insufficient experience with preventive maintenance and would not have been able to conduct large-scale rehabilitation without external financial resources.

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

## 1. Project Description


Project Locations

Revetment and riverbed repaired by the project (O&M agencies and residents remarked, "river flow became smooth", etc.)

[1] They are Directorate General for Water Resources of Ministry of Public Works and Housing (hereinafter referred to as "Ministry of Public Works") and Solo River Basin Management Offices (hereinafter referred to as "RBO"), Brantas RBO and Sumatra II RBO under the direct control of Ministry of the Public Works.

## 1.1 Background

Indonesia is a tropical monsoon climate country and has an average annual rainfall of 1,500–4,000 mm. The rainy season (from November to March) accounts for about 80% of annual rainfall. During the rainy seasons floods and landslides that occur in various locations substantially damage the social economy of Indonesia. Furthermore, the absolute amount of water resources available has been insufficient with increasing the residential and manufacturing demand (for example, the water demand increased from 156.0 billion $m^3$ per year in 2003 to 356.5 billion $m^3$ per year in 2015[2]). Appropriate water resources management is thus increasingly important.

For such needs, from the time of appraisal to the current ex-post evaluation, the improvement of the basic infrastructures for water resources has been challenges. The Indonesian government has developed various regulations in regard to water resources control and preservation and promoted long-term comprehensive water resources management and development. In particular for the development of the major rivers like this project, the Indonesian government has promoted the infrastructure developments including construction of multipurpose dams, flood control measures and development of irrigation systems in river basins in cooperation with the Japanese government, the World Bank, and other entities since 1960s.

However, the development of infrastructures remains insufficient. Interviews with the Ministry of Public Works indicated that while Presidential Order No. 12 of 2012 (regarding decisions pertaining to river basins) specifies about 55% of the total domestic river shoreline of 19,710 km as the rivers that should be protected (including the ones that had already been protected), most rivers have been neither protected nor improved. As well, while it is estimated that about 7 million ha can be irrigated in Indonesia, one-quarter of this area has not been developed and is not functional at present.

In addition, as for existing facilities and equipment, the number of facilities and equipment with 30-year passed after the construction had increased since 1990s, and they have become increasingly decrepit and have deteriorated their function. Moreover, due to chronic financial shortages and the Asian Financial Crisis of the late 1990s, facilities and equipment have not been well maintained, accelerating the deterioration. As a result, the quality of the public services was reduced. To ameliorate this, restoring the functioning of these existing facilities and strengthening the capacity of relevant O&M agencies were urgently necessary.

## 1.2 Project Outline

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen the operation and maintenance (hereinafter referred to as "O&M") system by assisting the capacity development of O&M agencies through the rehabilitation[3] of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the

[2] WEPA: Water Environment Partnership in Asia, "State of Water Environmental Issues," http://www.wepa-db.net/policies/state/indonesia/indonesia.htm (accessed March 2015).

[3] "Rehabilitation" includes not only physical repair of existing facilities and equipment, but also recovery and supplements of their function. Thus, the project included new construction needed for the recovery and supplements.

rehabilitation of the river facilities in Brantas River basin in Central and East Java Provinces, and the recovery of Ular River irrigation in North Sumatra Province that were highly emergent and needed, thereby contributing to stabilizing the life of residents and enhancing their living standards.

| | | |
|---|---|---|
| Loan Approved Amount/ Disbursed Amount | 14,696 million yen/13,784 million yen | |
| Exchange of Notes Date/ Loan Agreement Signing Date | March 2002/October 2002 | |
| Terms and Conditions | Interest Rate | 1.8% |
| | Repayment Period | 30 years<br>(Grace Period: 10 years) |
| | Conditions for Procurement | General untied<br>(Bilateral tied for consulting services) |
| Borrower/ Executing Agency (ies) | Government of Republic of Indonesia<br>/Ministry of Public Works<br>(The present Ministry of Public Works and Housing) | |
| Final Disbursement Date | August 2012 | |
| Main Contractors (over 1 billion yen) | PT. Adhi Karya (Indonesia)/PT. Istaka Karya (Indonesia) (JV), PT. Brantas Aripraya (Indonesia)/PT. Hutama Karya (Indonesia) (JV), PT. Nindya Karya (Indonesia)/PT. Pembanunan Perumahan (Indonesia)/PT. Hutama Karya (Indonesia) (JV), PT. Waskita Karya (Indonesia)/PT. Wijaya Karya (Indonesia)/PT. Adhi Karya (Indonesia) (JV) | |
| Main Consultants (over 100 million yen) | Nippon Koei Co., Ltd. (Japan)/Yachiyo Engineering Co., Ltd. (Japan)/ Nikken Consultant Inc. (Japan)/PT. Tata Guna Patria (Indonesia)/PT. Tri Tunggal Konsultant (Indonesia) (JV) | |
| Feasibility Studies, etc. | "Assistance Effectiveness Promotion Study on Rehabilitation Projects of Karangkates Dam Construction Project and others" (2001) | |
| Related Projects | 【Loans】(The years in which the relevant loan agreements were signed are given within parentheses. In certain cases, loan agreements were signed multiple times in a single year; for these cases, the number of times is given within brackets.)<br>- Wonogiri Multipurpose Dam Project (1976, 1977 [twice])<br>- Madiun River Urgent Flood Control Project (1985)<br>- Upper Solo River Improvement Project (1985)<br>- Countermeasures against Sediment in the Wonogiri Multipurpose Dam Reservoir (I)(II) (2009, 2014)<br>- Karangkates Multipurpose Dam Project (1968, 1969 [twice], 1970, 1971)<br>- Karangkates Hydropower Station Project (I)(II) (1970 [twice], 1971, 1973)<br>- Karangkates Second Stage Development Project (1974, 1975)<br>- Wlingi Multipurpose Dam Project (I)–(III) (1975, 1976 [twice])<br>- Brantas Middle Reaches Improvement Project (I)(II) (1979, 1985)<br>- Kali Porong River Improvement Project (1970, 1971, 1976)<br>- Porong River Rehabilitation Project (1988)<br>- Mt. Kelud Urgent Volcanic Disaster Mitigation Project (1991)<br>- Ular River Improvement Project (1971)<br>- Ular River Improvement and Irrigation Project (1981)<br><br>【Technical Cooperation】<br>- Project on Capacity Development for RBOs in Practical Water | |

| | |
|---|---|
| | Resources Management and Technology (2008-2011)<br>- Policy Advisory for Integrated Water Resources Management (2008–2015)<br>- Project for Assessing and Integrating the Impact of Climate Change into the Water Resources Management Plans for the Brantas and Musi River Basins (2013-2016)<br>- Project on Capacity Development for River Basin Organizations in Integrated Water Resources Management (2014-2018)<br><br>【Grant Aid】<br>- Pumping Station Project for the Lower Reaches of the Bengawan Solo (1991–1992)<br>- Countermeasures for Sedimentation in the Wonogiri Multipurpose Dam (2001–2003)<br><br>【Other Donors】<br>- World Bank, Java Irrigation Improvement and Water Management Project (1994–2002)<br>- Government of the Netherlands and the World Bank, Water Resources and Irrigation Reform Implementation Project (2001–2005)<br>- World Bank, Java Water Resources Strategic Study (2009–2011)<br>- World Bank, Water Resources and Irrigation Management Program (2003–2010) |

## 2. Outline of the Evaluation Study

2.1 External Evaluator

Hirofumi Tsuruta, Octavia Japan Co., Ltd.

2.2 Duration of Evaluation Study

Duration of the Study : September 2014–July 2015

Duration of the Field Study: November 22, 2014–December 5, 2014

March 2, 2015–March 5, 2015

## 3. Results of the Evaluation (Overall Rating: B[4])

### 3.1 Relevance (Rating: ③[5])

3.1.1 Relevance to the Development Plan of Indonesia

At the time of the appraisal, the Government of Indonesia prioritized maintenance of the functioning of the existing facilities by restoring and improving as one of crucial part of "the Program to Maintain Service Levels of Public Facilities and Infrastructures" in the "National Development Program 2000-2004" (hereinafter referred to as "Propenas"). In addition, the increase of food production and promotion of agricultural business through the expansion of water resources and streamlining of the management of irrigation system were also regarded as one of the goals in the

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[5] ③: High, ②: Fair, ①: Low

“Program to Develop and Manage Water Resources” in Propenas.

As of the ex-post evaluation, the Government of Indonesia has included “improvement of infrastructure” as an approach to accelerate economic and social development in the ”National Medium Term Development Plan 2010–2014”. Moreover, the plan regards improving the management of water resources as a priority issue.

From the time of the appraisal to the ex-post evaluation, maintaining and rehabilitating existing infrastructure have been regarded as important. It thus is recognized that the project is consistent with national and sector plan.

### 3.1.2 Relevance to the Development Needs of Indonesia

As mentioned in “1.1 Background”, restoring functions of existing infrastructure and developing the capacity of O&M agencies in Indonesia are urgently necessary.

At the time of the appraisal in the Solo and Brantas River basins targeted by the project, the risks of flood damage in the future had increased among facilities and equipment that had been completed in various past loan projects: extreme riverbed scouring; bank erosion; and destabilized existing river protection, bridge foundations, and groundsills were observed, and rehabilitation was thus urgently necessary. Furthermore, even in Ular River irrigation, problems such as difficulties of water intake because of scouring had been occurred, and countermeasures to ensure a certain amount of water intake were essential. In the background of these challenges, the lack of adequate and appropriate maintenance was one of the causes. Thus, it is highly necessary to develop the capacity of the Solo RBO, Brantas RBO, and Sumatra II RBO.

As of the ex-post evaluation, the situation has been improved but continued efforts are still required. According to interviews with the Solo and Brantas RBOs, certain river and dam facilities and equipment that were not targeted by the project require rehabilitation. Even among the Ular River irrigation facilities, there are still spaces of the improvement of agricultural productivity through the rehabilitation of the second and third canals. Regarding O&M capacity, organizational structures has been improved and strengthened by the establishment of the O&M Directorate in the Directorate General of Water Resources of the Ministry of Public Works, however, as the Directorate of O&M has indicated, experience with preventive maintenance remains insufficient.

As the above indicates, at the time of the appraisal and this ex-post evaluation, the project has been consistent with Indonesia’s developmental needs because this project targeted rehabilitating existing facilities for rivers and irrigation and developing the capacity of O&M agencies.

### 3.1.3 Relevance to Japan’s ODA Policy

At the time of the appraisal, Japan’s “Strategy for Overseas Economic Cooperation Operation” (2002) indicated that in providing assistance to Indonesia, priority would have been placed on restoring the social and economic infrastructure necessary to redirect to sustainable growth. In addition, the “Country Assistance Program for Indonesia” (2001) indicated three areas of focus: ① ensuring

economic stability, ② providing assistance for reform, and ③ providing assistance to improve infrastructure to overcome economic bottlenecks, and prioritized the rehabilitation of existing facilities and assistance for O&M as important agendas.

Thus, because this project targeted the rehabilitation of existing facilities, it was consistent with Japan's ODA policy.

As the above indicates, this project is highly consistent with Indonesia's development plan and developmental needs as well as Japan's ODA policy. Therefore its relevance is high.

### 3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

3.2.1.1 Civil Works and Equipment

In the course of conducting the detailed design study and during construction period, engineering changes were made, but not changes in regard to the scope of the project—"the civil works needed for recovery and maintenance of the function of targeted rivers and irrigation system" remained unchanged. Therefore, on the whole, the outputs of the project were as planned.

The first engineering change was made as the detailed design study was being conducted. This change was made because priorities had been revised in regard to the recover and maintenance of function of facilities and equipment servicing the targeted rivers and irrigation systems[6] as well as because of policy changes implemented by the Ministry of Public Works.[7] At this time, per a request from the Ministry of Public Works,[8] the packages of the civil works were rearranged and divided; the originally planned 7 packages at the appraisal were finally divided into 13 packages.

The second change was conducted after the detailed design study, because it became apparent that additional civil works were necessary to deal with the occurrence of hot sludge during river rehabilitation work in the Brantas River basin, and the planned procurement of dredging equipment capable of dredging to a depth of 30 m was cancelled.[9] As a result, in place of this planned

[6] This project aimed at the "civil works needed to recover and to maintain the function of river and irrigation system". Thus, several problems were clearly identified through careful investigation in the detailed design study (including river water leakage at the embankment of the Brantas River and change of a type of headworks at the Ular River irrigation), and new problems emerged during the implementation period (including the occurrence of hot sludge at the Brantas River Basin and aging of facilities of the Ular River irrigation as mentioned above). To deal with these problems, civil works were added each time on the basis of the needs.

[7] At first, a rubber weir was planned for the headworks of the Ular River irrigation facilities. However, as a result of technical discussion in regard to ease of operation and maintenance, etc., the decision was changed into installing a fixed weir. This change necessitated conducting detailed design studies twice.

[8] The civil works were reorganized and subdivided to improve efficiency (by making each package smaller and/or the civil works included in each package exhibited more of a unity, work efficiency can be improved, etc.). In separated procurement, besides such benefits, there was a risk that smaller packages could increase coordination costs among contractors. Thus, it is difficult to judge how many packages were of optimal size, and it cannot be said that there were problems with this reorganization and subdivision in the plan, even though issues were raised after the beginning of the project and during the project period as shown in Table 5. .

[9] As of the project, it was judged that there was less influence at least for a short-term period because the executing agency had the dredging system with dredging depth 10m. On the other hands, because the excusing agency had faced the challenges to manage urgently the hot sludge generated during the civil works of siphon at the Brantas River basin, it was necessary to secure the cost for it. If we focus on the "dredging", the cancellation might be a problematic in the mid- or long term. However, the decision of the cancellation was unavoidable for the project on the whole because emergency measures against the hot sludge were needed.

procurement, civil works to recover and maintain the targeted rivers and irrigation systems were entirely added.

The third change was conducted at the latter half of the construction period when it became obvious that additional rehabilitation work for the existing facilities[10] was necessary within the existing irrigation area (due to many years of waterlessness, facilities in the area had deteriorated, etc.) Thus, addition of civil works was undertaken.

As the above indicates, although the procurement of dredging equipment was cancelled, civil works were added with the surplus. In addition, these additional civil works remained in line with the project scope, which called for "civil works needed for restoring and maintaining rivers and irrigation system". Thus, the engineering changes of the civil works in the project were judged to be appropriate.

Table 1. Plan and Achievements in Regard to Project Outputs

| Civil Works | Plan as of the Appraisal | Achievements |
|---|---|---|
| ① Rehabilitation of the Solo River Basin | | |
| Rehabilitation of the Solo and Madiun Rivers | - Repair of the revetment of the upper Solo River<br>- Repair of the revetment of the Madiun River and of rubber gates | As planned<br>Additions were made; among other things, bridges were replaced and pier foundations were rehabilitated. |
| ② Rehabilitation of the Brantas River Basin | | |
| Rehabilitation around the Karangkates Multipurpose Dam | - Construction of groundsills (5 locations)<br>- Repair of the revetment of the spillway | As planned<br>Additions were made; among other things, the number of groundsills was increased (6 locations), and consolidation dams (2 locations) and a settling pond (1 location) were constructed. |
| Rehabilitation around the Wlingi Multipurpose Dam and Mt. Kelud | - Construction of groundsills (7 locations)<br>- Construction of a bypass channel | As planned<br>Additions were made; among other things, the number of groundsills (8 locations) was increased. |
| Rehabilitation of the Brantas and Porong Rivers | - Repair of the revetment<br>- Repair of groundsills<br>- Repair of irrigation weirs | As planned<br>Additions were made; among other things, siphons were constructed. |
| ③ Rehabilitation of Ular Irrigation | | |
| Rehabilitation of Ular River irrigation facilities | - Repair of headworks (1 location)<br>- Construction and repair of link canals (1st channel) | As planned<br>Additions were made; among other things, a target length of canals was expanded (approximately 4 km) and relevant facilities (culvert, siphon, etc.) were installed additionally. |
| ④ Procurement of equipment | | |
| Procurement of dredging equipment | - Procurement of two dredging systems | Changed<br>Only one dredging system was procured. |

(Sources) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

[10] Farming areas, inlet channel, sough, culvert, siphon, turnouts, etc.

3.2.1.2 Consulting Services

Consulting services were provided as planned.

Although the input for consulting services was more than planned, it is judged that this change was appropriate in light of schedule changes to consider the progress of civil works. .The main reasons of the increase are that additional work was added to the project during the construction period,[11] that the timeline of activities was reviewed[12] and that the schedule was extended.

Table 2. Plan and Achievements of Consulting Services Provided to the Project

| | Plan as of the Appraisal | Achievement |
|---|---|---|
| Services | 1) Overall project management<br>2) Holding meetings regarding monitoring<br>3) Tendering and monitoring civil works<br>4) Assistance in establishing the Solo River branch of the Perum Jasa Tirta 1 (hereinafter referred to as "PJT1"), the public company that manages the Brantas River<br>5) Development of a plan for basin-wide sediment management in the Solo and Brantas River basins<br>6) Monitoring and evaluation in regard to organizing and strengthening the water users' association of the Ular River irrigation<br>7) Consultation for environmental issues | As planned<br>Regarding 6), activities and the schedule were amended in light of the reinforcement of the Water Resources Management Law 2004. |
| Amount of Input | Foreign experts: 432 person-months; local experts: 1,014 person-months (service period: January 2003 to December 2007) | Foreign experts: 679.2 person-months; local experts (1,656.6 person-months; service period: October 2003to June 2012) |

(Source) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

3.2.2 Project Inputs

3.2.2.1 Project Cost

The planned and actual project costs are shown in Table 3. While the planned total project cost was 17,408 million Japanese yen (with the loan accounting for 14,696 million Japanese yen), the actual cost of the loan portion, 13,879 million Japanese yen, was 94% of what had been planned at the time of appraisal,[13] and was within the plan.

As for the project outputs, although the cost of procuring equipment was less than planned, additional works were instead added to each civil works package; in addition, during the project period, one additional package was added[14]. Thus, in terms of the total amount of outputs, there was not a large difference from what had been planned.

[11] As mentioned in the footnote No.7, the detail design study was conducted twice in regard to Ular River irrigation system.
[12] The timeline for "monitoring and evaluating water user associations' activities in the targeted area in the Ular River irrigation" was postponed because additional time was necessary for the preparation of the implementation system of the Ministry of Public Works in accordance to the reinforcement of the Water Resources Management Law of 2004.
[13] As of the ex-post evaluation, reliable information was not collected regarding costs borne by the Government of Indonesia because of data from the governmental budget and the budget of the Ministry of Public Works had not been kept. Completion reports submitted by the consultant constituted the entirety of the records kept at the Ministry of Public Works; these records do not reveal anything about disbursement from the governmental side. Thus, the loan part was compared between planned and actual cost.
[14] Civil works in the Ular River irrigation were added.

Thus, it was adequate project cost.

Table 3. Planned and Actual Project Costs

(Unit: millions of Japanese yen)

| Category | Foreign Currency | | | | Local Currency | | | | Total | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Plan | | Actual | | Plan | | Actual | | Plan | | Actual | |
| | Total | Loan | Total | Loan | Total | Loan | Total | Loan | Total | Loan | Total | Loan |
| Civil Works | 4,949 | 4,949 | 0 | 0 | 4,210 | 4,210 | 10,403 | 10,403 | 9,159 | 9,159 | 10,403 | 10,403 |
| Procurement of equipment | 1,415 | 1,415 | 447 | 447 | 734 | 734 | 202 | 202 | 2,149 | 2,149 | 649 | 649 |
| Consulting services | 1,258 | 1,258 | 1,629 | 1,629 | 1,561 | 1,561 | 1,198 | 1,198 | 2,819 | 2,819 | 2,827 | 2,827 |
| Contingency | 321 | 321 | Unknown | 0 | 333 | 248 | Unknown | 0 | 654 | 569 | Unknown | 0 |
| Land Acquisition | 0 | 0 | Unknown | 0 | 1,021 | 0 | Unknown | 0 | 1,021 | 0 | Unknown | 0 |
| Administration | 0 | 0 | Unknown | 0 | 745 | 0 | Unknown | 0 | 745 | 0 | Unknown | 0 |
| Tax | 0 | 0 | Unknown | 0 | 861 | 0 | Unknown | 0 | 861 | 0 | Unknown | 0 |
| Total | 7,943 | 7,943 | 2,076 | 2,076 | 9,465 | 6,753 | 11,803 | 11,803 | 17,408 | 14,696 | 13,879 | 13,879 |

(Sources) Plan: Documents provided by JICA
Actual: Documents provided by JICA and interviews with O&M agencies
Note: Total actual project costs were not equal to the amount of loans disbursed (13,784 million yen). This gap emerged because reported numbers were drawn from actual disbursements until July 2012 and estimations for July and August 2012.

Moreover, the portion of actual project costs covered by the loan decreased; this was because of differences in the exchange rate between the time of the appraisal and during the project period. At the time of the appraisal, 1 rupiah was equal to 0.014 Japanese yen (as of October 2001), whereas during the project period, 1 rupiah was equal to 0.011 Japanese yen (on average from July 2004 to June 2012),

3.2.2.2 Project Period

The planned and actual project periods are shown in Table 4. The actual project period was significantly longer than what had been planned—by 190%. The main reasons for the delay in implementation of each package are shown in Table 5. Because the delay was not caused only by the increase in outputs, this implies that the project period was lengthened in light of the outputs.

Table 4. Planned and Actual Project Periods

| | Planned Period as of the Appraisal | Actual Period |
|---|---|---|
| Overall | October 2002 (Signing on L/A)–September 2007 (Completion of all the civil works) (60 months) | October 2002 (Signing on L/A)–March 2012 (Completion of all the civil works) (114 months) |
| Selection of Consultants | October 2002–December 2002 | May2003–December 2003 |
| Consulting Services | January 2003–December 2007 | December 2003–June 2012 |
| Civil Works (Procurement and Construction) | December 2003–September 2007 | May 2005–March 2012 |
| Procurement of Equipment | January 2005–December 2005 | November 2005–June 2007 |

(Sources) Plan: Documents provided by JICA
Achievements: Documents provided by JICA and interviews with stakeholders

Table 5. Causes of Project Delays

| Causes | Detail |
|---|---|
| Delays due to the detailed design study | Two detailed design studies were conducted in regard to Ular River irrigation system due to changes in policy put forth by the Directorate General of Water Resources, Ministry of Public Works. As a result, the start of the project implementation was delayed for about one year. |
| Delays due to project implementation | 【Delays related to procurement of contractors】<br>The prequalification of contractors for tendering was delayed.<br>【Delays related to decision-making processes within the Ministry of Public Works】<br>Regarding the start of the work on the bypass channel around the Wlingi Multipurpose Dam, time was necessary to obtain consensus within the Directorate General of Water Resource, Ministry of Public Works.<br>【Delays related to bad weather】<br>The project implementation period was postponed due to floods and a prolonged rainy season.<br>【Delays related to civil works added to the original plan】<br>Additional civil works were necessary to deal with hot sludge generated in the Brantas River basin during the project period; this caused delays.<br>【Delays related to the managerial structure and capacity of joint ventures of contractors】<br>Certain civil works packages for the Brantas River basin were contracted to joint ventures consisting of major companies and small companies; in these joint ventures, however, the former provided insufficient supervision and assistance to the latter, giving rise to technical[15] and financial problems and delays on the small companies' end.<br>【Delays related to contractors' internal management】<br>Civil works to rehabilitate Ular River irrigation facilities were contracted to a major company. However, the company repeatedly delayed payment to subcontractors. As a result, work stoppages were frequent. Furthermore, this company repeatedly changed subcontractors, consistently rewarding subcontracts to subcontractors of progressively worse technical capacity. This delayed implementation. |

(Sources) Documents provided by JICA and interviews with O&M agencies

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

Economic internal rates of return (hereinafter referred to as "EIRR") for the project are shown in Table 6. EIRRs at the time of the ex-post evaluation were a little more than those planned at the time of the appraisal. This is because benefits were enlarged by, among other things, the escalation of the price of the rice (a 2.7-fold increase in comparison to the appraisal, according to the rice price in annual reports of each province).[16]

Financial internal rates of return (hereinafter referred to as "FIRR") were not calculated because the project didn't raise financial return. Even as of the appraisal, FIRRs were not estimated.

[15] Problems related to concrete placement, coffering, method of rehabilitation works, etc.

[16] Regarding the EIRR of the Ular River irrigation, it was a bit below the number at the time of the appraisal because the project cost increased (twice of the planned cost). In this connection, the project cost of the Solo River basin and the Brantas River basin were approximately 1.1 and 1.2-fold of the planned cost, respectively.

Table 6. EIRRs at the time of the Appraisal and as of the Ex-post Evaluation

| Civil Works | Benefit | Appraisal | Ex-post Evaluation |
|---|---|---|---|
| Overall | | 20.3% | 22.1% |
| Solo River | Alleviation of flood damage stemming from river rehabilitation | 10.7% | 16.4% |
| Brantas River | Increase of power generation stemming from recovery of the water capacity of the dam; alleviation of flood damage stemming from river rehabilitation | 21.4% | 23.6% |
| Ular River irrigation system | Increases in income stemming from increases in rice production made possible by irrigation rehabilitation | 22.2% | 21.0% |

(Sources) Documents provided by JICA, statistics
Note: EIRRs as of the ex-post evaluation were estimated using the conditions and formulas mentioned in the appraisal documents, but with current exchange rates, commodity prices, rice prices, etc. In addition, in the estimation, the project life of each civil work was set at 50 years and the cost sets included both of the civil works cost and O&M cost.

As the above indicates, the project cost was within the plan and project period exceeded what were planned. Therefore, the efficiency of the project is fair.

### 3.3 Effectiveness[17] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

3.3.1.1 Rehabilitation at the Solo River Basin

① Operation indicators

As shown in Table 7, as of the ex-post evaluation, the destruction of the river revetment rehabilitated by the project has not been reported. Although a survey was not conducted and precise data are unavailable, interviews with the staff of the Solo RBO indicated that the river revetment has not since been damaged and no expansion of flood damage has been observed around the project sites. Thus, targets of the operation indicators were (substantially) achieved.

[17] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 7. Achievement of Operation Indicators

| | Baseline | Target | Actual | | |
|---|---|---|---|---|---|
| | 2001 | 2014[*1] | 2012 | 2013 | 2014 |
| | Baseline year | 5 years after completion | 3 years after completion | 4 years after completion | 5 years after completion |
| Indicator "Length of Damaged Revetments among Revetments Repaired by the Project" (Unit: m) | | | | | |
| Upper Solo River | 960[*2] | 0 | -[*3] | -[*3] | -[*3] |
| Madiun River | 760[*2] | 0 | -[*3] | -[*3] | -[*3] |
| O&M Cost (Unit: millions of rupiah) | | | | | |
| Upper Solo River | 288[*4] | 617[*4] | Unknown | Unknown | 43,538[*5] |
| Madiun River | 268[*4] | 733[*4] | | | |

(Sources) Documents provided by JICA, documents provided by O&M agencies

*1 The relevant civil works were completed in 2009; thus, five years after the completion of construction would be 2014.

*2 These numbers refer to the total length of the revetment targeted by the project. In the detail design study, these numbers were changed to 1,420 m for the upper Solo River and 594 m for the Madiun River.

*3 Because a survey was not conducted, precise measurements could not be grasped. However, according to interviews with O&M agencies, destruction of the revetments has not been reported since the end of the project.

*4 Targeted O&M costs were estimated only in regard to facilities and equipment rehabilitated in the project.

*5 This number was estimated based on the O&M budget for the Solo RBO (refer to 3.5.3 Financial Aspects of O&M). The Solo River basin is 16,100 $km^2$ in total; of this, upper Solo River basin and Madiun River basin are 6,072 $km^2$ and 3,755 $km^2$, respectively. Thus, the O&M cost for the upper Solo and Madiun Rivers is 43,538 million rupiah (or the total O&M budget allocated to the Solo RBO: 71,331 million rupiah multiplied by (6,072+3,755)/16,100).

In addition, the target O&M costs planned for the upper Solo and Madiun Rivers at the time of the appraisal was only about 3.1% of actual costs estimated as of the ex-post evaluation[18]. According to the staff of the Solo RBO, the O&M budget was allocated for daily O&M activities and no problems around the project sites have been reported. Therefore, the indicators can be judged to have been (substantially) achieved.

As the above indicates, facilities and equipment in the Solo River basin are operated appropriately; no problems with the river facilities rehabilitated by the project have occurred and allocations for O&M have been disbursed as of the ex-post evaluation.

② Effect Indicators

Table 8 illustrates the flooding of the upper Solo River (a part of Solo river basin in the Central Java Province). The baseline and target estimations were established based on probability in a 10-year period. Floods of the same scale occurred in December 2010 and May 2011. Floods that were relatively larger in scale occurred in January 2012 and January 2013. The number of suffered houses in these floods was compared with the target numbers; in all cases (including in the large flood that occurred in January 2013 of a scale that was estimated only to occur every 20 years), the number of actual flooded houses was much lower than estimated with the exception of the flood that occurred in January 2012 with 100-year probability. Thus, it is judged that the indicators were mostly achieved.

[18] O&M costs at the time of the appraisal were only those for the rivers and facilities targeted by the project. These numbers were obtained by multiplying the project cost with a certain rate. However, in the ex-post evaluation, the O&M budget of the entire Solo RBO was referred to because of the difficulty involved in calculating costs separately by rivers and/or facilities.

Table 8. Achievement of Effect Indicators [+1](Flooding in the upper Solo River)

| | Year | Highest Water Level at Jurug (m)[*1] | Estimated Water Flow ($m^3/s$)[*2] | Estimated Probability of a Flood of Similar Scale[*3] | Number of Flooded Houses [*4] |
|---|---|---|---|---|---|
| Baseline | 2001 (Year of appraisal) | - | - | 10 year | 2,500 |
| Target | 2013 (5 years after completion) | - | - | 10 year | 1,900 |
| Actual | December 2010 | 8.52 | 1098 | 10 year | 300 |
| | May 2011 | 8.14 | 995 | 10 year | 136 |
| | December 2011 | Unknown | Unknown | Unknown | 102 |
| | January 2012 | 10.24 | 1,624 | 100 year | 4,072 |
| | January 2013 | 9.06 | 1,252 | 20 year | 77 |
| | February 2013 | 7.38 | 806 | 2 year | 1,462[*5] |

(Sources)
*1 These numbers were drawn from newspaper reports. Jurug is a measuring point near Surakarta at the upper Solo River.
*2 Water flow were estimated using the formula $(4.116 \times \text{water level} - 2.362)^2$, which was cited from the documents provided the consultant.
*3 These numbers were estimated with a "table of water flow and occurrence probability" provided by the O&M agencies.
*4 These numbers were drawn from a document provided by the O&M agencies. It indicate the number of flooded houses around the Solo Rivers in Central Java Province,
*5 This flood occurred upstream from Jurug. Thus, the figures for estimated water level can be considered to have been estimated low. As results, estimated water flow and occurrence probability can also have been estimated low.
Notes:+1 No data were available for other indicators, such as areas inundated by flood, amount of damage, and number of people affected.
+2 Shaded cells indicates floods that had a probability of occurring every 10 years.

Moreover, these data shows that flood damage was alleviated. Table 9 shows that the flood prevention has been promoted through various efforts besides the project: strengthening the early warning system, enhancing flood management capacity with multipurpose dams and weirs, and improving land utilization.

Table 9. Efforts or Environmental Change Influencing the Alleviation of Flood Damages

| Efforts and Change | Description |
|---|---|
| Changes in the weather and natural environment | ① If the amount of rainfall is compared between the time of the appraisal and the time of the ex-post evaluation, it has increased (for example, the average rainfall over a period of five years in Surakarta located on the upper Solo River, was 2,022 in 2000, and increased to 2,484 mm in 2012). This indicates that climate change has increased the risk of floods. However, the flood occurrence has been decreased. Thus, efforts to alleviate flood damage (the following activities described in ③–⑥ or their synergy, in addition to this project) have been successful. |
| Development of infrastructure by other entities | ② During the project period, no other infrastructure projects sought to conduct large-scale rehabilitation. |
| Efforts to alleviate flood damage besides this project | ③ A technical cooperation project supplementary to this loan project sought to develop the capacity of the Solo RBO.<br>④ The Water Council of the Begawan Solo Basin was established in 2009. Since then, efforts to alleviate flood impacts and facilitate coordination among stakeholders have been undertaken.<br>⑤ The Asia Development Bank conducted a survey in regard to the alleviation of flood damage (Project number: TA-7547); the results were shared. |

| | |
|---|---|
| | ⑥ The Integrated Flood Analysis System (system analyzing flood occurrence) for alleviating flood impact, was developed and disseminated by the Ministry of the Public Works.*1 |

*1 The system can provide comprehensive predictions from the amount of rainfall and the water flow of the river to flood areas.

3.3.1.2 Rehabilitation at the Brantas River Basin

① Operation indicators

Operation indicators are shown in Table 10.

The dams were judged to have been adequately operated and utilized on the whole with the exception of Sabo dams for which data were unavailable.

As for the Sengguruh and Karangkates Dams, maintenance dredging has been undertaken. That is, dredging has been conducted with a consideration of the labor costs and capacity of the relevant O&M agencies and the minimal amount of dredging necessary for ensuring functioning has been kept. Nevertheless, the capacity of the dams' effective total reservoir capacity[19] has been slightly increased in comparison to 2011. It indicates that dredging has dealt with little more than annual sedimentation.

In addition, according to interviews with PJT1 staff, floods resulted from effective reservoir capacity have not occurred in the past. This was also indicated by the situation that floods have not since occurred in the main stream despite a storm with a chance of occurring once every 100 years having occurred in January 2012 (Table 8) as well as that the PJT1 estimated that in a storm with a chance of occurring once every 50 years, the number of flooded areas has decreased (Table 12).

Thus, the dams may now be operated appropriately because maintenance dredging needed to their functioning has been undertaken.

Regarding the revetment, the destruction of the river revetment rehabilitated by the project had not been reported as of the ex-post evaluation. Although a survey was not conducted and precise data are unavailable, interviews with the staff of the Brantas RBO indicated that the revetment has not since been damaged and no expansion of flood damage has been observed around the project sites, even though there was a heavy rain with 100-year probability such as in January 2012 (Table 8). Thus, targets of the operation indicators were (substantially) achieved. In addition, as mentioned above, the PJT1 also estimated that flood damage had been reduced.

Table 10. Achievements of Operation Indicators

| | Baseline | Target | Actual | | |
|---|---|---|---|---|---|
| | 2001 | 2014*1 | 2011 | 2013 | 2014 |
| | Baseline year | 5 years after completion | 3 years after completion | 4 years after completion | 5 years after completion |
| Indicator "Effective total reservoir capacity" (Unit: million $m^3$) | | | | | |
| Sengguruh Dam | 1.2 | 2.5 | 0.57 | No data | 0.64 |
| Karangkates Dam | 144.0 | 144.0 | 133.9 | No data | 134.2 |
| Wlingi Dam | 1.4 | 1.5 | 1.99 | 2.01 | No data |
| Indicator "Total reservoir capacity" (unit: million $m^3$)*2 | | | | | |

[19] Effective total reservoir capacity is calculated by subtracting the volume of the sedimentation and dead water from the volume of the total reservoir capacity.

| | | | | | |
|---|---|---|---|---|---|
| Mt. Kelud | 37.8 | 38.8 | No data | No data | No data |
| Dredging volume (Unit: $m^3$/year) | | | | | |
| Sengguruh Dam | 200,000 | 500,000 | 240,782 | 283,544 | 248,199 |
| Wlingi Dam | 200,000 | 500,000 | 235,456 | 250,835 | 286,060 |
| Indicator "Length of damaged revetments among functional revetments" (Unit: m) | | | | | |
| Brantas Middle Reach | 1,550*3 | 0 | -*4 | -*4 | -*4 |
| Porong River | 2,200*3 | 0 | -*4 | -*4 | -*4 |
| Indicator "O&M cost" (Unit: millions of rupiah/year) | | | | | |
| Sengguruh Dam | 2,600 | 6,500 | 220,662*5 | 312,825*5 | 157,093*5 |
| Wlingi Dam | 1,100 | 4,700 | | | |
| Brantas Middle Reach | 403 | 1,450 | | | |
| Porong River | 250 | 890 | | | |
| Sabo dam | 135 | 308 | | | |

(Source) Documents provided by JICA, documents provided by O&M agency
*1 The relevant civil works were completed in 2009; thus, five years from the completion of construction would be 2014.
*2 Because no survey was conducted, no data were available. The 2014 eruption of Mt. Kelud exerted an influence.
*3 These numbers refer to the length of revetments targeted by the project. In the detailed design study, these numbers were changed to total 2,102 m for the Brantas and Porong Rivers.
*4 Because no survey was conducted, precise measurements could not be obtained. However, according to interviews with the O&M agency, no destruction of revetments has been reported.
*5 This number refers to the total O&M budget for the Brantas RBO.

For the O&M cost, calculating O&M separately by river and by facilities was difficult; thus, the O&M budget for the Brantas RBO was referred to. The O&M budget of the Brantas RBO represents the O&M cost for the entire Brantas River basin, including all of its branches, such as Porong River. The total O&M cost estimated at the time of the appraisal was about 4.4–8.9% of the O&M budget for the Brantas RBO as of the ex-post evaluation[20]. According to the staff of the Brantas RBO, the O&M budget was allocated for daily O&M activities and no problems with the O&M had been reported. Therefore, the indicators were judged to have been (substantially) achieved.

As the above indicates, facilities and equipment in the Brantas River basin are operated appropriately; no problems with dams and or the river facilities have occurred and allocations for O&M have been disbursed.

② Effect Indicators

Effect indicators are shown in Table 11. Floods have not occurred in the main stream of the Brantas River targeted by the project, although the baseline and target were established based on storms with a 50-year possibility of occurrence. It includes those storms in 2007 with a 50-year and in 2012 with 100-year possibility of occurrence. According to the interview to the staff of the Brantas RBO, in the future event of rainfall with a 50-year possibility of occurrence or more, floods would be unlikely to occur and, in the event of flooding, the mainstream of the Brantas River basin was functioned for the alleviation of flood damage. Thus, it was determined that indicators such as reductions in disaster areas caused by overflow, damaged houses, damage costs, and number of people

[20] O&M costs at the time of the appraisal were only those for the rivers and facilities targeted by the project. The numbers were obtained by multiplying the project cost with a certain rate. However, in the ex-post evaluation, the O&M budget of the entire Brantas RBO was referred to because of the difficulty involved in calculating costs separately by rivers and/or facilities..

affected by each flood were (substantially) achieved.

Table 11. Achievements of Effect Indicators

| | Baseline | Target | Actual | | |
|---|---|---|---|---|---|
| | 2001 | 2014*1 | 2012 | 2013 | 2014 |
| | Baseline year | 5 years after completion | 3 years after completion | 4 years after completion | 5 years after completion |
| Indicator "Disaster Areas Caused by Overflow" (Unit: km$^3$) | | | | | |
| Brantas River Middle Reach | 198 | 0 | 0 | 0 | 0 |
| Porong River | 437 | 0 | 0 | 0 | 0 |
| Mt. Kelud Sabo Dam | 27 | 0 | 0 | 0 | 0 |
| Indicator "Damaged Houses" (Unit: houses) | | | | | |
| Brantas River Middle Reach | 12,040 | 0 | 0 | 0 | 0 |
| Porong River | 136,458 | 0 | 0 | 0 | 0 |
| Mt. Kelud Sabo Dam | 2,425 | 0 | 0 | 0 | 0 |
| Indicator "Damage Costs" (unit: millions of rupiah) | | | | | |
| Brantas River Middle Reach | 46,375 | 0 | 0 | 0 | 0 |
| Porong River | 102,335 | 0 | 0 | 0 | 0 |
| Mt. Kelud Sabo Dam | 3,370 | 0 | 0 | 0 | 0 |
| Indicator "Number of People Affected" (unit: people) | | | | | |
| Brantas River Middle Reach | 48,000 | 0 | 0 | 0 | 0 |
| Porong River | 604,000 | 0 | 0 | 0 | 0 |
| Mt. Kelud Sabo Dam | 3,908 | 0 | 0 | 0 | 0 |

(Sources) Documents provided by JICA documents provided by O&M agencies
*1 The relevant civil works were completed in 2009 thus, five years after the completion of construction would be 2014.
Note: All actual numbers are "0" as no floods with a 50-year possibility of occurrence have occurred between the completion and the ex-post evaluation.

In addition, the flooded area estimated by PJT1 is shown in Table 12. The table indicates that the project reduced estimated flood damage in the event of a storm with a 50-year possibility.

Table 12. Flood Damage Estimated by PJT1

(Unit: ha)

| | Before 1990 | 1990 to 2000 | 2010 to the present |
|---|---|---|---|
| Brantas River Basin (Unit: km$^3$) | 500 | 50 | <50 |

(Sources) Centre for River Basin Organizations and Management (2014), Experiences of the Jasa Tirta I Public Corporation in Indonesia as a Corporate Type of River Basin Organization

As in the Solo River basin, the reduction of the risk of flood damage has been results of various efforts undertaken in the Brantas River basin. Furthermore, the project's substantial size has ensured that its effects have not been small.

3.3.1.3 Rehabilitation at the Ular River Irrigation system

① Operation Indicators

Operation indicators are shown in Table 13. The indicators were largely achieved.

Table 13. Achievement of Operation Indicators

| | Baseline | Target | Actual | | |
|---|---|---|---|---|---|
| | 2001 | 2017[*1] | 2012 | 2013 | 2014 |
| | Baseline year | 5 years after completion | Year of completion | 1 year after completion | 2 years after completion |
| Irrigation area (ha) | 18,500 | 18,500 | 18,500[*5] | | |
| Irrigated paddy fields (rainy season) (ha) | 14,500 | 18,500 | Unknown[*6] | | |
| Irrigated paddy fields (dry season) (ha) | 9,520 | 18,500 | Unknown[*6] | | |
| Average water intake | 18.0 | 24.5 | 28.1[*7] | | |
| Number of water user associations | 4 | 10[*4] | 63[*8] | | |
| Percentage of farmers who have joined water user associations (%)[*2] | 90 | 100 | 100[*9] | | |
| Collection ratio of water charges[*3] | 22 | 100 | Unknown[*10] | | |
| Water fees (rupiah/ha/year) | 55,000 | 145,400 | 600,000[*11] | | |
| Irrigation Service Fees and Membership earned (millions of rupiah/year) | 227 | 2,690 | Unknown[*10] | | |

(Sources) Documents provided by JICA, documents provided by O&M agencies
*1 The relevant civil works were completed in 2012; thus, five years after the completion of construction would be 2017.
*2 The percentage of farmers who have joined water associations was calculated by dividing the number of farmers who were members of water user associations by the total number of farmers, then multiplying the result by 100.
*3 The percentage of water fees collected from farmers was calculated by dividing the actual total water fees collected by the expected total water fees, then multiplying the result by 100.
*4 Because the irrigation area is divided into 10 divisions by 10 turnouts, the target number was set, as at least one association was needed for one division. Significant increase in the actual numbers was likely because the association has been subdivided into smaller because their independency has been reinforced in the transformation of the irrigation management.
*5 This figure was provided by the Sumatra II RBO and was the target area of the water supply.
*6 According to the interview with the staff of the Sumatra II RBO, planting has been in all the irrigation area. In this case, the irrigated paddy fields can be 18,500 ha. However, because survey has not been conducted to measure the area precisely, "unknown" was put in this report.
*7 This number refers to the average water intake at the headworks.
*8 This figure was provided by the Sumatra II RBO.
*9 This figure was obtained from interviews with the staff of the Sumatra II RBO.
*10 Water fees are collected by water user associations. However, the Sumatra II RBO did not have total aggregated data.
*11 This figure was obtained in interviews with the staff of the Sumatra II RBO. This figure changes annually because it is determined by the price of the rice.

According to the interview with the staff of the Sumatra II RBO, the project contributed to the expansion of paddy fields into all the irrigation area by ensuring the provision of water to the entirety of the irrigation area. Since the completion of the project, neither the Ministry of Public Works nor other donors had undertaken efforts to expand or repair the irrigation areas. Thus, any expansion of irrigated paddy fields can be ascribed mainly to this project.

In addition, the number of water user associations increased, exceeding the target. Regarding this increase, the World Bank's Water Resources and Irrigation Management Program (Phase 1: 2003–2010, Phase 2: 2012–2017) had also been implemented in the Ular River irrigation to strengthen water user associations. Because the project was focused on infrastructure improvement, the input was limited for the strengthening of the water user associations. Thus, this increase in the number of water user associations may mainly be ascribed to the influence of the World Bank's program, and the project can be considered to have had an indirect contribution to the program.

②Effect Indicators

Effect indicators are shown in Table 14.[21] It is evaluated that the indicators were mostly achieved.

Table 14. Achievements of Effect Indicators

| | Baseline | Target | Actual[*3] | | |
|---|---|---|---|---|---|
| | 2001 | 2017[*1] | 2012 | 2013 | 2014 |
| | Baseline | 5 years after completion | Year of completion | 1 year after completion | 2 years after completion |
| Volume of rice produced (ton/year) (rainy season) | 75,400 | 96,200 | 109,000[*4] (129,430–147,290)[*5] | | |
| Volume of crops produced (ton/year) (rainy season) | 50,456 | 98,050 | 109,000[*4] (129,430–147,290)[*5] | | |
| Rice productivity (ton/ ha) (rainy season) | 5.2 | 5.2[*2] | 5.9[*6] (7–8[*7]) | | |
| Rice productivity (ton/ ha) (dry season) | 5.3 | 5.2[*2] | 5.9[*6] (7–8[*7]) | | |
| Annual net income of farmers from farming (thousand rupiah/year) | 6,066 | 9,166 | No data | | |

(Sources) Documents provided by JICA, documents provided by O&M agencies

*1 The relevant civil works were completed in 2012 thus, five years after the completion of construction would be 2017.

*2 These figures were obtained from the Deli Serdan District at the time of appraisal. However, as of the ex-post evaluation, it couldn't be confirmed whether theses figures show only the data of the Ular River irrigation or the data all over the District.

*3 These figures were the volumes and rice productivity (the areas of registered paddy field multiplied by the unit productivity) estimated by the external evaluator, on the basis of the data provided by the O&M agencies. Thus, the number remained the same between the rainy and dry seasons.

*4 These figures were estimated by multiplying the irrigation area by rice productivity (5.9 ton/ha); rice productivity data were provided by the Deli Serdang District. Half of the irrigation area lies in the Deli Serdang District.

*5 These figures were estimated by multiplying the irrigation area by rice productivity, on the basis of the data of productivity obtained in interviews with the staff of the Sumatra II RBO(7–8 ton/ha).

*6 These figures were obtained from the Deli Serdang District. Differences between the rainy season and dry season could not be confirmed.

*7 These figures were obtained in interviews with the staff of the Sumatra II RBO. Differences between the rainy season and dry season could not be confirmed.

As for the production volumes and productivity, they increased subsequent to the project. The interview with the staff of the Sumatra II RBO and farmers indicated that the main reasons for this increase were as follows:

① The provision of a stable water supply increased the areas of paddy fields and the feasible cropping period, increasing the average amount of rice produced per irrigated field. (Effect of this project)

② Technological innovations and strengthening managerial capacity in the irrigation areas increased the amount of rice produced per irrigated field. (Effect of other efforts besides the project).

Regarding the famers' income per capita, although data could not be obtained, the farmers interviewed reported that their incomes had significantly increased subsequent to the project.

[21] At the time of the mid-term review, it was recommended that the target number be revised upward on the basis of situational changes. However, in the ex-post evaluation, it was not confirmed from documents that the target number was amended. Furthermore, the notion that the target number had been amended could not be confirmed in interviews with the O&M organizations and a project consultant.

3.3.2 Qualitative Effects

3.3.2.1 Rehabilitation at the Solo River Basin (Alleviation of Flood Damage)

According to interviews with the staff of the Solo RBO, there have been fewer floods in the mainstream; most floods have occurred in small branches and the lower reaches. Thus, the focuses of flood control efforts have also shifted to the lower branches.

In the hearing to residents conducted around the project sites (in focus group discussions that included a total of 23 people living at different three points), there were positive answers indicating "it has become more difficult for floods to occur" and that "flood damage has been lightened." It was reported that the flow of the river became smooth and that improvements to the revetments had made it more difficult for land erosion to occur.

3.3.2.2 Rehabilitation at the Brantas River Basin (Alleviation of Flood Damage)

According to interviews with the staff of the Brantas RBO, fewer floods have occurred in the Brantas River basin since the appraisal.[22] Documents of O&M agencies indicated that infrastructure for water resources had been developed between the 1960s and 80s; thus, floods with a 50-year probability of occurring have been controllable since the 1990s. However, until 2000, when the PJT1 became responsible for the management of the Brantas River basin, no O&M agency had worked continuously; thus, adequate O&M activities had not been conducted. Therefore, the project was implemented. All residents included in focus group discussions around the project sites[23] indicated that "flood damage has been lightened", while they reported that no catastrophic floods had occurred in the last 10 years.

Thus, although it was not very clear whether alleviation of the risk of flood damage had been undertaken, as flood damage had not worsened compared with when the appraisal was conducted, it was determined that facilities' functioning (revetment, agricultural weir, sabo dam, etc.) had been maintained.

3.3.2.3 Rehabilitation at the Ular River Irrigation (Change of the Water Supply and Agricultural Productivity)

Tables 15 and 16 show the results of the beneficiary survey targeting the members of water user associations who are farmers.[24] As for the satisfaction on the water supply, about 80% of respondents answered that the water supply in the dry season was "insufficient" at the time of the appraisal, but the same percentage of respondents indicated that the water supply was "adequate" as of the ex-post

[22] The project aimed to maintain the functioning of existing facilities. Thus, even though floods had not occurred, it was judged that the project was necessary as future flood risks were obvious due to problems with existing facilities and equipment.

[23] Focus group discussions were conducted with residents of three areas and at village offices near one Sabo dam construction site; a total of 26 residents were involved.

[24] Sampling targeted the members of water user associations for farmers as they were expected to be knowledgeable regarding the condition of Ular River irrigation facilities. Furthermore, water user associations could be regarded as a sampling cluster. Nine water user associations were selected randomly from a total of 63 water user associations serviced by Ular River irrigation facilities. A self-administrative questionnaire was distributed to 104 members from the sampled association who were available on the day of the survey. Then, the completed questionnaires were collected.

evaluation. In addition, as for the perception on agricultural productivity, about 60–70% of the respondents answered that productivity had increased across seasons. Interviews with water user association members indicated that the project facilitated the stable provision of water to farming areas where water had been insufficient or irregular prior to the implementation of the project. The project made it possible to double-crop rice and to plant two crops a year; the project also made it possible for farmers to cultivate more varied products.

However, regarding satisfaction with the water supply in the rainy season, about 90% answered that the supply was "excessive."[25] In addition, in the group discussions with about 35 farmers conducted in addition to the questionnaire survey, three participants indicated that "paddy fields are sometimes flooded during the rainy season.". Moreover, although no participants reported that productivity was significantly impacted, they indicated that "it is necessary to dig up sedimentation from the third channel to prevent flooding, but this is burdensome," and "additional work is necessary to restore paddy fields after flooding; workloads have increased.".

For such situation, interviews with the Sumatra II RBO indicated that agricultural productivity has not been damaged. However, they indicated that ① because the second channel's weir was stolen, the water supply to the third channel has not always been effectively controlled and ② because of the sedimentation of the third channel, there have been times in which water has not drained smoothly and accumulated easily. Appropriate O&M of the second and third channels needs to be undertaken by O&M agencies and water user associations

Table 15. Satisfaction with the Water Supply

(Unit: %, n=104)

| Answers | | Excess | Adequate | Insufficient |
|---|---|---|---|---|
| At the time of the appraisal | Dry season | 0.9 | 12.5 | 86.6 |
| | Rainy season | 49.5 | 47.6 | 2.9 |
| At the time of the ex-post evaluation | Dry season | 8.7 | 79.8 | 11.5 |
| | Rainy season | 89.4 | 10.6 | 0 |

(Sources) Answers to the questionnaire survey

Table 16. Perceptions Regarding the Increase or Decrease of Overall Agricultural Productivity in Comparison with 10 Years Ago

(Unit: %, n=104)

| Answers | | Increased | No change | Decreased |
|---|---|---|---|---|
| At the time of the ex-post evaluation | Dry season | 69.2 | 17.3 | 13.5 |
| | Rainy season | 58.6 | 15.4 | 25.6 |

(Sources) Answers to the questionnaire survey

### 3.4 Impacts

3.4.1 Intended Impacts

Regarding the impact; improvement of living standards and expansion of enablement of daily activities, residents of the Solo River basin indicated that "it became possible to plant banana trees and

[25] This indicator is just satisfaction, and then it cannot describe the actual situation of the irrigation area concretely and accurately. Thus, the achievement is judged not only by the indicator but also by the result of the interviews to the Sumatra II RBO.

other crops" and that "it became safe to engage in daily and leisure activities such as fishing" due to the decrease in the frequency of flooding. In addition, most residents near the rivers were wage laborers; the decrease in the frequency of flooding enabled them to work longer hours. As a result, they were able to broaden their sources of income, stabilizing their earnings and making daily life more affordable. Residents near the Brantas River basin indicated that their "incomes had been increased because it became possible to plant crops near the rivers and roads which had been improved" because the flood occurrence has been decreased. Farmers in the Ular River Irrigation indicated, "it became possible to construct new houses or repair them and to buy agricultural equipment such as tractor"

Although no background quantitative data for their responses were available, interviews with residents indicated that the project contributed to the improvement of the living standards and the expansion of enablement of daily activities.

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

As of the ex-post evaluation, no negative impacts on the environment had been reported. Because the project focused on the rehabilitation of the existing facilities and equipment, no new large-size civil works for facilities or equipment were undertaken in the project. At the time of the appraisal, it was confirmed that the environmental approvals were not necessary in accordance with the Indonesian laws[26]. In addition, at the time of the detailed design study, foreign and local experts on the environment were involved, and a comprehensive mid- /long-term basin-wide sediment management plan was developed with surveys in order to take environmental consideration thoroughly. Accordingly, the civil works for the repairs of the river and irrigation facilities and equipment were undertaken. During the project period, the consultant provided the practical assistance for environmental consideration, continuously monitoring the impact after the engineering changes.[27]

As the above indicates, the impacts on the natural environment were appropriately taken into consideration.

#### 3.4.2.2 Land Acquisition and Resettlement

The project required the resettlement of four households and the acquisition of about 150 ha of land. According to interviews with O&M agencies, no significant problems, such as protests against relocation, arose, although negotiating the price of the land required time. However, as same as the impacts on the natural environment, the project had little adverse effect, as large land acquisitions were not necessary because the project focused on the rehabilitation of existing facilities and equipment.

[26] The impacts on environment were checked with the environmental checklist by the executing agencies.
[27] For example, in order to response against the hot sludge mentioned above, a temporal cofferdam was constructed to prevent environmental pollution. Eventually the rehabilitation work was stopped at the hot sludge area.

3.4.2.3 Unintended Positive/Negative Impact

As positive impacts, interviews with residents indicated that the scenery around the project sites was improved and areas around the project sites were made available for leisure activities such as fishing and picnicking due to improvements in safety, as a result of the civil works.

However, regarding negative impacts, according to the interview with the residents near the project sites, there was an increase of dissatisfaction with unfairness among residents[28]. Because, although the productivity of the farms around the project sites was increased as a result of the alleviation of the risk of flood damage, only landowners directly benefited from the project and those who did not own land did not sufficient benefit.

Furthermore, because of the negative impacts of the accumulation of water in the Ular River irrigation in the rainy season, residents reported that their costs and workloads for repairing the paddy fields had increased after the accumulation of the water.

These negative impacts were not taken into consideration in the evaluation judgment as they were not considered to significantly relate to flood damage and agricultural productivity, which were indicated in the specification of the operation and effect indicators.

As the above indicates, this project has largely achieved its objectives. Therefore, the project's effectiveness and impact are high.

**3.5 Sustainability (Rating: ②)**

3.5.1 Institutional Aspects of O&M

As of the ex-post evaluation, the Directorate of O&M, which was newly established in the Directorate General of the Ministry of Public Works in 2012, supervises O&M for river and irrigation infrastructure. Before 2012 and during the project period, the Directorate of Irrigation and Directorate of Rivers and Coasts were tasked with O&M in addition to planning and managing the project. Once the tasks became independent, the Directorate for O&M needed after the project was separated from the Directorate for planning and management of the project, and the responsibilities for O&M became clearer.

O&M work on river and irrigation sites was conducted by the agencies shown in Table 17 on the basis of the Water Resources Management Law of 2004 and the Irrigation Management Regulation of 2006. In addition, it was decided that these agencies exchanged Memorandums of Understanding with relevant provincial offices and engaged in cooperation when necessary.

[28] There was exchange of opinions between village administration including the chief of village and residents.

Table 17. O&M Agencies in the Project Areas

| Areas | | O&M Agencies |
|---|---|---|
| Solo River basin | | Solo RBO, PJT1[*1] |
| Brantas River basin | | Brantas RBO, PJT1[*1] |
| Ular River Irrigation Facilities | First Channel | Sumatra II RBO |
| | Second Channel | Sumatra II RBO and/or North Sumatra Province[*2] |
| | Third Channel | Water User Associations |

(Sources) Documents provided by O&M agencies

*1 RBOs are responsible mainly for O&M for facilities and equipment for public services, whereas PJT1 is responsible for O&M for the facilities and equipment for commercial services.

*2 The Sumatra II RBO and the North Sumatra Provincial Office gave different answers in regard to which agency was responsible for the second channel.

However, in the ex-post evaluation when we asked certain O&M agencies and provincial offices which agencies were responsible for each facility and equipment, they sometimes gave different answers. This implied the situation that coordination and cooperation between RBOs and provincial offices did not remained smooth enough. In addition, many staff indicated in interviews that communication between RBOs, which are supervised by the central Ministry of Public Works, and provincial offices, is not always good. It could be essential to promote coordination among agencies to facilitate more effective and efficient operation of facilities and equipment.

As the above indicates, appropriate institutional structures to conduct O&M of facilities and equipment rehabilitated by the project have been established. However, the relevant agencies have minor operational problems.

### 3.5.2 Technical Aspects of O&M

According to the interviews with the staff of O&M agencies, no problems in regard to techniques for corrective rehabilitation have been observed. In addition, during the project period, the capacity of O&M agencies was developed through “the Project on Capacity Development for RBOs in Practical Water Resources Management and Technology” of JICA, a supplemental technical cooperation project to this loan project, undertaken from 2008 to 2011. As of the ex-post evaluation, each O&M agency has regularly conducted training sessions lasting from a half of day to several days that addressed topics from maintenance techniques for facilities to organizational management including human resources and financial management.

It was also indicated in the mid-term review that “the central and regional governments take responsibility for O&M of river protection facilities, but there are few engineers with sufficient skills and commitment because of budgetary constraints on work.” However, there is mechanism to gather skillful engineer because O&M activities have been partially contracted to PJT1, a public company, in which O&M performance directly influences the revenue; in other words, financial incentives for the O&M activities have been developed. .

However, according to the Directorate General of Water Resources, Ministry of Public Works, techniques and skills for preventive O&M are still underdeveloped. In particular, the Directorate of O&M pointed out that, although the capacity of RBOs as O&M agencies of the project has been strengthened, preventive techniques and skills tend to be underestimated and the O&M agencies still

do not have sufficient experience.

In sum, although O&M techniques for facilities and equipment completed by the project have been strengthened, minor problems remain because of insufficient experience with preventive maintenance.

### 3.5.3 Financial Aspects of O&M

Interviews with O&M agencies indicated that budgets for daily preventive O&M activities and minor corrective activities have been secured. Because O&M agencies fall under the direct supervision of the Ministry of Public Works except PJT1, O&M budgets are allocated from the budget of the Directorate General of Water Resources of the Ministry of Public Works. This overall budget of the Directorate General of Water Resources of the Ministry of Public Works has been increased (Table 18) and the budget for O&M is expected to be increased in the future because of the establishment of the Directorate of O&M.

In regard to actual conditions, increases and decreases in the budget of the Ministry of Public Works are influenced by the direction of the President. The overall budget of the Ministry of Public Works in 2014 was decreased sharply because it was based on the policy of the outgoing President Yudhoyono. However, the Ministry's budget was subsequently increased by the current President Joko, who was inaugurated in October 2014, for the proactive development of infrastructure. If organizational structures and institutional systems continue to be strengthened: O&M policy that is currently being drafted will become presidential orders, the O&M budget will be increased further.

Table 18. Budget of the Ministry of Public Works

| Year | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|---|---|---|---|---|---|---|
| Directorate General of Water Resources of the Ministry of Public Works (Unit: trillions of rupiah) | | | | | | |
| Overall Budget | 8.92 | 13.02 | 19.08 | 23.18 | 21.12 | 30.02 |
| O&M | Unknown | Unknown | Unknown | 1.21 | 2.13 | Unknown |
| Solo RBO (Unit: millions of rupiah) | | | | | | |
| Overall Budget | 678,166 | 1,247,414 | 1,516,984 | 1,140,272 | 949,940 | Unknown |
| O&M | Unknown | Unknown | Unknown | Unknown | 254,560 | Unknown |
| Brantas RBO (Unit: millions of rupiah) | | | | | | |
| Overall Budget | Unknown | Unknown | 564,311 | 1,141,960 | 707,025 | Unknown |
| O&M | Unknown | Unknown | 220,662 | 314,825 | 157,093 | Unknown |
| Sumatra II RBO (Unit: millions of rupiah) | | | | | | |
| Overall Budget | 99,380 | 134,569 | 133,300 | 117,455 | 89,685 | Unknown |
| O&M | 9,167 | 7,614 | 7,220 | 6,784 | 13,913 | Unknown |

(Sources) Answers to the questionnaires to O&M agencies

In addition, as for PJT1, to which O&M for facilities and equipment in the Solo and Brantas Rivers has been partially contracted, independent accounting has been used and the budget for basic O&M activities has been secured. Moreover, PJT1 is a well-run business; consequently, it is expanding in size—for example, it has newly expanded to servicing North Sumatra Province. Thus, PJT1's budget has tended to be increased (Table 19) and there have been no financial constrains on daily O&M activities.

Table 19 Budget of PJT1

(Unit: millions of rupiah)

| Year | 2010 | 2011 | 2012 | 2013 | 2014 |
|---|---|---|---|---|---|
| Overall Budget | 163,830 | 169,980 | 193,760 | 217,760 | 253,430 |
| O&M | 127,090 | 136,900 | 145,960 | 160,900 | 186,670 |

(Sources) Answers to the questionnaires to O&M agencies

However, it was reported that neither the Ministry of Public Works nor PJT1 have the revenue or financial resources to conduct large-scale infrastructure rehabilitation. Thus, when large-scale infrastructure rehabilitation is necessary, they have no choice but to obtain external funds from, among other entities, international donors. Furthermore, even spare parts for facilities and equipment cannot be purchased promptly once stock bought during the project period runs out. It is necessary to incorporate the procurement of such parts into planned budgets.

As the above indicates, daily O&M activities are not affected by financial problems and further improvements in financial situation are expected in the future. However, the lack of financial resources for large-scale infrastructure repair is a concern. Thus, it is judged that there is a minor challenge.

### 3.5.4 Current Status of O&M

#### 3.5.4.1 Facilities of the Solo River Basin

According to the interviews with the staff of the Solo RBO and PJT1, facilities and equipment rehabilitated by the project have been operated well. As an O&M activity of the Solo RBO, the RBO investigates the problems along the river basin through a survey at the Solo River basin, based on the O&M plan once per a year. If the problem is found, the response is included in the action plan of the next fiscal year and practiced.

#### 3.5.4.2 Facilities of Brantas River Basin

According to the interviews to the staff of the Brantas RBO the facilities and equipment rehabilitated by the project have been properly operated. O&M activities are conducted based on an annual action plan. In addition, branch offices with staff to manage facilities have been established, such as at Mt. Kelud and Semeru Sabo office and outreach is conducted around the river basin once a year.

According to interviews with the staff of the Brantas RBO, because some facilities around Mt. Kelud suffered from its volcanic eruption in 2014, large-scale rehabilitation will be necessary in the future.[29]

#### 3.5.4.3 Ular River Irrigation Facilities

According to the interviews with the Sumatra II RBO, facilities and equipment in the first channel

[29] Regarding the facilities rehabilitated by the project, the needs of rehabilitation were not reported although the bypass channel was influenced by sedimentation.

rehabilitated by the project have been properly operated. Staff members are stationed at the first channel's main water intake weir. Among them, about six staff members are assigned to managing the first channel overall. They conduct not only corrective activities but also periodic maintenance as part of O&M activities.

It may be concluded that facilities and equipment servicing the Solo River basin, the Brantas River basin, and Ular River irrigation have been properly operated.

As the above indicates, some minor problems have been observed in terms of institutional aspects, technical aspects, and financial aspects. Therefore, the sustainability of the project is fair.

## 4. Conclusion, Lessons Learned, and Recommendations

### 4.1 Conclusion

This project aimed to restore the function and to ensure the sustainability of the existing facilities as well as to improve and strengthen O&M system by assisting the capacity development of O&M agencies through the rehabilitation of the past completed loan projects in the water resources sector such as the rehabilitation of the river facilities in upper Solo River basin, the countermeasures against sedimentation of the multipurpose dams and the rehabilitation of the river facilities in Brantas River basin, and the recovery of Ular River irrigation that were highly emergent and needed. Because the project is consistent with Indonesia's National Medium Term Development Plan to prioritize the development, management and infrastructure improvement of water resources, Indonesia's national needs and Japan's aid policy, the relevance of the project is high. On the other hand, although project costs were within budget, the project period was significantly longer than had been planned. Thus, the efficiency is fair. The effectiveness and impact are high, because alleviation of flood suffering in the upper Solo and Brantas River basins and increased rice production in the Ular River irrigation have been observed, as well as because living standards of neighboring residents have been enhanced. The sustainability of the project is fair as minor institutional, technical, and financial problems arose: although the facilities and equipment rehabilitated by the project had been for the most part properly operated and maintained, the demarcation of responsibilities among O&M agencies was somewhat unclear and O&M agencies had insufficient experience with preventive maintenance and would not have been able to conduct large-scale rehabilitation without external financial resources.

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

### 4.2 Recommendations

4.2.1 Recommendations to the Executing Agency

4.2.1.1 Coordinating the Responsibilities of RBOs and Provincial Offices

It is desirable for the Directorate of Rivers and Coasts, Directorate of Irrigation, and Directorate of O&M in the Ministry of Public Works to examine the demarcation of responsibilities for O&M and coordination between the RBOs under their supervision and provincial offices by June 2016, when

discussions are to start regarding the supplementary budget for the next fiscal year. If necessary, it is better for the Directorates to agree to Memorandum of Understandings with provincial governments to clarify the demarcation of responsibilities and ensure coordination. In addition, it is desirable for the Directorates to monitor the actions of the O&M agencies for the coordination. In the ex-post evaluation, it was observed that coordination was not always achieved between RBOs under the supervision of the Ministry of Public Works and provincial offices. Promoting coordination could make O&M activities more efficient and effective.

4.2.1.2 Examination of the Condition of Facilities and Equipment After the Eruption of Mt. Kelud and Responses

It is desirable for the Directorate of Rivers and Coasts and the Directorate of O&M to investigate how facilities and equipment have been negatively affected by the eruption of Mt. Kelud by June 2016, when discussions are to start regarding the supplementary budget for the next fiscal year. Based on the results of investigation, a rehabilitation plan should be developed and actions should be specified in the draft action and budgeting plan for fiscal year 2017, if necessary. It is possible that there are facilities and equipment needed further rehabilitation to recover their functioning, because of the damage sustained around the project areas.

4.2.1.3 Investigation of the Accumulation of Water in Ular River Irrigation Facilities and Responses

It is desirable for the Directorate of Irrigation and the Sumatra II RBO to investigate the accumulation of water in Ular River irrigation and to analyze courses of action if there is problem by June 2016, when discussions are to start regarding the supplementary budget for the next fiscal year. If necessary, responses should be developed and included in the activity and budgeting plan for fiscal year 2017. While the water has been supplied to the entirety of the irrigation area as a result of the project, the beneficiary survey indicated that an increased number of farmers believed that the water supply had become excessive (accumulation of water).

4.2.2 Recommendations to JICA

None

**4.3 Lessons Learned**

4.3.1 Clarification of Managerial and Supervisory Responsibilities among Contractors of Joint Ventures

Some packages of civil works in the Brantas River basin were commissioned to joint ventures consisting of large companies and small- and medium-size companies. However, in certain cases, the large companies in these joint ventures provided insufficient support to the smaller companies, which encountered difficulties, delaying progress. During prequalification, tendering, or contracting, the executing agency should have requested the large companies, the main contractor, to clarify managerial and supervisory responsibilities in a document. In addition, during the implementation of

the civil works, the executing agency should have supervised the main contractor's management of joint ventures to the member companies.

4.3.2 Establishing Operation and Effect Indicators Based on Clear Definitions and Available Information and Data

It is desirable for JICA to reach a consensus with executing agencies regarding the selection of indicators, carefully considering the capacity of such agencies for the data measurement, collection, and aggregation, as well as the feasibility of evaluation, when operation and effect indicators are established at the time of the appraisal. For example, details pertaining to indicators should be defined clearly (particularly, confirmation and agreement should be reached in regard to data collection areas and the scope of the data). Furthermore, the practice of river surveys, types of periodically collected data, data aggregation situation and operation of information management systems should be taken into account. In this project, many indicators were established at the time of the appraisal, but data and evidence could not be collected sufficiently including at the time of the mid-term review.

**Comparison of the Original and Actual Scope of the Project**

| Items | Civil Works | Plan as of the Appraisal | Achievements |
|---|---|---|---|
| ①Outputs | ① Rehabilitation of the Solo River Basin | | |
| | Rehabilitation of the Solo and Madiun Rivers | - Repair of the revetment of the upper Solo River<br>- Repair of the revetment of the Madiun River and of rubber gates | As planned<br>Additions were made; among other things, bridges were replaced and pier foundations were rehabilitated. |
| | ② Rehabilitation of the Brantas River Basin | | |
| | Rehabilitation around the Karangkates Multipurpose Dam | - Construction of groundsills (5 locations)<br>- Repair of the revetment of the spillway | As planned<br>Additions were made; among other things, the number of groundsills was increased (6 locations), and consolidation dams (2 locations) and a settling pond (1 location) were constructed. |
| | Rehabilitation around the Wlingi Multipurpose Dam and Mt. Kelud | - Construction of groundsills (7 locations)<br>- Construction of a bypass channel | As planned<br>Additions were made; among other things, the number of groundsills (8 locations) was increased. |
| | Rehabilitation of the Brantas and Porong Rivers | - Repair of the revetment<br>- Repair of groundsills<br>- Repair of irrigation weirs | As planned<br>Additions were made; among other things, siphons were constructed. |
| | ③ Rehabilitation of Ular Irrigation | | |
| | Rehabilitation of Ular River irrigation facilities | - Repair of headworks (1 location)<br>- Construction and repair of link canals (1st channel) | As planned<br>Additions were made; among other things, a target length of canals was expanded (approximately 4 km) and relevant facilities (culvert, siphon, etc.) were installed additionally. |
| | ④ Procurement of equipment | | |
| | Procurement of dredging equipment | - Procurement of two dredging systems | Changed<br>Only one dredging system was procured. |
| ② Project Period | | October 2002 (Signing on L/A)–September 2007 (Completion of all the civil works) (60 months) | October 2002 (Signing on L/A)–March 2012 (Completion of all the civil works) (114 months) |
| ③ Project Cost<br>Foreign Currency<br>Local Currency<br><br>Total<br>Loan part<br>Ex-change rate | | 7,943 million Japanese yen<br>9,465 million Japanese yen<br><br>17,408 million Japanese yen<br>14,696 million Japanese yen<br>1 US dollar = 121.67 Japanese yen<br>1 rupiah = 0.014 Japanese yen<br>(as of October 2001) | 2,076 million Japanese yen<br>11,803 million Japanese yen<br><br>13,879 million Japanese yen<br>13,879 million Japanese yen<br>1 rupiah = 0.011 Japanese yen<br>(Average from July 2004 to June 2012) |

Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Muara Karang Gas Power Plant Project"

External Evaluator: Masumi Shimamura,
Mitsubishi UFJ Research and Consulting Co., Ltd.

## 0. Summary

This project converted the diesel oil-fired power facility in the existing Muara Karang power complex to a gas combined cycle thermal power generation facility and increased power capacity with the aim of improving power supply and demand balance as well as to improve stability and to maintain quality of power supply in the Java-Bali system. The project objective – to meet increasing power demand from both quantity and quality viewpoints by providing basic support to develop new power source until the State Electricity Company, PT. PLN (Persero)[1] (hereinafter referred to as "PLN"), and private enterprises can make on investment in power generation – is consistent with Indonesia's energy/power policy and with the development needs, as well as Japan's ODA policy; thus, the relevance of the project is high. Operation and Effect Indicators set at the time of appraisal have achieved more than 90% of the target figures after the commencement of power generation. It is worthy of special mention that the project is located in Jakarta Capital Region where there is a greatest demand of electricity, supplying power to "the strategic area" at the center of Indonesia's politics and economy, and is playing an important role to reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system. The power plant has been operating smoothly and project effects have appeared as planned; thus, the project's effectiveness and impact are high. No negative impact on natural environment has been pointed out. Rather, more than 60% of emission reduction of $SO_x$, $NO_x$, $CO_2$, and dust has realized as a result of converting fuel for power generation from diesel oil to gas, which has contributed to reduce environmental burden. Although the project cost was within the plan, the project period exceeded the plan; thus, efficiency of the project is fair. No major problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system; thus, sustainability of the project effects is high.

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

[1] PT. Perusahaan Listrik Negara (Persero)

## 1. Project Description


Project Location

Muara Karang Gas Power Plant (Block2)

### 1.1 Background

After the Asian Financial Crisis in 1997, new investments in power plants dried up in the Java-Bali system in Indonesia. However, demand for power grew at an annual rate of 9% fueled by economic recovery that followed the crisis, and reserve margin was decreasing. Despite plans for developing new power generation projects, prospect for their financing was not yet in sight. For these reasons, supply-demand balance worsened in the Jakarta Capital Region where demand for power was the country's largest, and this situation combined with falling capacities in the aging existing power plants raised the possibility of a major problem, as a tight supply situation was expected to emerge in 2004 and beyond. The project was expected to ensure stable power supply at the center of the Indonesian economy by expanding power outputs in the Jakarta Capital Region.

### 1.2 Project Outline

The objective of this project is to improve power supply and demand balance as well as to improve stability and to maintain quality of power supply in the Java-Bali system by increasing power capacity from 300MW to 720MW[2] class through converting the diesel oil-fired power facility in the existing Muara Karang power complex to a gas combined cycle thermal power generation facility in Jakarta, thereby contributing to the power sector reform until new investments for power development can be realized using PLN's own fund and through private enterprises.

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[2] 694.4MW in actuality due to difference from planned specification as a result of bidding, which led to change in rated power output.

| | |
|---|---|
| Loan Approved Amount/<br>Disbursed Amount | 55,750 million yen / 54,150 million yen |
| Exchange of Notes Date/<br>Loan Agreement Signing Date | March, 2003 / July, 2003 |
| Terms and Conditions | Interest Rate 1.8%<br>Repayment Period 30 years<br>(Grace Period 10 years)<br>Conditions for Procurement General Untied |
| Borrower /<br>Executing Agency | Republic of Indonesia / State Electricity Company (PT. PLN) |
| Final Disbursement Date | January, 2013 |
| Main Contractor<br>(Over 1 billion yen) | Mitsubishi Corporation (Japan) |
| Main Consultant<br>(Over 100 million yen) | Fichtner GMBH & Company KG. (Germany) / PT. Jaya CM Manggala Pratama (Indonesia) / PT. Kwarsa Hexagon (Indonesia) / PT. Connusa Energindo (Indonesia) / Tokyo Electric Power Company, Incorporated (Japan) / Tokyo Electric Power Services Co., Ltd. (Japan), JV |
| Feasibility Studies, etc. | F/S conducted in 2000 |
| Related Projects | Japanese ODA Loan (Loan Agreement signing year and month in parentheses)<br>・ South Sumatra-West Java Gas Pipeline Project (March, 2003)<br>・ Muara Tawar Gas Fired Power Plant Extension Project (July, 2003)<br>・ Tanjung Priok Gas Fired Power Station Extension Project (March, 2004)<br>・ Semarang Power Plant Rehabilitation and Gasification Project (March, 2004)<br>・ Engineering Services for Kamojang Geothermal Power Plant Extension Project (March, 2006)<br>Technical Cooperation<br>・ Study on the Effective Use of Captive Power in |

| | |
|---|---|
| | Java-Bali Region (2002)<br>Electric Power and Energy Policy Adviser dispatched to the Ministry of Energy and Mineral Resources<br>Grant Aid (Exchange of Notes signing year and month in parentheses)<br>・ The Project for Rehabilitation of Gresik Steam Power Plant Units 3 and 4 (July, 2004)<br>World Bank<br>・ Technical Cooperation (Supporting PLN's Corporate and Financial Restructuring)<br>・ Java-Bali Power Sector Restructuring and Strengthening Project<br>Asian Development Bank<br>・ Power Transmission Line Improvement Sector Project<br>・ Renewable Energy Development Sector Project |

## 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: September, 2014 – July, 2015

Duration of the Field Study: November 22–December 18, 2014, February 24–March 8, 2015

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

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance to the Development Plan of Indonesia

At the time of appraisal, according to Indonesian government's National Electricity General Plan (hereinafter referred to as "RUKN") in 2003, the minimum reserve margin necessary for stable power supply in Indonesia was considered to be 25%, and it was urgently necessary to secure new power sources because the ratio was declining (38.8% in

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[4] ③: High, ② Fair, ① Low

2001 to 30.5% in 2002), and the figure could lead to less than 25% due to the increasing power demand in the Java-Bali system. RUKN pointed out the necessity of fulfilling both quantity and quality of increasing power demand. In addition, the government of Indonesia announced a reorganization policy for the power sector[5] in 1998 and initiated reforms including financial restructuring of PLN, the executing agency, and the participation of private sector in order to establish a competitive power market and to improve the efficiency of the power sector. The project objective to provide basic support to develop new power source until new investments for power development can be realized using PLN's own fund and through private enterprises was consistent with the above policy.

At the time of ex-post evaluation, the project objective is consistent with Indonesia's energy/power policy. The government of Indonesia prepared National Energy Policy (KEN) in January 2014 after an interval of about ten years, and has set targets to increase the country's generation capacity from 51GW in 2014 to 115GW by 2025 and then to 430GW by 2050. At the time of ex-post evaluation, RUKN 2012-2031 set aims in the power supply plan to finish the shortage of power supply and to develop power plants for peak load by using gas and hydro power plants, so that oil fueled power plant development is minimized. Furthermore, PLN's Long Term Electricity Development Plan (hereinafter referred to as "RUPTL") 2013-2022, PLN's company plan to supply electric power for the next 10 years, states that power demand is expected to increase on an average of 7.6% per year for the Java-Bali system, and the additional generation capacity requirement is 31.5GW (an average of 3.2GW per year) by 2022 in order to alleviate tight power supply and demand situation.[6] RUPTL indicates that fuel sources and the availability, distance to the demand area and regional balance, transmission development plan and its constraints, and restrictions on environmental and social aspects should be taken into consideration when selecting the location of power plants. Trend of power supply and demand balance, and reserve margin in the Java-Bali system is shown in Figure 1. Reserve margin was 24.4% in 2010, less than 25%, however, it recovered to 34.9% in 2011 due to development of power sources. (See Table 1)

[5] Power Sector Restructuring Policy

[6] The additional generation capacity requirement is 38.5GW (an average of 3.8GW per year) by 2024 in RUPTL 2015-2024, which was prepared under the new "Jokowi" administration in January 2015. The administration has set forth a priority of newly developing 35GW generation capacity by 2019.

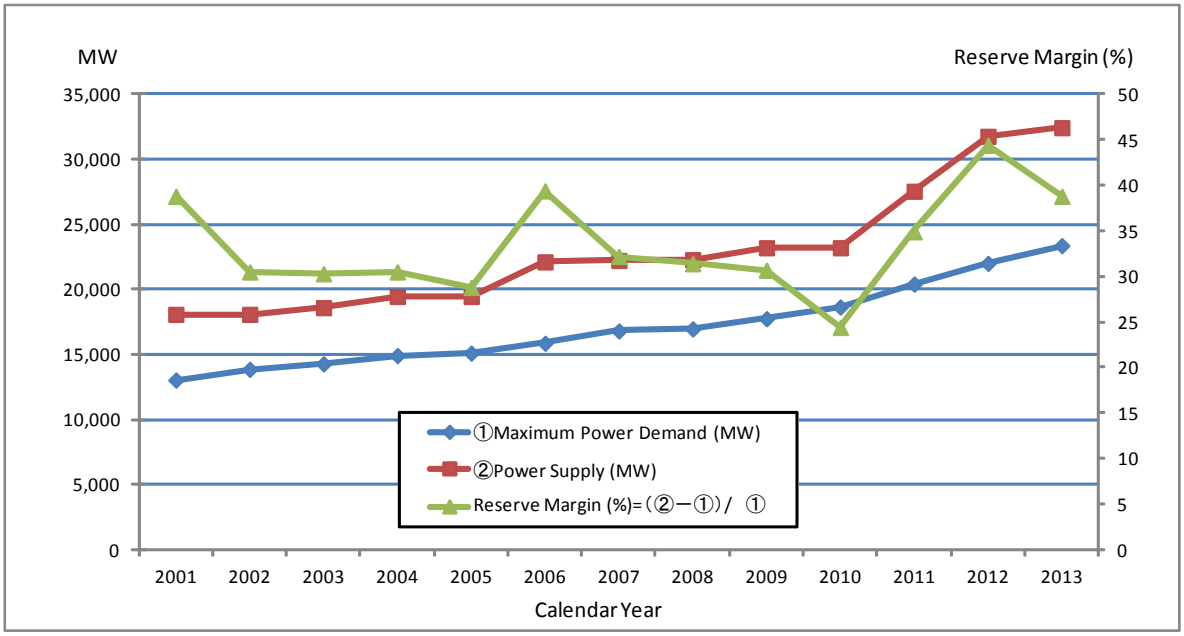


Figure 1: Trend of Power Supply-Demand Balance and Reserve Margin in the Java-Bali System

Source: Results from questionnaire survey of executing agency

In order to improve tight electricity supply and demand situation, the government of Indonesia has prepared two Crash Programs (short-term power development plans) (First Crash Program was prepared in 2006, and Second Program in 2010), and has been pushing forward large-scale development of power sources. The main purpose of the First Crash Program, which is the development plan of coal-fired power plants of approximately 10,000MW in total is to urgently develop power sources in the Java-Bali areas, however, significant delay has occurred due to problems of land acquisition and financial situations. The purpose of the Second Crash Program is to introduce renewable energy, including urgent development of power sources, diversification of power sources, and geothermal power generation, of approximately 10,000MW in total. Projects under the Second Crash Program have also encountered delay due to problems on financial arrangements. Development of new power sources for more than 20GW is assumed by the independent power producers (hereinafter referred to as "IPPs") among the targeted new power generation capacity of 35GW, which the new "Jokowi" administration considers as priority.

### 3.1.2 Relevance to the Development Needs of Indonesia

At the time of appraisal, coping with tight power supply and demand in the Java-Bali system and establishing stable power supply system were a pressing issue. In the Java-Bali system, which supplies power to the Jakarta Capital Region where demand for power was the country's largest, time was necessary until new investments for power development can

be recovered using PLN's own fund and through private enterprises. Therefore, it was important to tackle the immediate problem of stringent power supply and demand for stable economy and social situation of the country.

At the time of ex-post evaluation, facilitation of power development in the Java-Bali system, which supplies power to Jakarta Capital Region where many Japanese companies are investing, is also an urgent issue. RUPTL 2013-2022 states that demand for power in the Java-Bali system is expected to increase from 144TWh in 2013 to 275TWh in 2022, growing at an average rate of 7.6% per year.[7] While the government of Indonesia has been promoting Crash Programs as mentioned above, delays in the progress are seen. Further utilization of IPPs continues to be expected in developing power sources, and IPPs account for more than half of power development in the Second Crash Program. (Whereas PLN projects accounted for 100% of projects in the First Crash Program.) Table 1 shows the additional investment capacity of power sources in the Java-Bali system.

Table 1: Additional Investment Capacity of Power Sources in the Java-Bali System

(Unit: MW)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Generation Investment by PLN | | | | | | | | | | | | | | |
| Coal Fired | | | | | | | 1,320 | | | 300 | 300 | 3,220 | 1,950 | 980 |
| Combined Cycle | | | | | | | 740 | | | 500 | | 444 | 740 | |
| Hydroelectric | | | | | | | | | | | | | | |
| Gas Turbine | | | | | 899 | 41 | | | | | | | | |
| Diesel | | | | | | | | | | | 65 | 51 | 140 | |
| Geothermal | | | | | | | | | | | | | | |
| Others | | | | | | | | | | | | | | |
| Power Generation Investment by IPPs | | | | | | | | | | | | | | |
| Coal Fired | 2,450 | | | | | | 600 | | | | | | 1,475 | |
| Combined Cycle | | | | | | | | | | | | 150 | | 120 |
| Hydroelectric | | | | | | | | | | | | | | |
| Gas Turbine | | | | | | | | | | | | | | |
| Diesel | | | | | | | | | | | | | | |
| Geothermal | 200 | | 60 | | | | | 110 | 60 | 110 | | | | |
| Others | | | | | | | | | | | | | | |
| Total Investment Capacity of Power Sources by PLN and IPPs | | | | | | | | | | | | | | |
| Total | 2,650 | | 60 | | 899 | 41 | 2,660 | 110 | 60 | 910 | 365 | 3,865 | 4,305 | 1,100 |

Source: Results from questionnaire survey of executing agency

[7] RUPTL 2015-2024 states that the power demand is expected to increase from 165TWh in 2015 to 324TWh in 2024, growing at an average rate of 7.8% per year.

3.1.3 Relevance to Japan's ODA Policy

The Medium-Term Strategy for Overseas Economic Cooperation Operations of Japan Bank for International Cooperation (current Japan International Cooperation Agency (JICA)) (April 2002) indicated "economic infrastructure development" as priority area for assistance in Indonesia. In addition, Japan Bank for International Cooperation (current JICA) stated in its Country Assistance Strategy for Indonesia (prepared in November 2002) to support sector reform as well as to cope with development needs with high urgency such as resolving economic bottlenecks for the country's sustainable economic growth. At the time of appraisal, there was a fear of tight power supply in the Java-Bali system, and improvement of supply and demand balance was urgently needed. The project objective to provide basic support to develop new power source until new investments for power development can be recovered using PLN's own fund and through private enterprises, and to contribute to the increase of reserve margin was consistent with the above policy.

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

3.2 Efficiency (Rating: ②)

3.2.1 Project Outputs

The project developed a 2:3:2 structured combined cycle power generation as Block 2, consisting of two gas turbine generators, three steam turbine generators and two heat recovery steam generators in the existing Muara Karang power complex. Table 2 shows the comparison of planned and actual project outputs.

Table 2: Comparison of Planned and Actual Project Outputs

| Plan | Actual |
|---|---|
| Civil Works, Procurement of Equipments etc. (EPC Contract Related to Power Plant Construction) | |
| ・ Construction of two gas turbine generators (250 MW class× 2units) | ・ As planned |
| ・ Construction of three steam turbine generators (75 MW class ×3) | ・ As planned |
| ・ Construction of two heat recovery steam generators | ・ As planned |
| ・ Increase/extension of common facilities that need for adding on the gas fired combined cycle system | ・ As planned |
| ・ Increasing capacity of associated existing transmission line and substation | ・ As planned |
| ・ Rehabilitation of switchyard and substations | ・ As planned |
| ・ Rehabilitation of existing intake water canal | ・ As planned |
| ・ Related civil works and construction works | ・ As planned |
| | ・ Additional scope: Installation of Continuing |

| | |
|---|---|
| | Emission Monitoring System (CEMS) |
| Consulting Services | |
| ・ Detail design, assistance in tendering, construction supervision, inspection, testing, and delivery control during manufacturing, support in operation and maintenance during project period, assistance in environmental management, transfer of technology, training etc. | ・ As planned<br><br>・ Additional scope due to installation of CEMS |

Source: Results from questionnaire survey of executing agency

As regards civil works and procurement of equipments, installation of Continuing Emission Monitoring System was added to the scope. The system measures and monitors composition, density and emission amount of exhaust gas. According to the executing agency, this additional scope was due to the newly enforced regulation[8] of the Ministry of Environment in Indonesia. There was additional scope for consulting services as a result of installing Continuing Emission Monitoring System. The additional output is deemed appropriate, commensurate with inputs, in light of the objective to reduce environmental burden in accordance with the regulation of the Ministry of Environment. Other outputs were as planned – no other output change has observed.

As regards inputs of consulting services, total inputs have significantly increased as shown in Table 3.

Table 3: Comparison of Planned and Actual Inputs of Consulting Services

(Unit: M/M)

| | Plan | Actual | Comparison |
|---|---|---|---|
| International Consultants | 415 | 508.89 | Increased by 93.89 |
| Local Consultants | 604 | 717.00 | Increased by 113.00 |
| Total | 1,019 | 1,225.89 | Increased by 206.89 |

Source: Results from questionnaire survey of executing agency

According to the executing agency, significant increase of inputs of consulting services (man-month) took place due to the delay of engineering, procurement, and construction contract (hereinafter referred to as "EPC contract") (delay prior to construction) as well as delay in rehabilitation of switchyard and substations, replacement of existing transmission lines, and demolition for existing units[9] (delay during construction) (man-month increased

8 Regulation of the Ministry of Environment No. 21 /2008, Clause 9, Article No.1

9 According to the executing agency, delay was caused by unexpected technical problems which occurred

because consultants were on board including the period of project delay). Although the situation can not necessarily be regarded as efficient, it was deemed unavoidable from the viewpoint of securing quality of project implementation.

Facility where Gas Turbine is Installed

Gas Turbine

Heat Recovery Steam Generator


Generator

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

The total project cost was initially planned to be 65,588 million yen (out of which 55,750 million yen was to be covered by Japanese ODA loan). In actuality, the total project cost was 64,816 million yen (out of which 54,150 million was covered by Japanese ODA loan), which is lower than planned (98.8%[10] of the planned amount).

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when shutting down the substation, and troubles with transmission line in the neighboring area. The executing agency pointed out that necessary measures were carried out promptly and the trouble was resolved.

[10] This percentage was calculated by comparing the actual cost after the scope change and the planned cost

3.2.2.2 Project Period

The overall project period was planned as 79 months, from March 2003 (conclusion of Loan Agreement) to September 2009 (completion of warranty period) as opposed to 106 months in actuality, from July 2003 (conclusion of Loan Agreement) to April 2012 (completion of warranty period), which is longer than planned (134.2% of the initial plan). Loan period was extended due to project delay – loan extension was made on February 2012, resulting in the final loan expiry on January 2013.

Table 4 shows comparisons of planned and actual project period.

Table 4: Comparison of Planned and Actual Project Period

| Item | Plan (At Project Appraisal) | Actual (At Ex-post Evaluation) |
|---|---|---|
| Selection of consultants | Apr. 2003 – Mar. 2004 (12 months) | Jul. 2003 – Apr. 2004 (10 months) |
| Consulting services | Apr. 2004 – Sept. 2008 (53 months) | May 2004 – Apr. 2011 (84 months) |
| Designing and manufacturing | Apr. 2004 – Jan. 2006 (22 months) | May 2004 – Dec. 2007 (33 months) |
| Power plant construction | Feb. 2006 – Sept. 2008 (32 months) | Dec. 2007 – Apr. 2011 (41 months) |
| Start of power generation | Oct. 2008 | Apr. 2011 |
| Warranty period | Oct. 2008 – Sept. 2009 (12 months) | Apr. 2011 – Apr. 2012 (12 months) |

Source: Information provided by JICA, and results from questionnaire survey of executing agency

Main reasons for project delay were: (1) delay of gas supply[11] (conclusion of EPC contract delayed as a result) and (2) delay in rehabilitation of switchyard and substations, replacement of existing transmission lines, and demolition for existing units. Period for consulting services was extended significantly as a result.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

Table 5 shows the result of recalculation of the financial internal rate of return (FIRR).

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before the scope change.

11 <Background/reasons for delay of gas supply> As regards securing gas fuel for the project (Block 2), the executing agency initially planned to use natural gas to be extracted from the gas field in Sumatra through South Sumatra-West Java gas pipeline, which was expected to be developed by Japanese ODA loan. However, Tanjung Priok Port Authority did not approve the pipeline route. For this reason, the executing agency changed the original gas procurement plan and decided to utilize the gas fuel which has been supplying to the existing Muara Karang power plant (Block 1) for Block 2 power plant. Nevertheless, due to insufficient gas pressure, it was necessary to install compressor to reinforce pressure, which required time.

Table 5: Assumption and Results of FIRR Recalculation

| | At Project Appraisal | At Ex-post Evaluation |
|---|---|---|
| FIRR | 31.7% (before tax)<br>24.4% (after tax) | 26.5% (before tax)<br>22.5% (after tax) |
| Benefit | Construction cost (costs incurred to the project including consulting service cost), operation and maintenance cost | |
| Cost | Revenue from electricity tariff | |
| Project Life | 25 years after project completion | |

The FIRRs assessed at the time of ex-post evaluation were lower than those at the time of appraisal. This was primarily because the project period exceeded the plan.

Although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness [12] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

Table 6 summarizes the operation and effect indicators set at the time of appraisal of the project (Block 2) and their actual figures in 2013. (Warranty period was completed in April 2012.)

[12] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 6: Operation and Effect Indicators

| | Baseline Note 1) | Target | Actual |
|---|---|---|---|
| | 2002 | 2009 | 2013 |
| | Baseline Year | At Completion of Warranty Period | A Year after Completion of Warranty Period |
| Maximum output | — | 720MW Note 2) | 688 MW Note 3) |
| Plant load factor | — | 70% or more | 65.0% |
| Availability factor | — | 88% or more | 93.2% |
| Auxiliary power ratio | — | 3% or less | 1.84% |
| Gross thermal efficiency | — | 48% or more | 44.8% |
| Outage hours due to periodic maintenance and inspection | — | 1,080 hours or less/year | 550 hours/year |
| Outage hours due to human error | — | — Note 4) | 0 |
| Outage hours due to machine trouble | — | — Note 4) | 32.1 hours/year |
| Frequency of outage due to periodic maintenance and inspection | — | 1 time/year | 2 times/year |
| Annual power production | — | 4,282 GWh/year Note 2) | 4,046 GWh/year |

Source: Information provided by JICA, and results from questionnaire survey of executing agency

Note 1) Baseline figures did not exist at the time of appraisal because the existing Block 2 power plant had utilized diesel oil fuel.

Note 2) Maximum output and annual power production were subject to change due to difference from planned specification as a result of bidding.

Note 3) 694.4MW in actuality as a result of bidding.

Note 4) Targets were not set at the time of appraisal.

Since the commencement of power plant operation up to the time of ex-post evaluation, the operational condition is satisfactory, generating electricity smoothly. While actual figures for maximum output, plant load factor and gross thermal efficiency of the power plant (Block 2) in 2013 have not reached their targets set at the time of appraisal, they have achieved more than 90% of the targets. According to the executing agency, the issue is

administrative rather than technical – operation of the power plant is controlled by dispatcher. (Figure for annual power production has not reached the target as a result.) In other words, in view of reducing generation costs of the entire Java-Bali system, dispatchers prioritize operation of power plants with lower generation costs. Therefore, in light of rising fuel cost for Liquid Natural Gas[13], (hereinafter referred to as "LNG"), operation of this power plants with relatively expensive generation costs was said to be controlled.

The reason why the outage hours due to periodic maintenance and inspection were half of the target was because major inspection did not take place in 2013. (Major inspections are to be conducted for every 40,000 hour operation for Block 2. See "Sustainability" section below for detail.)

Power outage of 32.1 hours due to machine trouble was caused by an external factor. Flood which occurred in January 2013, inundated part of substation facilities, triggering malfunction. The power plant has been operating without any problem after its restoration. (The power plant is located in the area about 1m below the sea level, and seawall has been installed for flood control, however, the flood which occurred in January 2013 was unexpectedly large scale and flood damage was unavoidable. After this incidence, the seawall was heightened and pump facility was installed for flood prevention in Muara Karang power complex. No flood damage has seen since then.)

The reason why outage due to periodic maintenance and inspection took place two times was because periodic inspections are to be conducted for every 8,000 hours of operation, and operation hours in 2013 were 8,760.

### 3.3.2 Qualitative Effects (Other Effects)

Table 7 summarizes the share of installed capacity of the power plant (Block 2) in the entire Java-Bali system and in Jakarta Capital Region, respectively. The electricity generated is supplied to the Jakarta Capital Region, and this power plant carries an extremely important role to supply power to "the strategic area" at the center of Indonesia's politics and economy. The power plant has a share of over 10% in Jakarta Capital Region,

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[13] The main fuel source of the power plant is LNG. The assumed fuel costs written in each RUPTL are listed below. While the cost of natural gas is within the range of U$6-7/MMBTU, LNG cost has been rising from U$10 to 16/MMBTU. (Reference: The main fuel source of Muara Tawar gas fired power plant (Block 5), which was developed by Japanese ODA loan in the same period as this power plant is natural gas.)

RUPTL 2010-2019 Natural gas: USD6/MMBTU, LNG: USD10/MMBTU

RUPTL 2012-2021 Natural gas: USD6/MMBTU, LNG: USD13/MMBTU

RUPTL 2013-2022 Natural gas: USD7/MMBTU, LNG: USD16/MMBTU

RUPTL 2015-2024 Natural gas: USD7/MMBTU, LNG: USD16/MMBTU

and this figure also shows that it has a critical role in securing power supply and demand balance in the country's capital. Furthermore, considering that the power plant is located in Jakarta Capital Region, the largest power demand center, it can be said that it plays an important role to reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system.[14]

Table 7: Share of Muara Karang Gas Power Plant (Block 2)

| Installed Capacity for: | Installed Capacity for Muara Karang Gas Power Plant (Block 2) | Share |
|---|---|---|
| Entire Java-Bali System in 2013: 32,450MW | 694.4MW | 2.14% |
| Jakarta Capital Region in 2013: 6,647MW | | 10.45% |

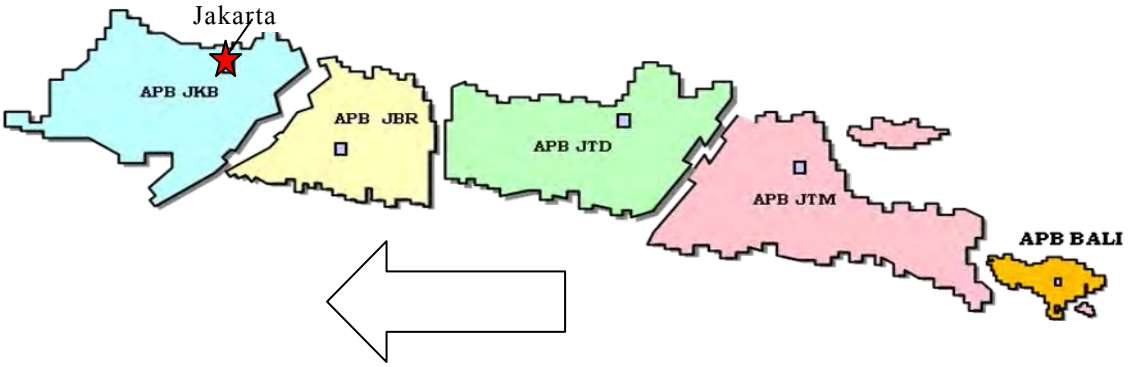
Source: Information provided by JICA, and results from questionnaire survey of executing agency

Net capacity and load for each of the five business/load dispatch area of the executing agency in the Java-Bali system are shown in Figure 2. Because load (demand) exceeds net capacity in the West Java area (JKB[15]) where Jakarta Capital Region is located, it means that power supply to this area is covered by electricity produced in other areas. The executing agency pointed out that such power interchange beyond business/load dispatch areas would cause voltage drop and power loss[16] in the Java-Bali system and would become a bottleneck for stable and efficient power supply. Hence, the executing agency mentioned that it is important to supply power within the same business/ load dispatch area as much as possible so as to secure stability and appropriate power quality in the entire power system. In this regard, it is extremely significant that the power plant is located in Jakarta Capital Region.

14 Among power plants developed by Japanese ODA loan in the same period, this project, "Muara Tawar Gas Fired Power Plant Extension Project" and "Tanjung Priok Gas Fired Power Station Extension Project" are located in Jakarta Capital Region, and are playing an extremely important role for stable power supply in Capital Region/West Java Region. There is a shared opinion regarding the significance/importance of these power plants among local experts, World Bank and Asian Development Bank officers in charge of power sector, in addition to officers in the executing agency.

15 Jakarta and Bandung Load Dispatch Area

16 The executing agency explained the following as its logic: "When the place for power generation is far from power consuming area (when power transmission distance is long) ➔ electric resistance increases ➔ power loss increases ➔ power voltage reduces."




| | JKB | JBR | JTD | JTM | BALI |
|---|---|---|---|---|---|
| Net Capacity (MW) | 9,559 | 7,445 | 5,216 | 8,554 | 558 |
| Load (MW) | 9,778 | 4,874 | 3,658 | 4,982 | 735 |

Figure 2: Comparison of Net Capacity of Power Plant and Load by Area in Java-Bali System (2014)

Source: Information provided by executing agency

## 3.4 Impacts

### 3.4.1 Intended Impacts

Table 8 shows the electrification rate, SAIDI [17] (power interruption duration per customer per year (minutes)) and SAIFI [18] (power interruption frequency per customer per year) for power plants in the Java-Bali system as data relating to power quality. [19] Data on reserve margin and transmission and distribution losses in the Java-Bali system is also included in the table.

Table 8: Trend of Electrification Rate, SAIDI, SAIFI, Reserve Margin, and Transmission and Distribution Losses in the Java-Bali System

| | 2008 | 2009 | 2010 | 2011 Note 1) | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Electrification Rate (%) | 68.0 | 69.8 | 71.4 | 72.3 | 78.2 | 83.2 |
| SAIDI for Power Plant (minutes/customer) | 4.583 | 0.614 | 0.179 | 0.309 | 0.076 | 0.02 |

[17] System Average Interruption Duration Index

[18] System Average Interruption Frequency Index

[19] SAIDI and SAIFI measure incidence per customer, and (as long as reserve margin is secured) they do not necessarily have direct linkage with Muara Karang power plant, however, the data is taken up for the analysis on project impact because they have indirect linkage with the impact of the power plant.

| | | | | | | |
|---|---|---|---|---|---|---|
| SAIFI for power plant (frequency/customer) | 1.030 | 0.247 | 0.151 | 0.182 | 0.04 | 0.019 |
| Reserve Margin (%) | 31.4 | 30.7 | 24.4 | 34.9 | 44.4 | 38.8 |
| Transmission and Distribution Losses (%) | 13.6 | 11.2 | 13.0 | 9.1 | 9.3 | 9.5 |

Source: Information provided by executing agency

Note 1) Start of combined cycle commercial operation

Since the power plant (Block 2) commenced its operation in April 2011, comparison was made for the Java-Bali system before (before 2010) and after (after 2012) the project. Electrification rates have been increasing steadily. As regards SAIDI and SAIFI for power plant, temporary increase can be seen in 2011[20], but are generally on a declining trend – when comparing figures in 2010 and 2012, both are definitely decreasing. According to the executing agency, the reason why transmission and distribution losses increased in 2013 was due to little rainfall in general compared to the usual year, which led to decrease in the availability factor of hydroelectric power plants in West Java area, where Jakarta Capital Region is located. This situation impelled the executing agency to interchange power from other areas, which resulted in increase of power loss. The executing agency also explained that reserve margin in 2013 fell because of increased power demand while new investments of power sources in that year (1,100MW) did not take place as compared to those of the previous year (4,305MW). (See Table 1)

Clear correlation between the above data trend and this project cannot be observed. There may have been a little contribution of the project, however, it is difficult to measure project impact quantitatively by analysing the data trend.

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

The project falls under A category of the Guideline for Japan Bank for International Cooperation (current JICA) because it is an improvement project of a large-scale power plant. At the time of appraisal, the executing agency confirmed its state of environmental procedures, pollution measures, and natural and social environmental considerations, and concluded that there was no problem. Environmental Impact Assessment Report (ANDAL), Environmental Management Plan (RKL), and Environmental Monitoring Plan (RPL) have been approved by Provincial DKI Jakarta Commission in October 19, 2001.

[20] The reason is uncertain. According to the executing agency, it cannot deny the possibility of data collection and processing error since data collection and consolidation were conducted manually.

The executing agency conducted environmental monitoring before and during the project as well as after the commencement of operation, and no particular negative environmental impact has been reported at the time of ex-post evaluation. In addition, no negative project effect has been identified from the results of interview with the local residents. The summaries of the monitoring results by the executing agency are as follows.

- Before construction:
  - Noise levels were all below the standard.
- During constriction:
  - As regards ambient air quality, $NO_2$, $SO_2$, CO, $CO_2$, Pb, $H_2S$, particles (PM10), TSP, and $O_3$ were all below the standard.
  - Vibration levels were all below the standard.
  - Noise levels were all below the standard.
- During warranty period: Ambient air quality and noise levels were all below the standard.
- Available environmental monitoring results (data on ambient air quality and noise levels measured in 2013) after the commencement of operation are shown in Table 9.

Table 9: Environmental Monitoring Results after the Commencement of Operation

| Item | Unit | Measurement Record | Standard Note 1) |
|---|---|---|---|
| Ambient Air Quality (24 hours sampling) | | | |
| $SO_2$ | $\mu$ g/Nm$^3$ | 13.69 | 260 |
| $NO_2$ | $\mu$ g/Nm$^3$ | 20.21 | 92.5 |
| CO | $\mu$ g/Nm$^3$ | 114.38 | 9,000 |
| TSP | $\mu$ g/Nm$^3$ | 142.56 | 230 |
| Pb | $\mu$ g/Nm$^3$ | 0.04 | 2 |
| Noise (recorded in front of the office building of PJB Muara Karang) | | | |
| Average of four sampling records | dB | 56.96 | 70 |

Source: Information provided by executing agency

Note 1) National Standards in Indonesia (Standards in Jakarta Capital Region) [21]

Because the project converted the diesel oil-fired power facility in the existing power complex to a gas combined cycle thermal power generation, it was expected at the time of appraisal that discharge density of air pollutant ($SO_x$, $NO_x$ and particles) would reduce, resulting in significant reduction of emissions below the standards in Indonesia. (Positive impacts on the natural environment.) Table 10 compares the emission data before and after

[21] Standards based on Kep Gub DKI Jakarta Governor Decree No. 551/2001.

the project completion, which was obtained from the executing agency.

Table 10: Comparison of Emission Data Before and After the Completion of the Project

| Item | Actual (ton/GWh) | | Reduction Ratio (%) |
|---|---|---|---|
| | Before the Project (2009) | After the Project Completion (2013) | |
| $SO_x$ | 1.239 | 0.273 | 78.0 |
| $NO_x$ | 1.730 | 0.580 | 66.5 |
| $CO_2$ | 3,080.09 | 1,230.60 | 60.0 |
| Particles | 0.104 | 0.040 | 61.5 |

Source: Results from questionnaire survey of executing agency

Reduction ratio of more than 60% was realized for all the items – $SO_x$, $NO_x$, $CO_2$, and particles – after the completion of the project. It can be grasped quantitatively that the project has contributed to the reduction of environmental burdens by converting diesel oil fuel to gas fuel.

3.4.2.2 Land Acquisition and Resettlement

At the time of appraisal, necessary land was already acquired and neither land acquisition nor relocation was expected. In actuality, land acquisition did not take place.

This project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

Transformer

Water Intake

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The operation and maintenance of the power plant (Block 2) after project completion is

undertaken by Java Bali Power Company (hereinafter referred to as "PJB[22]"). PJB is an affiliate company[23] of PLN, the executing agency, and is undertaking operation and maintenance of the existing Muara Karang power plant (Block 1). Performance based contract has been concluded between PLN and PJB, and operation and maintenance budget has been allocated to PJB from PLN based on the contract.

The total number of employees at PJB as of 2014 is 4,417, of which 3,821 are engineers in charge of operation and maintenance. At the time of ex-post evaluation, PJB is in charge of operation and maintenance of 26 power plants including Muara Karang.

For the purpose of increasing efficiency and performance in its operation, PJB initiated "Integrated Management System" in its organizational management in 2012, which covers human resource management/personnel utilization, management and procurement of maintenance system and spare parts, fuel management, safety management and so on. Under this system, PJB introduced "Maintenance Optimization Program" called "Big O" for efficient operation. According to Muara Karang power plant staffs, PJB's such management system and the program's way of thinking have penetrated across staffs, and instruction system between PJB and the power plant is clear. The organizational structure of Muara Karang power plant is illustrated in Figure 3.

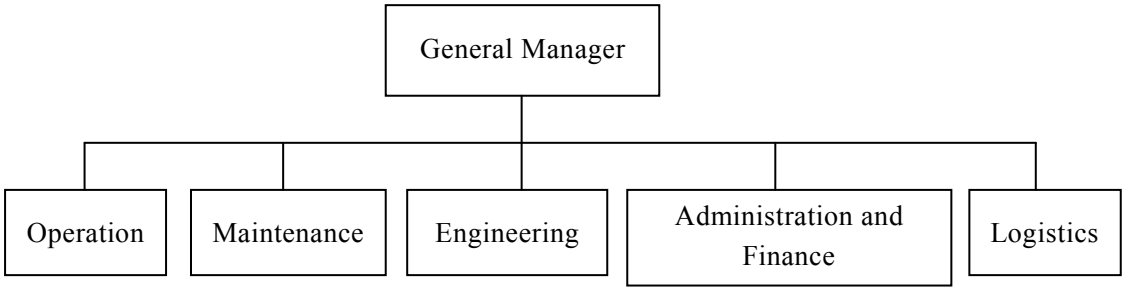



Figure 3: Organizational Structure of Muara Karang Gas Power Plant

Source: Information provided by executing agency

Under the General Manager, 295 staffs are working in the entire power plant, and of

[22] PT. Pembangkitan Jawa-Bali

[23] PLN has 47 business units across the country for generation, transmission, transformation and distribution. As regards generation assets and operation and maintenance in the Java-Bali system., two affiliate companies (PJB and PT. Indonesia Power) were divided from the generation section in 1995, and have been promoting efficient operation. (PLN reshuffled its organization in December 2009. The organization used to be siloed into two sections: construction, and sales/administration. The verticals were then reorganized into regional division to assure consistency from planning to procurement, construction, generation, transmission, distribution and sales, to realize more efficient operation.)

which 66 are engineers. According to power plant staffs, number of engineers necessary for operation and maintenance has been secured. No particular problem has been identified regarding the organizational structures of this power plant as well as PJB which manages the power plant.

### 3.5.2 Technical Aspects of Operation and Maintenance

Engineers who have gained sufficient experiences through operation and maintenance of the existing power plant are undertaking operation and maintenance work of the power plant (Block 2) after completion of the project. In addition, during project implementation, contractors and consultants have provided necessary training and technology transfer for operation and maintenance of Block 2 power plant to 60 staffs who have been in charge of operation and maintenance of the existing power plant (these include domestic training as well as training and inspection in Japan and in Germany). Also, PJB has prepared work instructions for staffs by adding easy-to-understand explanations to the manuals which contractors had prepared. The manuals/work instructions have been utilized for daily operation and maintenance work as well as periodic inspections. Moreover, on the job training is provided to operation and maintenance staffs. Therefore, it can be observed that technical level of operation and maintenance staffs is sufficient for ordinary maintenance work.

Furthermore, PJB has acquired ISO 90001 (quality management system), ISO 14001 (environmental management system), ISO 55000 (asset management system/risk management system), OHSAS 18001(occupational health and safety management system), and operation and maintenance of Muara Karang power plant has been taken place in conformity with these management systems.

Therefore, no particular problem has been identified regarding the technical aspects of operation and maintenance.

### 3.5.3 Financial Aspects of Operation and Maintenance

The operation and maintenance costs are estimated by Muara Karang power plant, and the estimation will be reviewed by PLN via UPJB[24] in Yogyakarta, which administers the power plant. The budget is allocated from PLN to the power plant based on the performance based contract between these organizations. Table 11 shows comparison of planned and actual maintenance cost of the power plant (Block 2) after completion of the project. The power plant's maintenance cost has been properly secured, and is well operated and maintained.

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[24] Unit Pembangkitan Jawa-Bali

Table 11: Maintenance Cost of the Power Plant (Block 2)

(Unit: million IDR)

| 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|
| Plan | Actual | Plan | Actual | Plan | Actual (up to October) |
| 166,612 | 77,511 Note 1) | 223,797 | 233,719 | 143,840 | 113,135 Note 2) |

Source: Results from questionnaire survey of executing agency

Note 1) The actual allocation in 2012 was below the budget because necessary equipments have been supplied by the contractor during warranty period (until April, 2012).

Note 2) The actual allocation in 2014 was below the budget because the figure was up to October.

When reviewing the overall financial situation of PLN, while electricity sales have been increasing smoothly every year, the organization would become mired in deficits without government subsidy – PLN is supported by a big amount of government subsidy. Based on "Public Service Obligation",[25] PLN has no choice but to sell electricity at the price that is lower than supply cost, and the generated losses have been compensated by the government subsidy. Main factors behind the high-cost structure are identified as the high financial burden for fuel and lubricants necessary for power generation, low electricity tariff, and so on. Financial performance and balance sheet of PLN are shown in the tables below.

Table 12: Financial Performance of PLN Note 1)

(Unit: billion IDR)

| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Sale of Electricity | 102,974 | 112,845 | 126,722 | 153,486 |
| Government's Electricity Subsidy | 58,108 | 93,178 | 103,331 | 101,208 |
| Other Revenues | 1,293 | 1,995 | 2,604 | 2,711 |
| Total Revenues | 162,375 | 208,018 | 232,656 | 257,405 |
| Fuel and Lubricants | 84,190 | 131,158 | 136,535 | 147,634 |
| Maintenance | 9,901 | 13,593 | 17,567 | 19,839 |
| Personnel | 12,954 | 13,197 | 14,401 | 15,555 |
| Other Operating Expenses Note 2) | 42,062 | 27,692 | 34,612 | 37,883 |
| Total Operating Expenses | 149,108 | 185,640 | 203,115 | 220,911 |
| Income Before Financial and Other Items | 13,267 | 22,378 | 29,541 | 36,493 |
| Net Financial and Other Items Note 3) | -1,861 | -16,863 | -28,509 | -75,715 |
| Tax Benefit | -1,313 | -89 | 2,174 | 9,654 |
| Income (Loss) for the Year and Total Comprehensive Income | 10,093 | 5,426 | 3,206 | -29,567 |

[25] The government subsidy to PLN is stipulated in the Article 66 of the Law on State Enterprises of 2001. (Financial compensation for state-owned enterprises.)

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.

Table 13: Balance Sheet of PLN Note 1)

(Unit: billion IDR)

| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Total Assets | 406,100 | 476,453 | 549,376 | 595,877 |
| Total Noncurrent Assets | 361,327 | 409,530 | 472,066 | 511,040 |
| Total Current Assets | 44,773 | 66,923 | 77,310 | 84,837 |
| Total Equity and Liabilities | 406,100 | 476,453 | 549,376 | 595,877 |
| Total Equity | 142,114 | 154,683 | 159,270 | 133,232 |
| Total Noncurrent Liabilities | 208,590 | 258,219 | 315,503 | 374,331 |
| Total Current Liabilities | 55,397 | 63,550 | 74,603 | 88,315 |

Source: PLN Annual Report

Note 1) Partial inconsistency of figures exists due to rounding error

PLN aims to reduce government subsidies, raise the electricity tariff, increase self-financing ratio, and introduce private fund aggressively, in order to improve its financial and management conditions. Electricity pricing is a decision matter of Indonesian government, which is out of control of PLN, though the government has been expanding customer categories introducing floating tariff as a direction of reform.[26] Furthermore, PLN has been producing corporate bonds, and the ratings by the credit rating agencies have been good.[27] However, government's subsidy may increase in the future considering the government's policy to improve electrification ratio of the entire country – electric power sales to unprofitable customers, the households with little power consumption, are expected to increase, and this would raise government's subsidy. For this reason, PLN has aimed to increase efficiency through converting diesel and oil to high efficiency coal, gas, geothermal, developing more efficient power generation facilities, decreasing transmission and distribution losses and so on to reduce power cost and to decrease government's

[26] The Ministry of Energy and Mineral Resources has indicated to introduce floating tariff for electricity in 12 customer categories out of 17 in total, which would not be eligible for government's electricity subsidy. This measure is based on the Presidential Decree No. 31 in 2014 to increase the number of customers who pay their electricity consumption based on floating tariff, in accordance with the market price. In fact, major electricity customers for industry were added as the target for this floating tariff from January 1, 2015. Fixed tariff will be maintained as before to households with little power consumption, commercial facilities and industries with less than a capacity of 200kVA. (Source: "Jakarta Shimbun", dated December 6, 2014.)

[27] Ratings as of the end of December, 2013 were as follows: Moody's: Baa3 stable, Standard & Poor's: BB, Fitsch: BBB-. (Source: PLN Annual Report.)

subsidy. Table 14 shows the projected electrification ratio, number of residential customers, and transmission and distribution losses in the entire country.

On the other hand, such PLN's financial situation will not directly affect the project because, as mentioned above, maintenance cost for the power plant (Block 2) has been appropriately financed and the power plant has been well operated and maintained. Therefore, no particular problem has been identified regarding the financial aspects of operation and maintenance.

Table 14: Projected Electrification Ratio, Number of Customers (Residential), and Transmission and Distribution Losses in Indonesia

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|
| Electrification Ratio (%) | 87.7 | 91.3 | 93.6 | 95.7 | 97.4 | 98.4 | 98.9 | 99.1 | 99.3 | 99.4 |
| Number of Customers – Residential (million) Note 1) | 56.0 | 59.1 | 61.3 | 63.5 | 65.4 | 66.8 | 67.9 | 68.7 | 69.5 | 70.3 |
| Transmission and Distribution Losses (%) | 6.72 | 6.68 | 6.61 | 6.57 | 6.51 | 6.48 | 6.46 | 6.44 | 6.42 | 6.40 |

Source: PLN

Note 1) According to PLN, most are households with little electricity consumption.

### 3.5.4 Current Status of Operation and Maintenance

The power plant facilities (Block 2) have been maintained well and operated smoothly. Maintenance activities (maintenance and inspections) have been conducted appropriately and no particular problem has been observed. Concretely, daily maintenance, periodic maintenance (weekly, monthly, every two months, and quarterly maintenance), condition based maintenance, corrective maintenance, preventive maintenance, and predictive maintenance activities have been conducted on site. As mentioned above, "Maintenance Optimization Program" has been introduced, and the executing agency aims to reduce accident ratio and to increase efficiency of the entire operation through raising the share of preventive maintenance (periodical cleaning, exchange of filters, inspection of various facilities etc.) and predictive maintenance (prevention of power plant's overheating and abnormal vibration by analyzing the past records). Inspections are conducted for every 8,000 hours of operation and major inspections for every 40,000 hours of operation.

As regards spare parts, PJB has introduced "Supply Chain Management System" in 2002 with the aim to realize automatic management of inventory system. Muara Karang power plant has also adopted this system and has been securing necessary spare parts on a timely

basis. Concretely, spear parts have been categorized A, B, and C, based on their importance,[28] and the power plant staffs are automatically reminded of necessary spear parts to be refilled, based on the inventory status and predicted period of time for the spear parts to be actually procured.

As regards gas fuel, PLN has concluded contracts with several gas supply companies to secure necessary gas. Table 15 summarizes the actual and projected gas fuel supply and demand for the entire Muara Karang power plant including this project (Block 2).

Therefore, no particular problem has been identified regarding the current status of operation and maintenance.

Table 15: Actual and Projected Gas Fuel Supply and Demand for Muara Karang Power Plant

Note 1), 2)

(Unit: BBTUD)

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Total Demand of PLTGU Muara Karang Note 3) | 150 | 270 | 334 | 370 | 360 | 360 | 311 | 311 |
| Muara Karang PP | 150 | 270 | 334 | 190 | 154 | 154 | 105 | 105 |
| Tanjung Priok PP | | | | 181 | 206 | 206 | 206 | 206 |
| Total Gas Supply | 156 | 304 | 416 | 371 | 361 | 364 | 311 | 311 |
| PHE - ONWJ | 129 | 125 | 130 | 115 | 100 | 70 | 70 | 70 |
| PGN | 27 | 30 | 30 | 37 | 50 | 100 | 100 | 100 |
| Nusantara Regas (FSRU Jabar) | | 149 | 256 | 219 | 211 | 194 | 141 | 141 |

Source: Results from questionnaire survey of executing agency

Note 1) Partial inconsistency of figures exists due to rounding error

Note 2) Actual figures for the year 2011 to 2014, and projection for the year 2015 to 2018.

Note 3) Total demand includes demand for Tanjung Priok power plant.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effects is high.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

[28] In case spear parts have not been procured in a timely manner, lack of A category spear parts would cause highly serious problems such as blackouts, lack of B category spear parts would cause temporary problems such as power output losses, and lack of C category spear parts would cause some problems but not to the point of affecting power outputs.

This project converted the diesel oil-fired power facility in the existing Muara Karang power complex to a gas combined cycle thermal power generation facility and increased power capacity with the aim of improving power supply and demand balance as well as to improve stability and to maintain quality of power supply in the Java-Bali system. The project objective – to meet increasing power demand from both quantity and quality viewpoints by providing basic support to develop new power source until PLN and private enterprises can make on investment in power generation – is consistent with Indonesia's energy/power policy and with the development needs, as well as Japan's ODA policy; thus, the relevance of the project is high. Operation and Effect Indicators set at the time of appraisal have achieved more than 90% of the target figures after the commencement of power generation. It is worthy of special mention that the project is located in Jakarta Capital Region where there is a greatest demand of electricity, supplying power to "the strategic area" at the center of Indonesia's politics and economy, and is playing an important role to reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system. The power plant has been operating smoothly and project effects have appeared as planned; thus, the project's effectiveness and impact are high. No negative impact on natural environment has been pointed out. Rather, more than 60% of emission reduction of $SO_x$, $NO_x$, $CO_2$, and dust has realized as a result of converting fuel for power generation from diesel oil to gas, which has contributed to reduce environmental burden. Although the project cost was within the plan, the project period exceeded the plan; thus, efficiency of the project is fair. No major problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system; thus, sustainability of the project effects is high.

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

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

None

### 4.2.2 Recommendations to JICA

None

## 4.3 Lessons Learned

The importance of the executing agency's cross-sectoral and comprehensive risk analysis regarding fuel supply as well as proactive sharing and consultation of its results with the central government in consideration of facilitating cross-ministerial coordination

The delay of gas supply was one of the main reasons for the project delay. The executing

agency initially planned to use natural gas to be extracted from the gas field in Sumatra through South Sumatra-West Java gas pipeline, which was expected to be developed by Japanese ODA loan around the same time. However, Tanjung Priok Port Authority did not approve the pipeline route. For this reason, the executing agency changed the original gas procurement plan and decided to utilize the gas fuel which has been supplying to the existing Muara Karang power plant (Block 1) for Block 2 power plant. However, due to insufficient gas pressure, it was necessary to install compressor to reinforce pressure, which required time. If the executing agency had been more risk-conscious at an early stage and undertaken sufficient analysis from cross-sectoral and comprehensive perspectives on risk associated with Tanjung Priok Port Authority not approving the pipeline route, which may affect the project and power supply and demand balance of the Java-Bali system (possible risk that may occur from project delay and delay of commencement of power supply as a consequence), then it could have sought to secure project implementation by considering and adopting alternative options. In other words, the executing agency could have: (1) conducted sufficient risk analysis regarding possibility of Tanjung Priok Port Authority not approving the pipeline route, (2) communicated with the central government (Ministry of Energy and Mineral Resources) on the results of analysis in a broad based manner, and (3) considered alternative measures to secure fuel for the project and urged the central government to do the necessary cross-ministerial coordination in case the risk occurred. In view of the above, it is critical that the executing agency extensively conducts cross-sectoral and comprehensive risk analysis on fuel supply, urges the central government based on the analysis as required, and encourages the government to take appropriate actions including cross-ministerial coordination. The above lessons learned should be considered applicable to PLN's other thermal power plant development projects.

<For reference>

The executing agency of the project has set up a "Risk Management Division" in December 2009, thereby establishing a system to conduct cross-organizational and comprehensive risk analysis from technical and operational perspectives. Risk management unit existed before then, however, its function had been limited to reviewing decisions made by the board, and in-depth and comprehensive analysis on the executing agency's company-wide corporate risk had not taken place.

End

Comparison of the Original and Actual Scope of the Project

| Item | Plan | Actual |
|---|---|---|
| 1.Project Outputs | 1) Civil Works, Procurement of Equipments etc.<br>・ Construction of two gas turbine generators (250 MW class×2units)<br>・ Construction of three steam turbine generators (75 MW class×3)<br>・ Construction of two heat recovery steam generators<br>・ Increase/extension of common facilities that need for adding on the gas fired combined cycle system<br>・ Increasing capacity of associated existing transmission line and substation<br>・ Rehabilitation of switchyard and substations<br>・ Rehabilitation of existing intake water canal<br>・ Related civil works and construction works<br><br>2) Consulting Services<br>・ Detail design, assistance in tendering, construction supervision, inspection, testing, and delivery control during manufacturing, support in operation and maintenance during project period, assistance in environmental management, transfer of technology, training etc. | 1) Civil Works, Procurement of Equipments etc.<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ Additional scope: Installation of Continuing Emission Monitoring System (CEMS)<br><br>2) Consulting Services<br>・ As planned<br>・ Additional scope due to installation of CEMS |
| 2.Project Period | Mar. 2003 – Sept. 2009<br>(79 months) | Jul. 2003 – Apr. 2012<br>(106 months) |
| 3.Project Cost<br>Amount paid in Foreign currency<br>Amount paid in Local currency<br>Total<br>Japanese ODA loan portion<br>Exchange rate | <br>46,828 million yen<br>18,760 million yen<br>(1,443,078 million IDR)<br>65,588 million yen<br>55,750 million yen<br>1 IDR=0.013 yen<br>(November 2002) | <br>58,974 million yen<br>5,842 million yen<br>(478,626 million IDR)<br>64,816 million yen<br>54,150 million yen<br>1 IDR=0.012 yen<br>(November 2006) |

[END]

Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Muara Tawar Gas Fired Power Plant Extension Project"

External Evaluator: Masumi Shimamura

Mitsubishi UFJ Research and Consulting Co., Ltd.

## 0. Summary

This project developed a new gas-fired combined cycle power plant in the existing Muara Tawar power complex with the aim of improving power supply and demand balance as well as improving stability and maintaining quality of power supply in the Java-Bali system. The project objective – to meet increasing power demand from both quantity and quality viewpoints by providing basic support to develop new power source until the State Electricity Company, PT. PLN (Persero)[1] (hereinafter referred to as "PLN"), and private enterprises can make on investment in power generation – is consistent with Indonesia's energy/power policy and with the development needs, as well as Japan's ODA policy; thus, the relevance of the project is high. All the Operation and Effect Indicators set at the time of appraisal have been achieved against the target figures after the commencement of power generation. It is worthy of special mention that the project is located in Jakarta Capital Region where there is a greatest demand of electricity, and is playing an important role to reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system. The power plant has been operating smoothly and project effects have appeared as planned; thus, the project's effectiveness and impact are high. No negative impact on natural environment has been pointed out. Land acquisition and resettlement which were not expected at the time of appraisal took place, however, the process was properly carried out in accordance with the governing Indonesian regulation and no particular problem has been pointed out. Both the project cost and project period exceeded the plan though not significantly; thus, efficiency of the project is fair. No major problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system; thus, sustainability of the project effects is high.

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

[1] PT. Perusahaan Listrik Negara (Persero)

## 1. Project Description


Project Location

Muara Tawar Gas Power Plant (Block 5)

### 1.1 Background

After the Asian Financial Crisis in 1997, new investments in power plants dried up in the Java-Bali system in Indonesia. However, demand for power grew at an annual rate of 9% fueled by economic recovery that followed the crisis, and reserve margin was decreasing. Despite plans for developing new power generation projects, prospect for their financing was not yet in sight. For these reasons, supply-demand balance worsened in the Jakarta Capital Region where demand for power was the country's largest, and this situation combined with falling capacities in the aging existing power plants raised the possibility of a major problem, as a tight supply situation was expected to emerge in 2004 and beyond. The project was expected to ensure stable power supply at the center of the Indonesian economy by expanding power outputs in the Jakarta Capital Region.

### 1.2 Project Outline

The objective of this project is to improve power supply and demand balance as well as to improve stability and to maintain quality of power supply in the Java-Bali system by building a new gas-fired combined cycle power plant with a capacity of 225MW class[2] at the existing Muara Tawar power complex in the suburbs of Jakarta, thereby contributing to the power sector reform until new investments for power development can be realized using PLN's own fund and through private enterprises.

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[2] 234MW in actuality due to difference from planned specification as a result of bidding, which led to change in rated power output.

| | |
|---|---|
| Loan Approved Amount/<br>Disbursed Amount | 18,182 million yen / 16,526 million yen |
| Exchange of Notes Date/<br>Loan Agreement Signing Date | March, 2003 / July, 2003 |
| Terms and Conditions | Interest Rate 1.8%<br>Repayment Period 30 years<br>(Grace Period 10 years)<br>Conditions for Procurement General Untied |
| Borrower /<br>Executing Agency | Republic of Indonesia / State Electricity Company (PT. PLN) |
| Final Disbursement Date | January, 2013 |
| Main Contractor<br>(Over 1 billion yen) | PT. Alstom Power Energy System Indonesia (Indonesia) / Marubeni Corporation (Japan) / Alstom Switzerland Ltd. (Switzerland), JV |
| Main Consultant<br>(Over 100 million yen) | Fichtner GMBH & Company KG. (Germany) / PT. Jaya CM Manggala Pratama (Indonesia) / PT. Kwarsa Hexagon (Indonesia) / PT. Connusa Energindo (Indonesia) / Tokyo Electric Power Company, Incorporated (Japan) / Tokyo Electric Power Services Co., Ltd. (Japan), JV |
| Feasibility Studies, etc. | F/S conducted in 2001 |
| Related Projects | Japanese ODA Loan (Loan Agreement signing year and month in parentheses)<br>・ South Sumatra-West Java Gas Pipeline Project (March, 2003)<br>・ Muara Karang Gas Power Plant Project (July, 2003)<br>・ Tanjung Priok Gas Fired Power Station Extension Project (March, 2004)<br>・ Semarang Power Plant Rehabilitation and Gasification Project (March, 2004)<br>・ Engineering Services for Kamojang Geothermal Power Plant Extension Project (March, 2006)<br>Technical Cooperation<br>・ Study on the Effective Use of Captive Power in |

| | |
|---|---|
| | Java-Bali Region (2002)<br>Electric Power and Energy Policy Adviser dispatched to the Ministry of Energy and Mineral Resources<br>Grant Aid (Exchange of Notes signing year and month in parentheses)<br>・ The Project for Rehabilitation of Gresik Steam Power Plant Units 3 and 4 (July, 2004)<br>World Bank<br>・ Technical Cooperation (Supporting PLN's Corporate and Financial Restructuring)<br>・ Java-Bali Power Sector Restructuring and Strengthening Project<br>Asian Development Bank<br>・ Power Transmission Line Improvement Sector Project<br>Renewable Energy Development Sector Project |

## 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: September, 2014 – July, 2015

Duration of the Field Study: November 22–December 18, 2014, February 24–March 8, 2015

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

3.1 Relevance (Rating: ③[4])

3.1.1 Relevance to the Development Plan of Indonesia

At the time of appraisal, according to Indonesian government's National Electricity General Plan (hereinafter referred to as "RUKN") in 2003, the minimum reserve margin necessary for stable power supply in Indonesia was considered to be 25%, and it was urgently necessary to secure new power sources because the ratio was declining (38.8% in 2001 to 30.5% in 2002), and the figure could lead to less than 25% due to the increasing power demand in the Java-Bali system. RUKN pointed out the necessity of fulfilling both

[3] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[4] ③: High, ② Fair, ① Low

quantity and quality of increasing power demand. In addition, the government of Indonesia announced a reorganization policy for the power sector[5] in 1998 and initiated reforms including financial restructuring of PLN, the executing agency, and the participation of private sector in order to establish a competitive power market and to improve the efficiency of the power sector. The project objective to provide basic support to develop new power source until new investments for power development can be realized using PLN's own fund and through private enterprises was consistent with the above policy.

At the time of ex-post evaluation, the project objective is consistent with Indonesia's energy/power policy. The government of Indonesia prepared National Energy Policy (KEN) in January 2014 after an interval of about ten years, and has set targets to increase the country's generation capacity from 51GW in 2014 to 115GW by 2025 and then to 430GW by 2050. At the time of ex-post evaluation, RUKN 2012-2031 set aims in the power supply plan to finish the shortage of power supply and to develop power plants for peak load by using gas and hydro power plants, so that oil fueled power plant development is minimized. Furthermore, PLN's Long Term Electricity Development Plan (hereinafter referred to as "RUPTL") 2013-2022, PLN's company plan to supply electric power for the next 10 years, states that power demand is expected to increase on an average of 7.6% per year for the Java-Bali system, and the additional generation capacity requirement is 31.5GW (an average of 3.2GW per year) by 2022 in order to alleviate tight power supply and demand situation.[6] RUPTL indicates that fuel sources and the availability, distance to the demand area and regional balance, transmission development plan and its constraints, and restrictions on environmental and social aspects should be taken into consideration when selecting the location of power plants. Trend of power supply and demand balance, and reserve margin in the Java-Bali system is shown in Figure 1. Reserve margin was 24.4% in 2010, less than 25%, however, it recovered to 34.9% in 2011 due to development of power sources. (See Table 1)

[5] Power Sector Restructuring Policy

[6] The additional generation capacity requirement is 38.5GW (an average of 3.8GW per year) by 2024 in RUPTL 2015-2024, which was prepared under the new "Jokowi" administration in January 2015. The administration has set forth a priority of newly developing 35GW generation capacity by 2019.

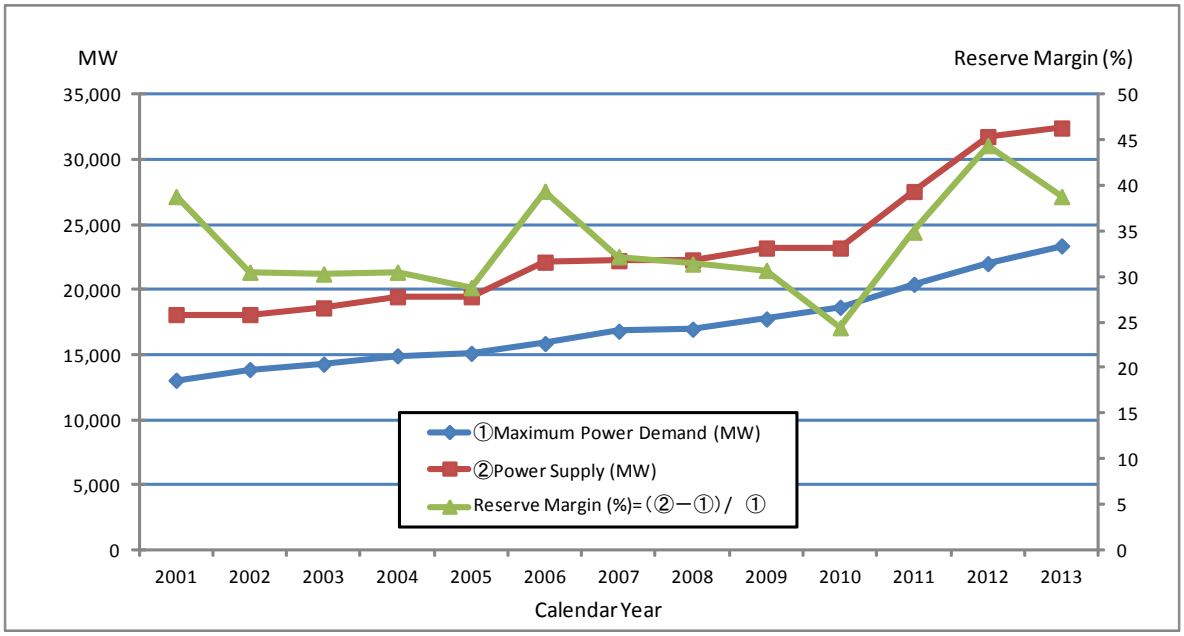


Figure 1: Trend of Power Supply-Demand Balance and Reserve Margin in the Java-Bali System

Source: Results from questionnaire survey of executing agency

In order to improve tight electricity supply and demand situation, the government of Indonesia has prepared two Crash Programs (short-term power development plans) (First Crash Program was prepared in 2006, and Second Program in 2010), and has been pushing forward large-scale development of power sources. The main purpose of the First Crash Program, which is the development plan of coal-fired power plants of approximately 10,000MW in total is to urgently develop power sources in the Java-Bali areas, however, significant delay has occurred due to problems of land acquisition and financial situations. The purpose of the Second Crash Program is to introduce renewable energy, including urgent development of power sources, diversification of power sources, and geothermal power generation, of approximately 10,000MW in total. Projects under the Second Crash Program have also encountered delay due to problems on financial arrangements. Development of new power sources for more than 20GW is assumed by the independent power producers (hereinafter referred to as "IPPs") among the targeted new power generation capacity of 35GW, which the new "Jokowi" administration considers as priority.

### 3.1.2 Relevance to the Development Needs of Indonesia

At the time of appraisal, coping with tight power supply and demand in the Java-Bali system and establishing stable power supply system were a pressing issue. In the Java-Bali system, which supplies power to the Jakarta Capital Region where demand for power was the country's largest, time was necessary until new investments for power development can

be recovered using PLN's own fund and through private enterprises. Therefore, it was important to tackle the immediate problem of stringent power supply and demand for stable economy and social situation of the country.

At the time of ex-post evaluation, facilitation of power development in the Java-Bali system, which supplies power to Jakarta Capital Region where many Japanese companies are investing, is also an urgent issue. RUPTL 2013-2022 states that demand for power in the Java-Bali system is expected to increase from 144TWh in 2013 to 275TWh in 2022, growing at an average rate of 7.6% per year.[7] While the government of Indonesia has been promoting Crash Programs as mentioned above, delays in the progress are seen. Further utilization of IPPs continues to be expected in developing power sources, and IPPs account for more than half of power development in the Second Crash Program. (Whereas PLN projects accounted for 100% of projects in the First Crash Program.) Table 1 shows the additional investment capacity of power sources in the Java-Bali system.

Table 1: Additional Investment Capacity of Power Sources in the Java-Bali System

(Unit: MW)

| | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Power Generation Investment by PLN | | | | | | | | | | | | | | |
| Coal Fired | | | | | | | 1,320 | | | 300 | 300 | 3,220 | 1,950 | 980 |
| Combined Cycle | | | | | | | 740 | | | 500 | | 444 | 740 | |
| Hydroelectric | | | | | | | | | | | | | | |
| Gas Turbine | | | | | 899 | 41 | | | | | | | | |
| Diesel | | | | | | | | | | | 65 | 51 | 140 | |
| Geothermal | | | | | | | | | | | | | | |
| Others | | | | | | | | | | | | | | |
| Power Generation Investment by IPPs | | | | | | | | | | | | | | |
| Coal Fired | 2,450 | | | | | | 600 | | | | | | 1,475 | |
| Combined Cycle | | | | | | | | | | | | 150 | | 120 |
| Hydroelectric | | | | | | | | | | | | | | |
| Gas Turbine | | | | | | | | | | | | | | |
| Diesel | | | | | | | | | | | | | | |
| Geothermal | 200 | | 60 | | | | | 110 | 60 | 110 | | | | |
| Others | | | | | | | | | | | | | | |
| Total Investment Capacity of Power Sources by PLN and IPPs | | | | | | | | | | | | | | |
| Total | 2,650 | | 60 | | 899 | 41 | 2,660 | 110 | 60 | 910 | 365 | 3,865 | 4,305 | 1,100 |

Source: Results from questionnaire survey of executing agency

### 3.1.3 Relevance to Japan's ODA Policy

The Medium-Term Strategy for Overseas Economic Cooperation Operations of Japan Bank for International Cooperation (current Japan International Cooperation Agency (JICA)) (April 2002) indicated "economic infrastructure development" as priority area for

[7] RUPTL 2015-2024 states that the power demand is expected to increase from 165TWh in 2015 to 324TWh in 2024, growing at an average rate of 7.8% per year.

assistance in Indonesia. In addition, Japan Bank for International Cooperation (current JICA) stated in its Country Assistance Strategy for Indonesia (prepared in November 2002) to support sector reform as well as to cope with development needs with high urgency such as resolving economic bottlenecks for the country's sustainable economic growth. At the time of appraisal, there was a fear of tight power supply in the Java-Bali system, and improvement of supply and demand balance was urgently needed. The project objective to provide basic support to develop new power source until new investments for power development can be recovered using PLN's own fund and through private enterprises, and to contribute to the increase of reserve margin was consistent with the above policy.

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

## 3.2 Efficiency (Rating: ②)

### 3.2.1 Project Outputs

The project developed a 1:1:1 structured combined cycle power generation as Block 5,[8] consisting of one gas turbine generator, one steam turbine generator and one heat recovery steam generator in the existing Muara Tawar power complex.[9] Table 2 shows the comparison of planned and actual project outputs.

Table 2: Comparison of Planned and Actual Project Outputs

| Plan | Actual |
|---|---|
| Civil Works, Procurement of Equipments etc. (EPC Contract Related to Power Plant Construction) | |
| ・ Construction of one gas turbine generator (150 MW class×1unit) | ・ As planned |
| ・ Construction of one steam turbine generator (75 MW class×1) | ・ As planned |
| ・ Construction of one heat recovery steam generator | ・ As planned |
| ・ Increase/extension of common facilities that need for adding on the gas fired combined cycle system (gas supply facilities, 500kV switchyard etc.) | ・ As planned |
| ・ Related civil works and construction works | ・ As planned |

[8] <Background information regarding the project scope> Originally, the government of Indonesia made project quest to the Japanese government to convert the existing Block 2 power plant to a 3:1:3 structured combined cycle power generation, consisting of three gas turbine generators, one steam turbine generator and three heat recovery steam generators. However, during project preparation process, it became clear that among three gas turbine generators of Block 2, one had been relocated to Bali, and the other had been out of order. Therefore, considering the situation, the executing agency dropped the Block 2 conversion plan. Alternatively, the plan was changed to build a combined cycle power generation as new Block 5, consisting of one gas turbine generator, one steam turbine generator and one heat recovery steam generator, next to the existing Block 3 and 4 power plants. Project appraisal was conducted based on the revised project scope and the Japanese ODA loan agreement was concluded accordingly.

[9] The existing Muara Tawar power plants are Block 1-4.

| | |
|---|---|
| | ・ Additional scope: Installation of Continuing Emission Monitoring System (CEMS) |
| Consulting Services | |
| ・ Detail design, assistance in tendering, construction supervision, inspection, testing, and delivery control during manufacturing, support in operation and maintenance during project period, assistance in environmental management, transfer of technology, training etc. | ・ As planned<br>・ Additional scope due to installation of CEMS |

Source: Results from questionnaire survey of executing agency

As regards civil works and procurement of equipments, installation of Continuing Emission Monitoring System was added to the scope. The system measures and monitors composition, density and emission amount of exhaust gas. According to the executing agency, this additional scope was due to the newly enforced regulation[10] of the Ministry of Environment in Indonesia. There was additional scope for consulting services as a result of installing Continuing Emission Monitoring System. The additional output is deemed appropriate, commensurate with inputs, in light of the objective to reduce environmental burden in accordance with the regulation of the Ministry of Environment. Other outputs were as planned – no other output change has observed.

As regards inputs of consulting services, total inputs have significantly increased as shown in Table 3.

Table 3: Comparison of Planned and Actual Inputs of Consulting Services

(Unit: M/M)

| | Plan | Actual | Comparison |
|---|---|---|---|
| International Consultants | 218.5 | 341.71 | Increased by 123.21 |
| Local Consultants | 302.5 | 335.87 | Increased by 33.37 |
| Total | 521.0 | 677.58 | Increased by 156.58 |

Source: Results from questionnaire survey of executing agency

According to the executing agency, significant increase of inputs of consulting services (man-month) took place due to the delay of engineering, procurement, and construction contract (hereinafter referred to as "EPC contract") and delay of full site handover due to land acquisition and resettlement which were not expected at the time of appraisal (delay

[10] Regulation of the Ministry of Environment No. 21 /2008, Clause 9, Article No.1

prior to construction). (Man-month increased because consultants were on board including the period of project delay). Although the situation can not necessarily be regarded as efficient, it was deemed unavoidable from the viewpoint of securing quality of project implementation.

Facility Containing Gas Turbine Generator

Heat Recovery Steam Generator

Exciter and Generator

Switchyard

3.2.2 Project Inputs

3.2.2.1 Project Cost

The total project cost was initially planned to be 21,414 million yen (out of which 18,182 million yen was to be covered by Japanese ODA loan). In actuality, the total project cost was 28,681 million yen (out of which 16,526 million was covered by Japanese ODA loan),

which is higher than planned (133.9%[11] of the planned amount).

The project cost increased mainly due to increase in the price of gas turbine by the rise[12] in steel materials price on a global basis as well as input cost increase due to significant increase in consulting service man-month. Project cost overrun was already assumed at the time of the conclusion of the EPC contract. While power supply and demand in Indonesia was tight, the executing agency made judgment that it could not accept further delay of the project (by rebidding etc.), but decided to bear the project cost overrun. With such premise, JICA concurred the conclusion of the EPC contract.

3.2.2.2 Project Period

The overall project period was planned as 75 months, from March 2003 (conclusion of Loan Agreement) to May 2009 (completion of warranty period) as opposed to 112 months in actuality, from July 2003 (conclusion of Loan Agreement) to October 2012 (completion of warranty period), which is longer than planned (149.3% of the initial plan). Loan period was extended due to project delay – loan extension was made on February 2012, resulting in the final loan expiry on January 2013.

Table 4 shows comparisons of planned and actual project period.

Table 4: Comparison of Planned and Actual Project Period

| Item | Plan (At Project Appraisal) | Actual (At Ex-post Evaluation) |
|---|---|---|
| Selection of consultants | Apr. 2003 – Mar. 2004 (12 months) | Jul. 2003 – Apr. 2004 (10 months) |
| Consulting services | Apr. 2004 – May 2008 (50 months) | May 2004 – Oct. 2011 (90 months) |
| Designing and manufacturing | Apr. 2004 – Jan. 2006 (22 months) | May 2004 – Jun. 2009 (63 months) |
| Power plant construction | Feb. 2006 – May 2008 (28 months) | Jun. 2009 – Oct. 2011 (29 months) |
| Start of power generation | Jun. 2008 | Oct. 2011 |
| Warranty period | Jun. 2008 – May 2009 (12 months) | Oct. 2011 – Oct. 2012 (12 months) |

Source: Information provided by JICA, and results from questionnaire survey of executing agency

Main reasons for project delay were as follows: (1) negotiation with the gas company, revision of gas procurement plan, and conclusion of gas purchase contract took time,[13] (2)

[11] This percentage was calculated by comparing the actual cost after the scope change and the planned cost before the scope change.

[12] While the project delayed – in addition to the delay in EPC tendering process, delay in project site handover occurred due to land acquisition – the gas turbine market soared still more. From 2005 to 2009, the FOB (Free on Board) price of gas turbine increased on the average of about 53%, which became one of the major reasons for the increase in project cost. (Data source: Gas Turbine World.)

[13] <Background/reasons for delay of gas supply> As regards securing gas fuel for the project (Block 5), the executing agency initially planned to supply gas to be extracted from the gas field in South Sumatra where a private energy related company reserved the rights, through South Sumatra-West Java gas pipeline. However,

selection of EPC contractor was delayed, and (3) full site handover was delayed due to land acquisition and resettlement. (See "3.4.2.2 Land Acquisition and Resettlement" under "Impact" section below.) Period for consulting services was extended significantly as a result.

3.2.3 Results of Calculations of Internal Rates of Return (Reference only)

Table 5 shows the result of recalculation of the financial internal rate of return (FIRR).

Table 5: Assumption and Results of FIRR Recalculation

| | At Project Appraisal | At Ex-post Evaluation |
|---|---|---|
| FIRR | 28.5% (before tax)<br>21.2% (after tax) | 24.8% (before tax)<br>21.0% (after tax) |
| Benefit | Construction cost (costs incurred to the project including consulting service cost), operation and maintenance cost | Construction cost (costs incurred to the project including consulting service cost and land acquisition cost), operation and maintenance cost |
| Cost | Revenue from electricity tariff | |
| Project Life | 25 years after project completion | |

The FIRRs assessed at the time of ex-post evaluation were lower than those at the time of appraisal. This was primarily because the project period and project cost exceeded the plan.

Both the project cost and project period exceeded the plan. Therefore, efficiency of the project is fair.

3.3 Effectiveness [14] (Rating: ③)

3.3.1 Quantitative Effects (Operation and Effect Indicators)

Table 6 summarizes the operation and effect indicators set at the time of appraisal and their actual figures in 2013. (Warranty period was completed in October 2012.) In addition, data of the existing Muara Tawar power plant (Block 1) was added to the table as a comparison of the project (Block 5).

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long negotiation broke down without reaching an agreement between the executing agency and the company over risk-taking of the gas pipeline which was under construction. While construction of the gas pipeline completed in August 2008, the executing agency revised the original gas procurement plan, and concluded a gas purchase contract with a state-owned gas enterprise in Indonesia (PGN) in the end. (Gas price that was agreed upon between the executing agency and PGN turned out to be higher than the price at the time of the contract negotiation with the private energy related company.)

[14] Sub-rating for Effectiveness is to be put with consideration of Impact.

Table 6: Operation and Effect Indicators

| | The Project (Block 5) | | | Block 1 Actual (for Reference) |
|---|---|---|---|---|
| | Baseline Note 1) | Target | Actual | |
| | 2002 | 2009 | 2013 | 2013 |
| | Baseline Year | At Completion of Warranty Period | A Year after Completion of Warranty Period | |
| Maximum output | — | 225 MW Note2) | 225 MW Note 3) | 681MW |
| Plant load factor | — | 70% or more | 85.1% | 80.9% |
| Availability factor | — | 83% or more | 94.3% | 96.8% |
| Auxiliary power ratio | — | 3% or less | 1.67% | 1.96% |
| Gross thermal efficiency | — | 45% or more | 45% | 43.1% |
| Outage hours due to periodic maintenance and inspection | — | 1,512 hours or less/year | 255 hours/year | 258 hours/year |
| Outage hours due to human error | — | — Note 4) | 0 | 0 |
| Outage hours due to machine trouble | — | — Note 4) | 65.6 hours/year | 19.0 hours/year |
| Frequency of outage due to periodic maintenance and inspection | — | 1 time/year | 1 time/year | 0 time/year |
| Annual power production | — | 1,338 GWh/year Note 2) | 1,622 GWh/year | 4,464 GWh/year |

Source: Information provided by JICA, and results from questionnaire survey of executing agency

Note 1) Baseline figures did not exist at the time of appraisal because Block 5 power plant was newly developed power plant

Note 2) Maximum output and annual power production were subject to change due to difference from planned specification as a result of bidding.

Note 3) 234MW in actuality as a result of bidding.

Note 4) Targets were not set at the time of appraisal.

Since the commencement of power plant operation up to the time of ex-post evaluation, the operational condition is satisfactory, generating electricity smoothly. Actual figures in 2013 for the project (Block 5) for all the indicators have reached their targets set at the time of appraisal. While outputs of the power plants (scale of power plans) between the existing one (Block 1) and the project (Block 5) are different, plant load factor, auxiliary power

ratio and gross thermal efficiency for Block 5 have shown better figures compared to those of Block 1.

As regards outage hours due to machine trouble, target was not set at the time of appraisal, but according to the executing agency, both the figure of 65.6 hours/year and the contents of trouble were within the scope of the assumption, not to be regarded as a problem. The power plant has been operating without any trouble after restoration by the executing agency.

The reason why the outage hours due to periodic maintenance and inspection were about one sixth of the target was because of major inspection did not take place in 2013. (Major inspections are to be conducted for every 36,000 hour operation for Block 5. See "Sustainability" section below for detail.)

3.3.2 Qualitative Effects (Other Effects)

Table 7 summarizes the share of installed capacity of the power plant (Block 5) in the entire Java-Bali system and in Jakarta Capital Region, respectively. The power plant has a share of 0.72% in the entire Java-Bali system which is small – that is to say, quantitative contribution in terms of improvement of power supply and demand balance, and increase of reserve margin is very small.[15] In addition, as reference figure, provided that all the electricity from the power plant was supplied to Jakarta Capital Region, the share becomes 3.52% – quantitative contribution of the power plant is also limited.

Table 7: Share of Muara Tawar Gas Power Plant (Block 5)

| Installed Capacity for: | Installed Capacity for Muara Tawar Gas Power Plant (Block 5) | Share |
|---|---|---|
| Entire Java-Bali System in 2013: 32,450MW | 234MW | 0.72% |
| Jakarta Capital Region in 2013: 6,647MW | | 3.52% |

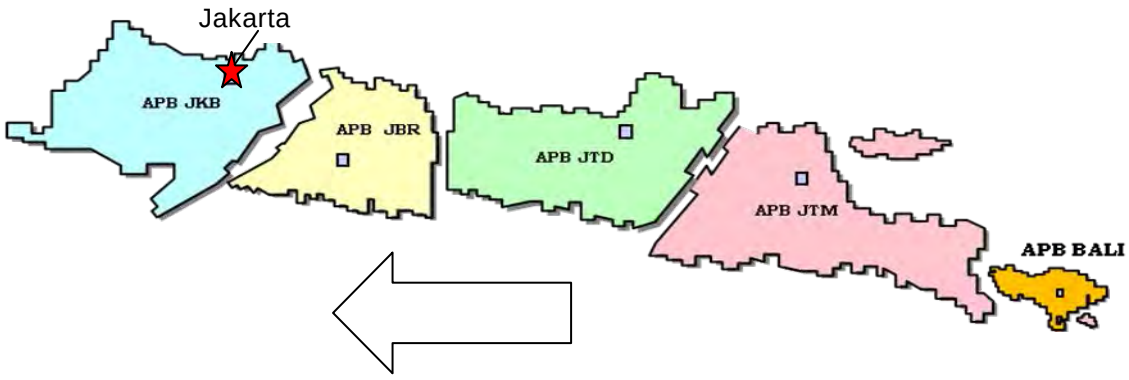
Source: Information provided by JICA, and results from questionnaire survey of executing agency

However, considering that the power plant is located in Jakarta Capital Region, the largest power demand center, it can be said that it plays an extremely important role to

[15] However, it is inferred that the project delay have brought negative effect to the reserve margin in the Java-Bali system to a limited extent. A the time of appraisal, commencement of power plant operation was expected on June 2008, however, due to project delay, operation started in October 2011 in actuality, approximately a little over three years behind the plan. In the mean time, reserve margin for the Java-Bali system changed as follows: 31.4% (2008) ➔ 30.7%(2009 年) ➔ 24.4% (2010) ➔ 34.9% (2011) ➔ 44.4% (2012). In 2010, the figure fell below 25%, necessary level of reserve margin stipulated in RUKN for stable power supply in Indonesia. While the share of the power plant in the Java-Bali system is limited, reserve margin after 2009 could have exceeded a little more than the above figures if project delay did not take place.

reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system. [16]

Net capacity and load for each of the five business/load dispatch area of the executing agency in the Java-Bali system are shown in Figure 2. Because load (demand) exceeds net capacity in the West Java area (JKB [17]) where Jakarta Capital Region is located, it means that power supply to this area is covered by electricity produced in other areas. The executing agency pointed out that such power interchange beyond business/load dispatch areas would cause voltage drop and power loss [18] in the Java-Bali system and would become a bottleneck for stable and efficient power supply. Hence, the executing agency mentioned that it is important to supply power within the same business/ load dispatch area as much as possible so as to secure stability and appropriate power quality in the entire power system. In this regard, it is extremely significant that the power plant is located in Jakarta Capital Region.




| | JKB | JBR | JTD | JTM | BALI |
|---|---|---|---|---|---|
| Net Capacity (MW) | 9,559 | 7,445 | 5,216 | 8,554 | 558 |
| Load (MW) | 9,778 | 4,874 | 3,658 | 4,982 | 735 |

Figure 2: Comparison of Net Capacity of Power Plant and Load by Area in Java-Bali System (2014)

Source: Information provided by executing agency

[16] Among power plants developed by Japanese ODA loan in the same period, this project, " Muara Karang Gas Power Plant Project" and "Tanjung Priok Gas Fired Power Station Extension Project" are located in Jakarta Capital Region, and are playing an extremely important role for stable power supply in Capital Region/West Java Region. There is a shared opinion regarding the significance/importance of these power plants among local experts, World Bank and Asian Development Bank officers in charge of power sector, in addition to officers in the executing agency.

[17] Jakarta and Bandung Load Dispatch Area

[18] The executing agency explained the following as its logic: "When the place for power generation is far from power consuming area (when power transmission distance is long) ➔ electric resistance increases ➔ power loss increases ➔ power voltage reduces."

## 3.4 Impacts

### 3.4.1 Intended Impacts

Table 8 shows the electrification rate, SAIDI [19] (power interruption duration per customer per year (minutes)) and SAIFI [20] (power interruption frequency per customer per year) for power plants in the Java-Bali system as data relating to power quality. [21] Data on reserve margin and transmission and distribution losses in the Java-Bali system is also included in the table.

Table 8: Trend of Electrification Rate, SAIDI, SAIFI, Reserve Margin, and Transmission and Distribution Losses in the Java-Bali System

| | 2008 | 2009 | 2010 | 2011 Note 1) | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Electrification Rate (%) | 68.0 | 69.8 | 71.4 | 72.3 | 78.2 | 83.2 |
| SAIDI for Power Plant (minutes/customer) | 4.583 | 0.614 | 0.179 | 0.309 | 0.076 | 0.02 |
| SAIFI for power plant (frequency/customer) | 1.030 | 0.247 | 0.151 | 0.182 | 0.04 | 0.019 |
| Reserve Margin (%) | 31.4 | 30.7 | 24.4 | 34.9 | 44.4 | 38.8 |
| Transmission and Distribution Losses (%) | 13.6 | 11.2 | 13.0 | 9.1 | 9.3 | 9.5 |

Source: Information provided by executing agency

Note 1) Start of combined cycle commercial operation

Since the power plant (Block 5) commenced its operation in October 2011, comparison was made for the Java-Bali system before (before 2010) and after (after 2012) the project. Electrification rates have been increasing steadily. As regards SAIDI and SAIFI for power plant, temporary increase can be seen in 2011 [22], but are generally on a declining trend – when comparing figures in 2010 and 2012, both are definitely decreasing. According to the executing agency, the reason why transmission and distribution losses increased in 2013 was due to little rainfall in general compared to the usual year, which led to decrease in the availability factor of hydroelectric power plants in West Java area, where Jakarta Capital Region is located. This situation impelled the executing agency to interchange power from other areas, which resulted in increase of power loss. The executing agency also explained

19 System Average Interruption Duration Index

20 System Average Interruption Frequency Index

21 SAIDI and SAIFI measure incidence per customer, and (as long as reserve margin is secured) they do not necessarily have direct linkage with Muara Tawar power plant, however, the data is taken up for the analysis on project impact because they have indirect linkage with the impact of the power plant.

22 The reason is uncertain. According to the executing agency, it cannot deny the possibility of data collection and processing error since data collection and consolidation were conducted manually.

that reserve margin in 2013 fell because of increased power demand while new investments of power sources in that year (1,100MW) did not take place as compared to those of the previous year (4,305MW). (See Table 1)

Clear correlation between the above data trend and this project cannot be observed. There may have been a little contribution of the project, however, it is difficult to measure project impact quantitatively by analysing the data trend.

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

The project falls under A category of the Guideline for Japan Bank for International Cooperation (current JICA) because it is a development project of a large-scale power plant. At the time of appraisal, the executing agency confirmed its state of environmental procedures, pollution measures, and natural and social environmental considerations, and concluded that there was no problem.

Environmental Impact Assessment Report (ANDAL), Environmental Management Plan (RKL), and Environmental Monitoring Plan (RPL) have been approved by the Ministry of Energy and Mineral Resources on December 14, 1994. After that, ANDAL was revised in accordance with changes in state of land use in the project surrounding areas as well as changes in project plan within the power plant site. The revised ANDAL was approved in May 2003 by Regional Impact Control Board of West Java.

The executing agency conducted environmental monitoring before and during the project as well as after the commencement of operation, and no particular negative environmental impact has been reported at the time of ex-post evaluation. In addition, no negative project effect has been identified from the results of interview with the local residents. The summaries of the monitoring results by the executing agency are as follows.

- Before construction (existing power plant): Monitoring was conducted within the power plant site and the surrounding areas (total of four places).
  - Measurements for ambient air quality were all below the standard.
  - Noise level slightly exceeded the standard in one place.
- During construction (first time): Monitoring was conducted within the project site and the surrounding areas (total of four places).
  - As regards ambient air quality, NO2, SO2, CO, CO2, Pb, H2S, particles (PM10), and TSP were all below the standard.
  - Noise levels were all below the standard.
  - Solid wastes were limited in quantity and were handled appropriately.
  - The results of interview survey with 50 local residents near the project site have shown that 40% of the residents expressed their support to the environmental

improvement which was anticipated after project completion.

- During construction (second time): Monitoring was conducted within the project site and the surrounding areas (total of four places).
  - Measurements for ambient air quality were all below the standard.
  - Noise levels were all below the standard.
  - Solid wastes were limited in quantity and were handled appropriately.
- The latest environmental monitoring results (data on ambient air quality and noise levels) within the project site after the commencement of the power plant (Block 5) operation are shown in Table 9. Monitoring was conducted on September 28, 2014. The executing agency has been conducting environmental monitoring every three months.

Table 9: Environmental Monitoring Results after the Commencement of Operation

| Item | Unit | Measurement Record | Standard Note 1) |
|---|---|---|---|
| Ambient Air Quality (24 hours sampling) | | | |
| $SO_2$ | $\mu g/Nm^3$ | 30.61 | 260 |
| $NO_2$ | $\mu g/Nm^3$ | 15.27 | 92.5 |
| CO | $\mu g/Nm^3$ | 1,305 | 9,000 |
| TSP | $\mu g/Nm^3$ | 113.26 | 230 |
| Pb | $\mu g/Nm^3$ | 0.02 | 2 |
| HC | $\mu g/Nm^3$ | 7.6 | 160 |
| $O_3$ | $\mu g/Nm^3$ | < 8 | — |
| Particles (PM10) | $\mu g/Nm^3$ | 48.17 | 150 |
| Particles (PM2.5) | $\mu g/Nm^3$ | < 5 | 65 |
| Noise (recorded on following time) | | | |
| 7:00 | dB | 59.5 | 70 |
| 10:00 | dB | 61.3 | 70 |
| 15:00 | dB | 61.9 | 70 |
| 20:00 | dB | 59.9 | 70 |
| 23:00 | dB | 59.7 | 70 |
| 1:00 | dB | 59.2 | 70 |
| 4:00 | dB | 58.8 | 70 |

Source: Information provided by executing agency

Note 1) National Standards in Indonesia (Standards in Jakarta Capital Region) [23]

Data on positive impacts on the natural environment (reduction of discharge density of air pollutant) does not exist because the project was a development of new power plant (Block 5) and the fuel used for power generation was natural gas in the first place.

On the other hand, the existing Muara Tawar power plants (Block 1-4) had been installed with dual type turbines, compatible with both gas fuel and diesel oil fuel. Since 2008, these

[23] Standards based on Kep Gub DKI Jakarta Governor Decree No. 551/2001.

existing power plants have converted the fuel from diesel oil to gas in generating power, contributing to the reduction of environmental burdens.

3.4.2.2 Land Acquisition and Resettlement

At the time of appraisal, necessary land had already been acquired, and land acquisition and resettlement were not expected.. However, as a result of survey conducted after the commencement of the project, it became clear that layout problems would occur if land for the power plant were not newly extended. For this reason, the executing agency decided to acquire land.[24] Moreover, the executing agency decided to acquire additional land based on the request from local residents living in adjacent land outside Block 5 extended area to buy their land. Table 10 shows the results of land acquisition.

Table 10: Results of Land Acquisition

| | |
|---|---|
| Areas of acquisition (for extended areas for Block 5 and for adjacent land outside Block 5) | 5.7ha |
| Removed structures | 33 |
| Number of land ownership | 228 |

Source: Information provided by executing agency

The land acquisition process was properly carried out based on the governing Indonesian regulations.[25] Consultations with the affected residents were conducted repeatedly, and no particular problem was pointed out by local residence regarding land acquisition and process for payment of compensation. Residents who needed to be resettled[26] received compensation and desired to move to the nearby land on their own, therefore, development of alternative land was not necessary for the executing agency. According to the interview survey with the residents, resettlement process to the nearby land, including negotiation of compensation of land, took place smoothly after public hearing was conducted by the executing agency. As part of CSR activities of the executing agency, mosques and nursery schools have been constructed near the project site. Among the affected residents, there are residents engaging in duties at the power plant such as cleaning, which has become their income source.

24 Remote cause of land acquisition is the lack of feasibility study of the project in the first place. At the time of appraisal, drawing of the existing power plants (Block 1 and 2) was utilized for the layout plan of the project (Block 5), and the power plant was anticipated to fit in the site. However, after the survey, it revealed that land acquisition was necessary.

25 Governing regulations are Presidential Decree No.36-2005 and No.65-2006 (revised regulation).

26 Although repeated inquiry was made during the local interview survey, the number of resettled households is unknown since the data was not left in the executing agency.

This project has largely achieved its objectives. Therefore effectiveness and impact of the project are high.

Transformer

Water Intake

3.5 Sustainability (Rating: ③)

3.5.1 Institutional Aspects of Operation and Maintenance

The operation and maintenance of the power plant (Block 5) after project completion is undertaken by Java Bali Power Company (hereinafter referred to as "PJB[27]"). PJB is an affiliate company[28] of PLN, the executing agency, and is undertaking operation and maintenance of the existing Muara Tawar power plants (Block 1-4). Performance based contract has been concluded between PLN and PJB, and operation and maintenance budget has been allocated to PJB from PLN based on the contract.

The total number of employees at PJB as of 2014 is 4,417, of which 3,821 are engineers in charge of operation and maintenance. At the time of ex-post evaluation, PJB is in charge of operation and maintenance of 26 power plants including Muara Tawar.

For the purpose of increasing efficiency and performance in its operation, PJB initiated "Integrated Management System" in its organizational management in 2012, which covers human resource management/personnel utilization, management and procurement of maintenance system and spare parts, fuel management, safety management and so on. Under this system, PJB introduced "Maintenance Optimization Program" called "Big O" for efficient operation. According to Muara Tawar power plant staffs, PJB's such management system and the program's way of thinking have penetrated across staffs, and

27 PT. Pembangkitan Jawa-Bali

28 PLN has 47 business units across the country for generation, transmission, transformation and distribution. As regards generation assets and operation and maintenance in the Java-Bali system., two affiliate companies (PJB and PT. Indonesia Power) were divided from the generation section in 1995, and have been promoting efficient operation. (PLN reshuffled its organization in December 2009. The organization used to be siloed into two sections: construction, and sales/administration. The verticals were then reorganized into regional division to assure consistency from planning to procurement, construction, generation, transmission, distribution and sales, to realize more efficient operation.)

instruction system between PJB and the power plant is clear. The organizational structure of Muara Tawar power plant is illustrated in Figure 3.

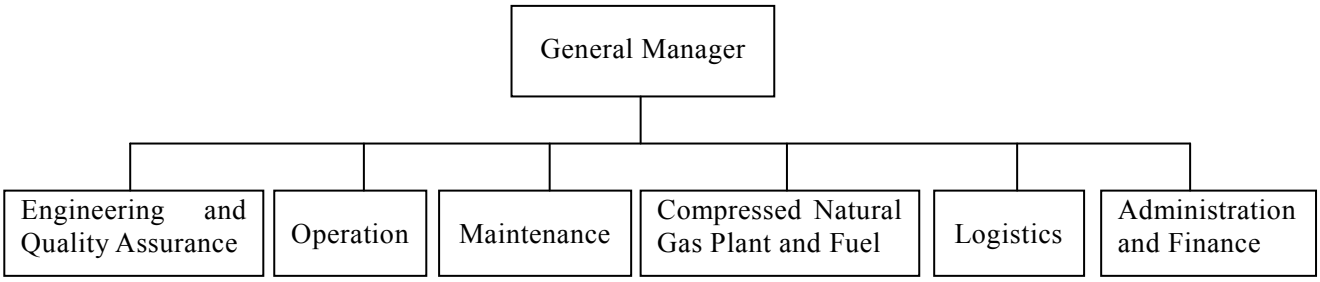



Figure 3: Organizational Structure of Muara Tawar Gas Power Plant

Source: Information provided by executing agency

Under the General Manager, 261 staffs are working in the entire power plant, and of which 72 are engineers. According to power plant staffs, number of engineers necessary for operation and maintenance has been secured. No particular problem has been identified regarding the organizational structures of this power plant as well as PJB which manages the power plant.

3.5.2 Technical Aspects of Operation and Maintenance

Engineers who have gained sufficient experiences through operation and maintenance of the existing power plant are undertaking operation and maintenance work of the power plant (Block 5) after completion of the project. In addition, during project implementation, contractors and consultants have provided necessary training and technology transfer for operation and maintenance of Block 5 power plant to 17 staffs who have been in charge of operation and maintenance of the existing power plant (these include domestic training as well as training and inspection in Japan and in Germany). Also, PJB has prepared work instructions for staffs by adding easy-to-understand explanations to the manuals which contractors had prepared. The manuals/work instructions have been utilized for daily operation and maintenance work as well as periodic inspections. Moreover, on the job training is provided to operation and maintenance staffs. Therefore, it can be observed that technical level of operation and maintenance staffs is sufficient for ordinary maintenance work.

Furthermore, PJB has acquired ISO 90001 (quality management system), ISO 14001 (environmental management system), ISO 55000 (asset management system/risk management system), OHSAS 18001(occupational health and safety management system), and operation and maintenance of Muara Tawar power plant has been taken place in

conformity with these management systems.

Therefore, no particular problem has been identified regarding the technical aspects of operation and maintenance.

3.5.3 Financial Aspects of Operation and Maintenance

The operation and maintenance costs are estimated by Muara Tawar power plant, and the estimation will be reviewed by PLN via UPJB[29] in Yogyakarta, which administers the power plant. The budget is allocated from PLN to the power plant based on the performance based contract between these organizations. Table 11 shows comparison of planned and actual maintenance cost of the power plant (Block 5) after completion of the project. The power plant's maintenance cost has been properly secured, and is well operated and maintained.

Table 11: Maintenance Cost of the Power Plant (Block 5)

(Unit: million IDR)

| 2012 | | 2013 | | 2014 | |
|---|---|---|---|---|---|
| Plan | Actual | Plan | Actual | Plan | Actual (up to October) |
| 30,925 | — Note 1) | 57,316 | 74,739 Note 2) | 57,211 | 52,398 Note 3) |

Source: Results from questionnaire survey of executing agency

Note 1) The reason for the unavailable figure on the actual maintenance cost in 2012 is that contract between PLN and PJB had not been concluded procedurally then, and PLN paid the expense incurred in connection with maintenance. (Maintenance cost including the expense paid by PLN in the previous year has been allocated to PJB in 2013.)

Note 2) The actual allocation in 2013 was below the total amount of budget for 2012 and 2013 because the operation of the power plant was smooth without any problem and thus maintenance cost turned out to be lower than expected.

Note 3) The actual allocation in 2014 was below the budget because the figure was up to October.

When reviewing the overall financial situation of PLN, while electricity sales have been increasing smoothly every year, the organization would become mired in deficits without government subsidy – PLN is supported by a big amount of government subsidy. Based on "Public Service Obligation",[30] PLN has no choice but to sell electricity at the price that is lower than supply cost, and the generated losses have been compensated by the government

[29] Unit Pembangkitan Jawa-Bali

[30] The government subsidy to PLN is stipulated in the Article 66 of the Law on State Enterprises of 2001. (Financial compensation for state-owned enterprises.)

subsidy. Main factors behind the high-cost structure are identified as the high financial burden for fuel and lubricants necessary for power generation, low electricity tariff, and so on. Financial performance and balance sheet of PLN are shown in the tables below.

Table 12: Financial Performance of PLN Note 1)

(Unit: billion IDR)

| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Sale of Electricity | 102,974 | 112,845 | 126,722 | 153,486 |
| Government's Electricity Subsidy | 58,108 | 93,178 | 103,331 | 101,208 |
| Other Revenues | 1,293 | 1,995 | 2,604 | 2,711 |
| Total Revenues | 162,375 | 208,018 | 232,656 | 257,405 |
| Fuel and Lubricants | 84,190 | 131,158 | 136,535 | 147,634 |
| Maintenance | 9,901 | 13,593 | 17,567 | 19,839 |
| Personnel | 12,954 | 13,197 | 14,401 | 15,555 |
| Other Operating Expenses Note 2) | 42,062 | 27,692 | 34,612 | 37,883 |
| Total Operating Expenses | 149,108 | 185,640 | 203,115 | 220,911 |
| Income Before Financial and Other Items | 13,267 | 22,378 | 29,541 | 36,493 |
| Net Financial and Other Items Note 3) | -1,861 | -16,863 | -28,509 | -75,715 |
| Tax Benefit | -1,313 | -89 | 2,174 | 9,654 |
| Income (Loss) for the Year and Total Comprehensive Income | 10,093 | 5,426 | 3,206 | -29,567 |

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.

Table 13: Balance Sheet of PLN Note 1)

(Unit: billion IDR)

| | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|
| Total Assets | 406,100 | 476,453 | 549,376 | 595,877 |
| Total Noncurrent Assets | 361,327 | 409,530 | 472,066 | 511,040 |
| Total Current Assets | 44,773 | 66,923 | 77,310 | 84,837 |
| Total Equity and Liabilities | 406,100 | 476,453 | 549,376 | 595,877 |
| Total Equity | 142,114 | 154,683 | 159,270 | 133,232 |
| Total Noncurrent Liabilities | 208,590 | 258,219 | 315,503 | 374,331 |
| Total Current Liabilities | 55,397 | 63,550 | 74,603 | 88,315 |

Source: PLN Annual Report

Note 1) Partial inconsistency of figures exists due to rounding error

PLN aims to reduce government subsidies, raise the electricity tariff, increase self-financing ratio, and introduce private fund aggressively, in order to improve its financial and management conditions. Electricity pricing is a decision matter of Indonesian government, which is out of control of PLN, though the government has been expanding

customer categories introducing floating tariff as a direction of reform.[31] Furthermore, PLN has been producing corporate bonds, and the ratings by the credit rating agencies have been good.[32] However, government's subsidy may increase in the future considering the government's policy to improve electrification ratio of the entire country – electric power sales to unprofitable customers, the households with little power consumption, are expected to increase, and this would raise government's subsidy. For this reason, PLN has aimed to increase efficiency through converting diesel and oil to high efficiency coal, gas, geothermal, developing more efficient power generation facilities, decreasing transmission and distribution losses and so on to reduce power cost and to decrease government's subsidy. Table 14 shows the projected electrification ratio, number of residential customers, and transmission and distribution losses in the entire country.

On the other hand, such PLN's financial situation will not directly affect the project because, as mentioned above, maintenance cost for the power plant (Block 5) has been appropriately financed and the power plant has been well operated and maintained. Therefore, no particular problem has been identified regarding the financial aspects of operation and maintenance.

Table 14: Projected Electrification Ratio, Number of Customers (Residential), and Transmission and Distribution Losses in Indonesia

| | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 |
|---|---|---|---|---|---|---|---|---|---|---|
| Electrification Ratio (%) | 87.7 | 91.3 | 93.6 | 95.7 | 97.4 | 98.4 | 98.9 | 99.1 | 99.3 | 99.4 |
| Number of Customers – Residential (million) Note 1) | 56.0 | 59.1 | 61.3 | 63.5 | 65.4 | 66.8 | 67.9 | 68.7 | 69.5 | 70.3 |
| Transmission and Distribution Losses (%) | 6.72 | 6.68 | 6.61 | 6.57 | 6.51 | 6.48 | 6.46 | 6.44 | 6.42 | 6.40 |

Source: PLN

Note 1) According to PLN, most are households with little electricity consumption.

[31] The Ministry of Energy and Mineral Resources has indicated to introduce floating tariff for electricity in 12 customer categories out of 17 in total, which would not be eligible for government's electricity subsidy. This measure is based on the Presidential Decree No. 31 in 2014 to increase the number of customers who pay their electricity consumption based on floating tariff, in accordance with the market price. In fact, major electricity customers for industry were added as the target for this floating tariff from January 1, 2015. Fixed tariff will be maintained as before to households with little power consumption, commercial facilities and industries with less than a capacity of 200kVA. (Source: "Jakarta Shimbun", dated December 6, 2014.)

[32] Ratings as of the end of December, 2013 were as follows: Moody's: Baa3 stable, Standard & Poor's: BB, Fitsch: BBB-. (Source: PLN Annual Report.)

3.5.4 Current Status of Operation and Maintenance

The power plant facilities (Block 5) have been maintained well and operated smoothly. Maintenance activities (maintenance and inspections) have been conducted appropriately and no particular problem has been observed. Concretely, daily maintenance, periodic maintenance (weekly, monthly, every two months, and quarterly maintenance), condition based maintenance, corrective maintenance, preventive maintenance, and predictive maintenance activities have been conducted on site. As mentioned above, "Maintenance Optimization Program" has been introduced, and the executing agency aims to reduce accident ratio and to increase efficiency of the entire operation through raising the share of preventive maintenance (periodical cleaning, exchange of filters, inspection of various facilities etc.) and predictive maintenance (prevention of power plant's overheating and abnormal vibration by analyzing the past records). Inspections are conducted for every 9,000 hours of operation and major inspections for every 36,000 hours of operation.

As regards spare parts, PJB has introduced "Supply Chain Management System" in 2002 with the aim to realize automatic management of inventory system. Muara Tawar power plant has also adopted this system and has been securing necessary spare parts on a timely basis. Concretely, spear parts have been categorized A, B, and C, based on their importance,[33] and the power plant staffs are automatically reminded of necessary spear parts to be refilled, based on the inventory status and predicted period of time for the spear parts to be actually procured.

As regards gas fuel, PLN has concluded contracts with several gas supply companies to secure necessary gas. Table 15 summarizes the actual and projected gas fuel supply and demand for the entire Muara Tawar power plant including this project (Block 5).

Therefore, no particular problem has been identified regarding the current status of operation and maintenance.

Table 15: Actual and Projected Gas Fuel Supply and Demand for Muara Tawar Power Plant

Note 1), 2)

(Unit: BBTUD)

| | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|
| Total Demand of PLTGU Muara Tawar | 125 | 161 | 150 | 183 | 211 | 217 | 215 | 213 |
| Total Gas Supply | 147 | 182 | 180 | 264 | 213 | 217 | 217 | 219 |
| Pertamina | 35 | 31 | 25 | 24 | 20 | | | |

[33] In case spear parts have not been procured in a timely manner, lack of A category spear parts would cause highly serious problems such as blackouts, lack of B category spear parts would cause temporary problems such as power output losses, and lack of C category spear parts would cause some problems but not to the point of affecting power outputs.

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| PGN | 113 | 109 | 125 | 161 | 41 | 41 | 41 | 41 |
| Medco | | | | | 43 | 33 | 25 | 19 |
| Jambi Merang | | 42 | 30 | 20 | 35 | 35 | 35 | 35 |
| PHE | | | | | | 25 | 25 | 25 |
| Swap Premier | | | | 4 | 5 | | | |
| FSRU Lampung | | | | 55 | 68 | 83 | 91 | 99 |

Source: Results from questionnaire survey of executing agency

Note 1) Partial inconsistency of figures exists due to rounding error

Note 2) Actual figures for the year 2011 to 2014, and projection for the year 2015 to 2018.

No major problems have been observed in the institutional, technical and financial aspects of the operation and maintenance system. Therefore sustainability of the project effects is high.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

This project developed a new gas-fired combined cycle power plant in the existing Muara Tawar power complex with the aim of improving power supply and demand balance as well as improving stability and maintaining quality of power supply in the Java-Bali system. The project objective – to meet increasing power demand from both quantity and quality viewpoints by providing basic support to develop new power source until PLN and private enterprises can make on investment in power generation – is consistent with Indonesia's energy/power policy and with the development needs, as well as Japan's ODA policy; thus, the relevance of the project is high. All the Operation and Effect Indicators set at the time of appraisal have been achieved against the target figures after the commencement of power generation. It is worthy of special mention that the project is located in Jakarta Capital Region where there is a greatest demand of electricity, and is playing an important role to reduce power loss and to maintain quality (voltage) of power supply in the Java-Bali system. The power plant has been operating smoothly and project effects have appeared as planned; thus, the project's effectiveness and impact are high. No negative impact on natural environment has been pointed out. Land acquisition and resettlement which were not expected at the time of appraisal took place, however, the process was properly carried out in accordance with the governing Indonesian regulation and no particular problem has been pointed out. Both the project cost and project period exceeded the plan though not significantly; thus, efficiency of the project is fair. No major problem has been observed in the institutional, technical and financial aspects of the operation and maintenance system; thus, sustainability of the project effects is high.

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

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

None

### 4.2.2 Recommendations to JICA

None

## 4.3 Lessons Learned

The importance of the executing agency's cross-sectoral and comprehensive risk analysis regarding fuel supply as well as proactive sharing and consultation of its results with the central government in consideration of facilitating cross-ministerial coordination

The delay of gas supply was one of the main reasons for the project delay. The executing agency had initially planned to supply gas from the gas field in South Sumatra for which an affiliated private energy company reserved the concession, through South Sumatra-West Java gas pipeline to the plant. However, long negotiation failed to reach an agreement between the executing agency and the company over risk-taking of the gas pipeline which was under construction. While construction of the gas pipeline was completed in August 2008, the executing agency revised the original gas procurement plan, and concluded a gas purchase contract with a state-owned gas enterprise in Indonesia (PGN) in the end. If the executing agency had been more risk-conscious at an early stage and undertaken sufficient analysis from cross-sectoral and comprehensive perspectives on risk associated with prolonged contract negotiation with the private energy related company to the project and power supply to the Java-Bali system (possible risk that may occur from project delay and delay of commencement of power supply as a consequence), then it could have sought to secure project implementation by considering and adopting alternative options before contract negotiation was extended for a long period of time. In other words, the executing agency could have: (1) conducted sufficient risk analysis regarding possibility of prolonged contract negotiation with the private energy related company, (2) communicated with the central government (Ministry of Energy and Mineral Resources) on the results of analysis, and (3) considered alternative measures to secure fuel for the project and urged the central government to do the necessary cross-ministerial coordination in a timely manner. In view of the above, it is critical that the executing agency extensively conducts cross-sectoral and comprehensive risk analysis on fuel supply, urges the central government based on the analysis as required, and encourages the government to take appropriate actions including cross-ministerial coordination. The above lessons learned should be considered applicable

to PLN's other thermal power plant development projects.

<For reference>

The executing agency of the project has set up a "Risk Management Division" in December 2009, thereby establishing a system to conduct cross-organizational and comprehensive risk analysis from technical and operational perspectives. Risk management unit existed before then, however, its function had been limited to reviewing decisions made by the board, and in-depth, and comprehensive analysis on the executing agency's company-wide corporate risk had not taken place.

4.4 Others

In relation to this project, JICA decided to take measures[34] against the main contractor as they admitted their involvement in bribery.

End

[34] http://www.jica.go.jp/english/notice/150209_01.html

Comparison of the Original and Actual Scope of the Project

| Item | Plan | Actual |
|---|---|---|
| 1.Project Outputs | 1) Civil Works, Procurement of Equipments etc.<br>・ Construction of one gas turbine generator (150 MW class×1unit)<br>・ Construction of one steam turbine generator (75 MW class×1)<br>・ Construction of one heat recovery steam generator<br>・ Increase/extension of common facilities that need for adding on the gas fired combined cycle system (gas supply facilities, 500kV switchyard etc.)<br>・ Related civil works and construction works<br><br>2) Consulting Services<br>・ Detail design, assistance in tendering, construction supervision, inspection, testing, and delivery control during manufacturing, support in operation and maintenance during project period, assistance in environmental management, transfer of technology, training etc. | 1) Civil Works, Procurement of Equipments etc.<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ As planned<br>・ Additional scope: Installation of Continuing Emission Monitoring System (CEMS)<br><br>2) Consulting Services<br>・ As planned<br>・ Additional scope due to installation of CEMS |
| 2.Project Period | Mar. 2003 – May 2009<br>(75 months) | Jul. 2003 – Oct. 2012<br>(112 months) |
| 3.Project Cost<br>Amount paid in Foreign currency | 15,617 million yen | 24,153 million yen |
| Amount paid in Local currency | 5,797 million yen<br>(446,077 million IDR) | 4,528 million yen<br>(371,003 million IDR) |
| Total | 21,414million yen | 28,681million yen |
| Japanese ODA loan portion | 18,182million yen | 16,526million yen |
| Exchange rate | 1 IDR=0.013 yen<br>(November 2002) | 1 IDR=0.012 yen<br>(November 2006) |

[END]

Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Rehabilitation and Improvement Project of Jakarta Fishing Port"

External Evaluator: Keiko Watanabe,
Mitsubishi UFJ Research & Consulting Co., Ltd

## 0. Summary

The project aimed to restore the function of the Jakarta Fishing Port (hereinafter referred to as "JFP") and to make effective use of related facilities by elevating quaywalls and other major facilities which have sunk down by the land subsidence effect. The target quaywalls were constructed by the Phase 1 project (completed in 1982). In addition to the quaywalls, the project rehabilitated breakwaters, revetments and roads which were also affected by the land subsidence, and constructed a control tower.

The project is well consistent with the development policy and development needs of Indonesia, as well as with the Japan's ODA policy; thus, the relevance of the project is high. All of the operation and effect indicators, i.e., fish landing volume, fish landing value, total berthing income and total number of operation days for Control Tower reached the target level, thus, the restoration of the function of JFP was confirmed. A beneficiary survey also confirmed the improvement of quality of fishery products by better sanitary and hygienic conditions of JFP and the enhancement of convenience for port users by the project. In addition, JFP has been expanding with having more than 300 fishery companies and 46,000 employees. This contributed to the promotion of fishery industry in Indonesia. In particular, impact was observed on the generation of employment for women living close to JFP after restoring the functions by the project. Therefore, effectiveness and impact of the project are high. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, efficiency of the project is fair. In regard to operation and maintenance, the clear divisions of work and responsibility have not been made between the two organizations, "UPT" under the Ministry of Marine Affairs and Fisheries and "PERUM" under the Ministry of Ministry of State-Owned Enterprises. Therefore, some issues were observed in the institutional aspects. It was also found that there was room for improvement in staffing and financial aspects; thus, sustainability of the project is fair.

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

## 1. Project Description


Project Location

Jakarta Fishing Port (Control Tower)

### 1.1 Backgrounds

Indonesia is the third largest maritime country having waters with its fishing rights waters of 5.87 million km$^2$ including 3.17 million km$^2$ of territorial waters and 2.7 million km$^2$ of Exclusive Economic Zone (EEZ) waters. The nation has huge marine fishery resources with more than 8 million tons of fish landing a year. In order to promote effective use of the affluent fishery resources, total of 589 fishing ports (at the time of 2004) had been established across Indonesia as infrastructure directly related to the marine fisheries. JFP was one of them and one of 31 government managed ports at the time of appraisal. JFP is a port for serving the ocean-going fishing vessels with capacity of berthing as much as 200 tons ships (full capacity). Japan has been provided Yen loan to develop JFP for four times since 1970's[1] and it became a largest fishing port in Indonesia. However, JFP has been affected and sinking down by the land subsidence mainly due to the excessive deep ground water pumping in Jakarta city. The settlement had reduced the functionality of the JFP. In light of this, the urgent measures such as elevating east and west quaywalls which were mostly affected by the settlement were required to maintain the function of the port and to make effective use of the related facilities.

[1] Basic infrastructure of the port was constructed for the Phase 1 and Phase 2 projects. Phase 1 project developed lands by reclaiming, and constructed revetments, breakwaters, light houses and so on. Phase 2 project constructed minimum required facilities to operate port on the reclaimed lands such as refrigeration facilities, ice works factory, place for landing fish, administrative office, and drainages. In Phase 3 (Engineering services), a master plan for JFP was developed aiming JFP to have a full function as a fishing port, distribution center, and a place for building and developing fishery industry. In Phase 4, the port was expanded and modern sewage water treatment center, administration office and landing place for fresh tuna were newly constructed in order to meet the increasing fishing volume and enhance convenience for port users.

### 1.2 Project Outline

The objectives of the project are to maintain the function of the port and to make effective use of the related facilities in Jakarta Fishing Port by elevating major facilities such as east and west quaywalls which were sank by the subsidence effect, thereby contributing to the promotion of effective and sustainable use of marine and fishery resources.

| | |
|---|---|
| Loan Approved Amount/<br>Disbursed Amount | 3,437 million yen /<br>3,382 million yen |
| Exchange of Notes Date/<br>Loan Agreement Signing Date | March 2004 /<br>March 2004 |
| Terms and Conditions | Interest Rate: 1.3 %<br>Repayment Period: 30 years (Grace Period: 10 years)<br>Condition for Procurement: General Untied<br>Consultant: Untied |
| Borrower/<br>Executing Agency(ies) | The Government of Republic of Indonesia /<br>Directorate General of Capture Fisheries (DGCF),<br>Ministry of Marine Affairs and Fisheries (MMAF) |
| Final Disbursement Date | September 2012 |
| Main Contractor<br>(Over 1 billion yen) | ・Package 1 (Lot1): TOA Corporation (Japan) / PT. Pembangunan Perumahan JO (Indonesia) (JV)<br>・Package 2 (Lot2): PT. Hutama Karya (Persero) (Indonesia)<br>・Package 3 (Lot3): TOA Corporation (Japan) / PT. Pembangunan Perumahan JO (Indonesia) (JV) |
| Main Consultant<br>(Over 100 million yen) | Oriental Consultants Co., Ltd. (Japan) / PT. Perentjana Djana (Indonesia) (JV) |
| Feasibility Studies, etc. | ・Feasibility Study on Construction of Jakarta Fishing Port/Market Development (1974)<br>・Rehabilitation Needs Survey on Yen Loan Completed Project (2000)<br>・Distribution Mechanism Reform through Development of Wholesale Market (Improving of Post-Harvest Handling and Marketing Facilities) (2011) |
| Related Projects | ＜Yen Loan Project (L/A date)＞<br>・Jakarta Fishing Port/Market Development Project (1) (March 1979)<br>・Jakarta Fishing Port/Market Development Project (2) (June 1980)<br>・Jakarta Fishing Port/Market Development Project (3) (March 1985)<br>・Jakarta Fishing Port/Market Development Project (4) |

| | |
|---|---|
| | (November 1993)<br><br>＜Technical Cooperation Project＞<br>・Project for the Promotion of Port Maintenance and Management Skills (September 2004 – September 2006)<br>・Dispatch a Policy Advisor on Fishery (March 2013 - March2015)<br><br>＜Other Donors and International Organization＞<br>・World Bank: Technical Assistance on Restructure of the Ministry of Marine Affairs and Fisheries (2004)<br>・Asia Development Bank: Development of Fishing Ports Infrastructure, Assistance in Marine Resources Management<br>・World Bank: Water Resources Sector Adjustment Loan Project (WATSAL) |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

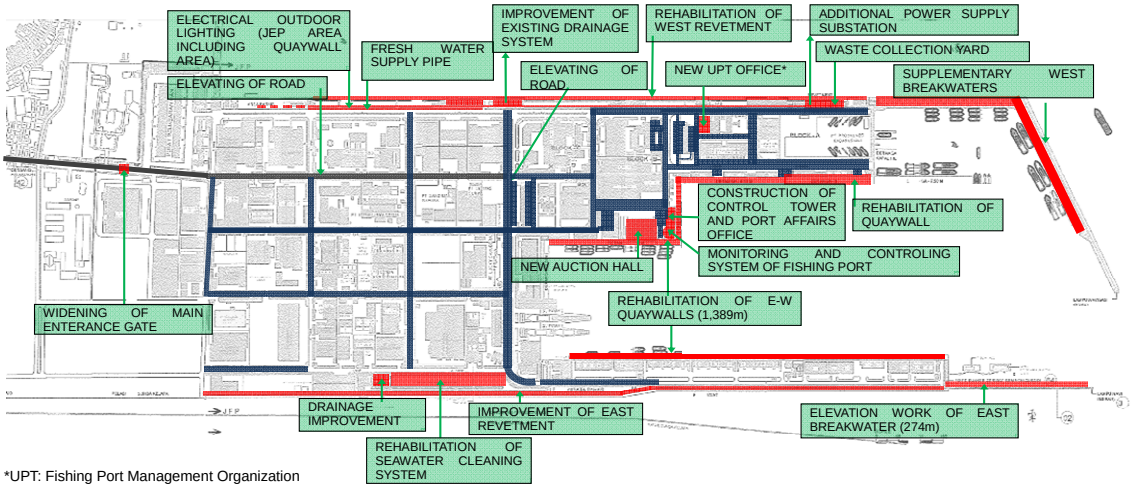
Keiko Watanabe, Mitsubishi UFJ Research & Consulting Co., Ltd.

### 2.2 Duration of Evaluation Study

Duration of ex-post evaluation study was conducted as follows;

Duration of the Study: September 2014 – September 2015

Duration of the Field Survey: December 10 – December 22, 2014, March 16 – March 20, 2015




Source: Modified based on the map provided by the executing agency

Figure 1: Jakarta Fishing Port (Main project sites)

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

### 3.1 Relevance (Rating: ③[3])

#### 3.1.1 Relevance to the Development Plan of Indonesia

In PROPENAS (2000-2004), the national five-year development plan of Indonesia at the time of appraisal, "economic recovery and securing sustainable economic recovery" was listed as one of the priority issues and stipulated function maintenance of existing infrastructure by rehabilitation and improvement as its strategy. In addition, in fishery sector in the above development plan, improvement of productivity and quality of fishery products and income generation of fishery workers were listed as important issues. Furthermore, a master plan formulated by the Directorate General of Capture Fisheries (hereinafter referred to as "DGCF") in 2003 emphasized on the role of JFP as a port for ocean-going vessels to promotion of fishery industry. Therefore, the objective of the project that restores the function of JFP is in line with the master plan.

PRJMN (2010-2014), the national five-year development plan at the time of the ex-post evaluation, prioritizes strategic development inside of the territorial water and conservation of marine resources. In addition, new administration of Indonesia since October 2014 launched "maritime doctrine" highlighting importance of conservation of marine resources and construction of marine infrastructure.

In light of the above, the objective of the project is in line with the development policy of Indonesia both at the time of appraisal and the ex-post evaluation.

#### 3.1.2 Relevance to the Development Needs of Indonesia

At the time of appraisal, mainly due to the excessive deep ground water pumping in Jakarta city, the quaywalls and revetments which were constructed in the Phase 1 project had been sinking down. It brought not only the inconvenience for fish landing since the water flowed into the landing place at the time of high tides but also created problems in hygiene of fishery products and in operation of fishery processing factories. JFP plays an important position for Indonesian economy in terms of fish industry and employment. Considering the serious influence on the business in the JFP[4], the rehabilitation of the JFP had high urgency and importance.

At the time of the ex-post evaluation, JFP generated about 46,000 employments and

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[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory

[3] ③: High, ②: Fair, ①: Low

[4] JFP held a prominent position since fish landing volume of JFP occupied about 60,000 ton (about 22%) of total amount of 31 government managed ports, which was about 280,000 ton at the time of 1988. Besides, since late 1980's the demand of tuna has been rapidly increased in the international market. JFP which is close to the international airport and has facilities to deal with fresh and frozen tuna assumed important role to promote fishery industry and obtain foreign currency. At the time of appraisal, JFP became one of the leading ports in the world which had more than 100 private companies operated and generated more than 30,000 employees inside the port.

handled about 100 million yen worth fishery production every day; therefore, JFP continues to play an important position for Indonesian economy. Additionally, the settlement has been progressing even at the time of the ex-post evaluation and the land around JFP keeps sinking down at an annual pace of 7-15 cm. The land subsidence is the serious problem not only for JFP but also Jakarta city as a whole; however, the effective countermeasures have not been identified yet. Therefore, the need of the project, which is to prevent flood in JFP, is high even at the time of the ex-post evaluation.

3.1.3 Relevance to Japan's ODA Policy

JICA prepared the "Mid-Term Strategy for Overseas Economic Cooperation Operations" in April 2002, based on the Japan's assistance policy to Indonesia. In this document, "infrastructure development for economic growth" was put as one of priority areas and "economic infrastructure development" which was vital for recovery towards sustainable growth through economic reform was promoted as country specific assistance to Indonesia. Country assistance strategy to Indonesia formulated in October 2003 stipulates "creating environment for private sector led development" as one of important issues. Since the project which strengthened economic infrastructure through rehabilitation of the Fishing Port and related facilities would contribute to the economic growth, the project was in accordance with the assistance policy of that time.

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

## 3.2 Efficiency (Rating:②)

3.2.1 Project Outputs

(1) Civil Works

Comparison of planned and actual project outputs is summarized in Table 1.

Table 1: Comparison of Planned and Actual Project Outputs

| | Construction Works | Planned | Actual |
|---|---|---|---|
| Package1 | 1-1)Elevation of East and West Quaywalls[5] | West : 574m<br>East : 775m<br>Total : 1,349m | West : 614m<br>East : 775m<br>Total : 1,389m (West: add 40m) |
| | 1-2) Rehabilitation of West Breakwaters[6] | 600m | 594m (difference is a result of actual measurement) |
| | 1-3) Control Tower | New Construction | As planned |
| | Additional works | - | 1) Elevation of East and West Breakwaters (West: 745m, East |

[5] Quaywall is a structure that ships can be tied up for landing goods and fish. The quaywall are equipped with barrier curbs, mooring posts for tied up ropes of ships, and rubber buffers between wall and ships.
[6] Breakwater is a structure that protects harbor and coast lines from the wave actions of off shore.

| | | | |
|---|---|---|---|
| | | | 272m)<br>2) Dredging[7] in front of -4.5 m revetment<br>3) Construction of Port Authority Office |
| Package2 | 2-1)Rehabilitation of roads near the main gate | Distance: 300m<br>Width: 6m | Additional rehabilitation was done other than the planned distance (distance 6,250m、width 6-18m) |
| | Additional Works | - | 1) Rehabilitation of West Revetments[8] 1,113m<br>2) Rehabilitation of East Revetment 1,500m<br>3) Improvement of Existing Drainage system |
| Package3 | Additional Works | - | 1) Expansion of Quaywalls 175m, width 20m<br>2) Improved Sea Water Cleaning System (change of installation point of outlets<br>3) Construction of Revetment near Shipyard<br>4) Improvement of Waste Water Treatment System<br>5) Improvement of Fresh Water Supply System<br>6) Construction of Waste Collection Yard (including provision of backhoe loader and compactor truck)<br>7) Construction of Auction Hall (two storied)<br>8) Expansion of UPT Office (five storied)<br>9) Installment of Solar Outdoor lightning (147 lightings)<br>10) Installment of Monitoring Control System (CCTV system)<br>11) Additional Installment of Power Supply (for backup when blackout) |

Source: Information provided by JICA, Results of questionnaire and interviews to executing agency

Photo 1: Main Gate of JFP
(January, 2008)


Photo 2: Main Gate of JFP
(At the time of the Ex-post Evaluation)

Source: DGCF

[7] Dredging is an excavation work which removes sediments from the bottom of harbors and others.
[8] Revetment is a structure that prevents lands behind from erosion. Ships cannot moor at revetments.

Photo 3: Access Road inside JFP
（January, 2008）
Source: DGCF

Photo 4: Access Road inside JFP
（At the time of the Ex-post Evaluation）

Photo 5: Elevated West Quaywall
（At the time of the Ex-post Evaluation）

Photo 6: UPT Office (extension)
（At the time of the Ex-post Evaluation）

Photo 7: Sewage Treatment System
（At the time of the Ex-post Evaluation）

Photo 8: Sea Water Cleaning System
（At the time of the Ex-post Evaluation）

Intended outputs were implemented almost as planned. The additional and some changes of works occurred due to the following reasons. Those changes are deemed appropriate since all of them were intended to restore the functions and enhance effectiveness of JFP.

- Massive flood in entire area of Jakarta city happened in 2007 and 2008 during the construction period of the project and caused extensive damage on JFP including roads and drainage system inside of JFP (Photo 1 and Photo 3). For this reason, the additional

works were required as emergency flood measures.

- The land subsidence and sea level rise (which is assumed to be caused by climate change) have advanced more than it was expected at the time of appraisal. It caused flood especially from the west revetment and the construction works were also affected by the flood. Therefore, the elevation of other areas of quaywalls and revetments which were not in the initial plan was urgently required.
- Other facilities which were not functioning well due to the flood and aging including roads, drainage, east and west revetment, reservoir for flood control, drainage pumps and so on had to be improved.

The construction was done by the method with an emphasis on economic efficiency. For example, the depth of piles for elevation of quaywalls was decided to be the same -20m as the existing one from the view of economic efficiency. However, the piles made of concrete were adopted to have strength withstanding future elevation. Similarly, for the improvement of the breakwaters, instead of conventional way of heightening by elevation, the project incorporated efficient and environmentally friendly ideas. The project expanded width and planted dense mangrove to absorb waters by driving sheet piles and putting sediments on the inner side of the existing breakwater.

Photo 9: Breakwater using Mangrove (2011)
Source: DGCF

Photo 10: At the time of the Ex-post Evaluation（December, 2014）

(2) Consulting Services

Table 2 shows the comparison of planned and actual inputs of consulting services. It was found the reason of increase in actual man months (hereinafter referred to as “M/M”) of both foreign and local consultants was mainly due to the extension of project period associated with additional civil works.

Table 2: Comparison of Planned and Actual Inputs of Consulting Services (M/M)

| | Plan | Actual | Comparison |
|---|---|---|---|
| Foreign Consultants | 69 | 81.2 | Increased by 12.2 |
| Local Consultants | 217 | 285.2 | Increased by 68.2 |
| Total | 286 | 366.4 | Increased by 80.4 |

Source: Information from JICA and results from questionnaire survey to the executing agency

### 3.2.2 Project Inputs

#### 3.2.2.1 Project Cost

At the time of appraisal, total project cost was planned to be 4,056 million yen (out of which 3,437 million yen was to be covered by Japanese ODA loan). In reality, the total project cost was 4,056 million yen (out of which 3,382 million yen was covered by Japanese ODA loan) which was as planned (100% of the planned amount).

The reason why the total project cost was as planned despite the additional outputs was mainly due to the exchange gains from the strong yen[9]. Since the construction contract was nearly 100 percent rupiah-denominated, the surplus with the yen gains was utilized.

#### 3.2.2.2 Project Period

The overall project period was planned as 57 months, from April 2004 (conclusion of Loan Agreement) to December 2008 (completion of construction). In reality, the overall project period was 100 months, from April 2004 (conclusion of Loan Agreement) to July 2012 (completion of construction), which was significantly longer than planned (175% of the planned period).

Table 3 shows the comparison of planned and actual project period.

Table 3: Comparison of Planned and Actual Project Period

| Item | Planned | Actual |
|---|---|---|
| Selection of Consultants | April 2004 – March 2005 (12 months) | April 2004 – December 2005 (21 months) |
| Consulting Services | April 2005 – December 2009 (57 months) | December 2005 – December 2012 (85 months) |
| Detailed Design | February 2005 – November 2005 (10 months) | PKG1 : December 2005 – January 2007<br>PKG2 : March – June 2007<br>PKG3 : August – October 2010<br>(Total of 59 months) |
| Procurement Period | December 2005 – December 2006 (13 months) | PKG1 : September 2006 – April 2007<br>November 2007 – May 2008<br>PKG2 : October 2008, January 2009<br>PKG3 : December 2010 – May 2011<br>(Total of 31 months) |

[9] Exchange rate at the time of appraisal was ¥1 = Rp. 71.4, while actual exchange rate during the implementation period was ¥1 = Rp. 110 (average of 2008 – 2010 when the construction was implemented), which produced gains about 54% rise of yen from the strong yen.

| | | |
|---|---|---|
| Civil Works | January 2007 – December 2008 (24 months) | PKG1 : December 2008 – December 2010<br>PKG2 : March – November 2009<br>PKG3 : September 2011 – July 2012 (Total of 44 months) |
| Total | April 2004 – December 2008 (57 months) | April 2004 – July 2012 (100 months) |
| Defect Liability | January – December 2009 (12 months) | PKG1 : January 2011 – December 2011<br>PKG2 : December 2010 – November 2011<br>PKG3 : August 2012 – July 2013 (12 months each) |

Source: Information from JICA, results from questionnaire survey to the executing agency and interview survey results from the field survey

The main reasons of delay are listed below;

- In selection of consultants, the submission period of bidding documents was within three weeks after the announcement according to the procurement regulation of Indonesia (Presidential Decree 80 (Keppres 80, 2003)), while the JICA regulated the submission period was within two months after the announcement. Therefore, the process delayed significantly to adjust which regulations to be followed.
- The additional construction works were required since only the initial scope of the plan could not prevent inundations which happened more than assumed at the time of appraisal. The inundation was caused by the flood occurred during the implementation period as well as continuous land subsidence. Therefore, extra time for detailed design and construction of the additional works was necessary.

3.2.3 Results of Calculations of Internal Rates of Return (Reference Only): Economic Internal Rates of Return (EIRR)

At the time of appraisal, EIRR was calculated by considering construction cost, maintenance cost (1% of construction cost), future rehabilitation cost for elevation of quaywalls as costs, and loss of profits when rehabilitation was not done (decrease value of fish catches in case of "With or Without project" which attributed to the available annual time by the settlement) as benefits, with the project life of 50 years. As a result, EIRR was calculated as 20.3%.

On the other hand, EIRR at the time of the ex-post evaluation could not be calculated under the same conditions since the statistical data for fish landing volume of the same kinds of fish which were the basis of calculating benefit have not been collected. Therefore, EIRR values of appraisal and the ex-post evaluation could not be compared under the same conditions. However, using alternate representative of fish value[10], EIRR was calculated as 25.9%, which

[10] At the time of appraisal, tuna (fresh, frozen, and canned), non tuna (local and export), and shrimp were used for calculation of EIRR. Alternatively, at the time of the ex-post evaluation, tuna (no classification of

slightly exceeded the value of assessment.

Although the project cost was within the plan, the project period was significantly exceeded the plan. Therefore, efficiency of the project is fair.

### 3.3 Effectiveness[11] (Rating: ③)

#### 3.3.1 Quantitative Effects (Operation and Effect Indicators)

As shown in Table 4, all of the four operation and effective indicators exceeded the target value of 2016 set forth at the time of appraisal, therefore, it can be regarded the original goal has been achieved[12]. However, regarding the operational hours of control tower, it was found that staff members were not always present at the control tower. The monitoring was conducted mostly in the monitoring room situated next to the control tower using the closed-circuit television (CCTV) during the working hours[13]. The control tower was constructed aiming to monitor the movement of fishing vessels and preservation of environment inside of JFP. It is expected that the control tower be operated 24 hours a day by the direct observation of the officers at the tower and by CCTV. Therefore, although the operation indicator of "total number of days of surveillance of the control tower" reached the target at 365 days per year, it is thought that there is room for improvement for effective use of the tower since the direct observation were not conducted and officers were not resided at the tower.

The project aims to restore the function that was aggravated by land subsidence. The target year of the indicators was set in 2016 which was seven years after the project completion scheduled in 2009. However, setting the 2016 as target year, after 15 years of the baseline year of 2001 is considered to be underestimated[14] since indicators would be influenced greatly by other external factors[15] during the period of 15 years. As pointed out in the mid-term review of this project (implemented in 2009), the target year should have been set two years after the project completion as standard time frame of the ex-post evaluation expecting early realization of the rehabilitation effect.

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fresh, frozen and canned), tongkol (similar kind of tuna), skip jack and squid were used.

[11] Sub-rating for Effectiveness is to be put with consideration of Impact.

[12] Fish landing volume were not always proportional to the fish landing value. The changes in the price of tuna which are the majority of landing fish are thought to be the cause for this.

[13] The monitoring of fishing port is expected to be conducted, in principle, both by direct observation from the control tower and by CCTV which can monitor the places with close views which cannot be observed from the tower. The current situation of monitoring of the port was confirmed at the field survey of the ex-post evaluation.

[14] Background reasons for setting a target value after seven years of the project completion could not be identified clearly. JFP has handled a lot of landing of tuna as open-ocean fishing port and at the time of appraisal, it is conceivable that in particular taking into account that from the point of view of tuna resource management, measures had been taken not to increase the level of tuna catch globally.

[15] For example, fish landing value is not only influenced by the elevation of quaywalls by the project but it is also affected largely by other external factors such as number of fish industry workers, unit cost of fish, economic trends of Indonesia and so on.

Table 4: Operation and Effect Indicators

| Indicator | | Baseline 2001 (Appraisal) | Target 2016 (7 years after completion) | Actual 2011 (1 year before completion) | Actual 2012 (completion year) | Actual 2013 (1 year after completion) |
|---|---|---|---|---|---|---|
| Effect Indicators | Fish landing volume (total tons/year) | 35,760 | 35,760 | 101,189 | 104,854 | 113,342 |
| | Fish landing value (million Rp./year) | 1,673,000 | 1,673,000 | 1,931,197 | 2,357,590 | 3,093,454 |
| | Total income from berthing vessels (million Rp. /year) | 2,350 | 2,350 | 6,080 | 6,790 | 7,658 |
| Operation Indicator | Total number of days for the surveillance (days/year) | 0 (2003) | 365 | 365 | 365 | 365 |

Source: Information from JICA, results from questionnaire survey of the executing agency and interview survey results from the field survey

Figure 2 displays the total annual fish handling volume[16] at JFP. The total fish volume (ton/year) increased year by year, growing almost double during the period of four years from 2009 to 2013, which amounted from about 13 million tons to 25 million tons. This indicates the increase in the fish landing volume at JFP. In addition, as shown in Table 5, which shows the trend of number of vessels using JFP, as incoming vessels were increasing, the rate of landing vessels out of incoming vessels was also increasing. In 2008, out of 3,276 incoming vessels only 1,493 vessels (45%) landed fish, while in 2013 out of 4,396 incoming vessels 3,911 vessels (89%) did fish landing. According to the interviews to the executing agency and seafarers of fishing vessels, it was found that "they had to use neighboring ports other than JFP when they could not off load fishery products at JFP due to flooding". In this way, the increase in the portion of landing vessels out of incoming vessels was mainly due to the restoration of landing function of JFP. It is, therefore, considered to be the effect realized by the project.

[16] Total fish handling volume includes fish landing volume at JFP and fishery production from other domestic ports which are imported by both land and sea.

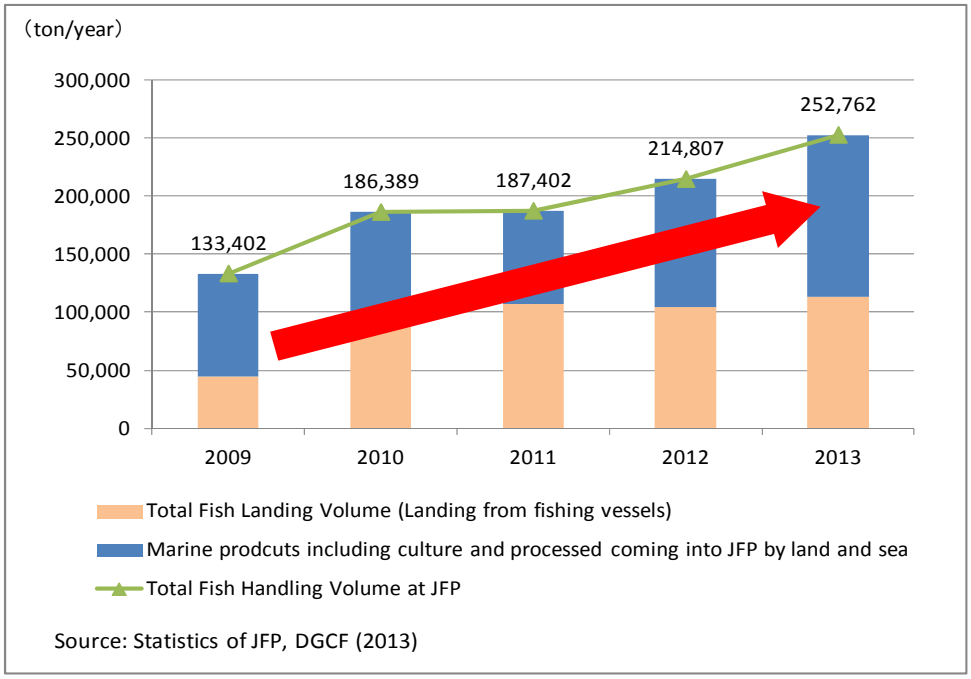



Figure 2: Total Fish Handling Volume at JFP

Table 5: Fishing Vessel Activities in JFP

| Vessels (number) | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Registration* | 1,181 | 1,178 | 1,259 | 1,309 | 1,382 | 1,478 |
| Incoming vessels | 3,276 | 3,400 | 3,478 | 3,890 | 4,075 | 4,396 |
| Outgoing vessels | 3,166 | 3,370 | 3,383 | 3,817 | 3,968 | 4,208 |
| Landing vessels | 1,493 | 2,704 | 2,983 | 3,496 | 3,588 | 3,911 |

*Note : Ships registered at JFP as their base
Source: Statistics of JFP, DGCF (2013)

Photo 11: Fishing ships entering at JFP
(At the time of the Ex-post Evaluation)

Photo 12: Fish landing at Quaywall
(At the time of the Ex-post Evaluation)

### 3.3.2 Qualitative Effects

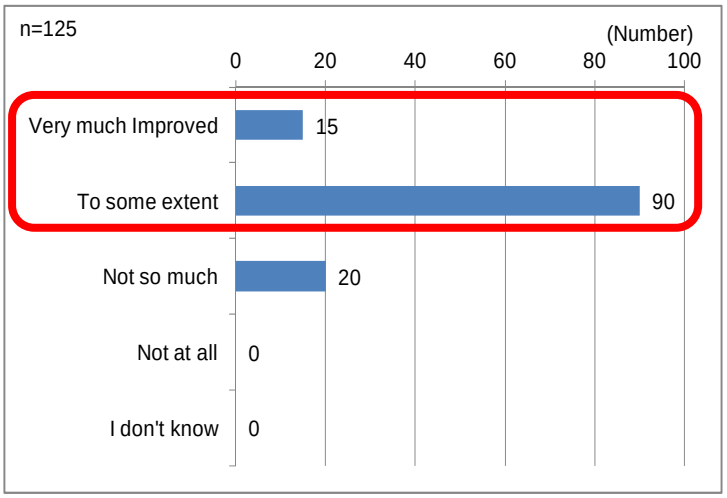
As the quantitative effects, three issues below, namely, improvement of environment in

JFP, improvement of sanitary and hygienic conditions, and enhancement of convenience for port users are raised.

A beneficiary survey was conducted to assess effectiveness and impact by the project. The survey targeted port officials, fisheries industries and neighboring local residents. The total of 125 samples was collected[17].

#### 3.3.2.1 Improvement of Environment in JFP

As seen in the Figure 3, most of the beneficiaries recognized the improvement of environment of JFP judging from the fact that 105 (84%) answered either "very much improved" or "to some extent" to the question. Most of the people who felt the improvement of environment of JFP raised its reason as no flooding in the Fishing Port (46 respondents, 36.8%) and improvement of access by roads (37 respondents, 29.6%). It can be said, therefore, improvement of environment of JFP was achieved because the effectiveness of measures against flooding and inundation that project undertook were successfully realized.




Source: Results from the beneficiary survey

Figure 3: Assessment against Improvement of Environment of JFP

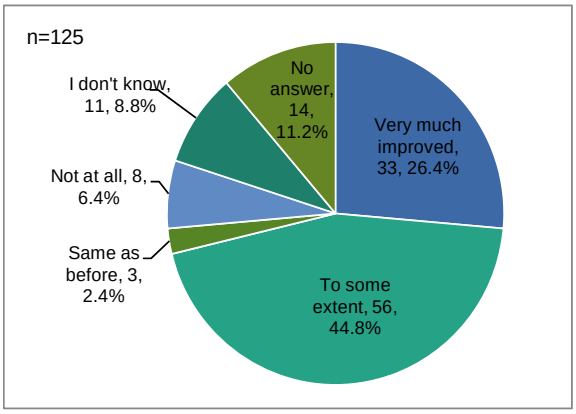
#### 3.3.2.2 Improvement of Sanitary and Hygienic Conditions

As a result of the beneficiary survey, as shown in Figure 4, 33 respondents (26.4%) responded "very much improved" and 56 respondents (44.8%) responded "to some extent" towards the quality of fishery products after the project. In this way, more than 70% of beneficiaries recognized the improvement of quality of fishing products. 79 out of 89 respondents (88.7%) raised its reason as "reduction of flooding" and 67 respondents (75.2%) answered as "improvement of sanitary and hygienic conditions". In addition, interviews to the beneficiaries revealed that efficient management of waste was realized using backhoe[18] and

[17] A total of 125 samples (Male: 105, 84% and Female 20, 16%) were collected at random with face to face interviews; Wholesale dealers (23, 18.4%), Fish retailers (15, 12.0%), Fish boat crews (14, 11.2%), Fish processing workers (29, 23.2%), Workers at JFP (bank officers, truck drivers, bicycle rental workers, mechanics, etc.) (35, 28.0%), and people living nearby JFP (9, 7.2%).

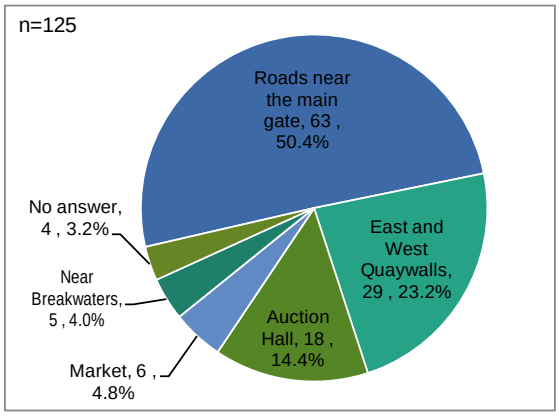
[18] Please refer to the photo 18 in "3.5.4 Current Status of Operation and Maintenance".

compact truck which were procured by the project. In light of the above, the effect by the project which prevented flood by elevating quaywalls and roads, and enhanced hygienic conditions by improving waste water and solid waste management is presumed as high. The places where the beneficiary feels improvement in sanitary and hygienic conditions are shown in Figure 5. More than half of respondents (63, 50.4%) pointed out roads near the main gate as the hygienic improvement place and 23.3% (29 respondents) of respondents raised east and west quaywalls where fish landing takes place. Apparently, those are the effect of the project.




Source: Results from the beneficiary survey

Figure 4: Improvement of Quality of Fishery Production




Source: Results from the beneficiary survey

Figure 5: Places where Sanitary and Hygienic Conditions have been Improved

3.3.2.3 Enhancement of Convenience for JFP Users

Table 6 shows the results of interview on the enhancement of convenience for JFP users. As seen in the answers to the Question (1), more than half of respondents (69, 55.2%) had some difficulties on their works in the port due to the flood inside of the port before the project. Due to the floods inside of the port, many of them could not sell the fishery products and they had to stop fish landing, delivery and operation of fish processing factories. As much as 30% of the respondents answered that “it was very difficult even to enter the port due to the flood of access roads”. It was assumed that the flood of roads became a big obstacle for them. On the other hand, “access roads to the port” was raised by 82.4% of respondents as significant effect of the project. The improvement of the roads had highly evaluated as tangible effects of improvement. Other highly marked facility by the respondents was elevation of quaywalls since 57.6% of the respondents felt that the elevation of quaywalls by the project prevented the port from flooding. Overall, it was confirmed that convenience for the users enhanced judging from that 101 respondents (80.8%) answered that “the port has become user friendly” against the question (4) in Table 6.

Table 6: Enhancement of Convenience

| Questions | Answers (n=125) |
|---|---|
| (1) Before the project, in what way were you affected by the flood in the port? (Free answers) | ・Could not work (could not sell fish, could not deliver fish production, could not work because water came into the factory, could not land fish, income reduced, etc.) 69 (55.2%)<br>・Very difficult to access to the port due to flood of roads 38 (30.4%)<br>・Water came into the house 12 ( 9.6%)<br>・Others (Vessels were always late, No answer) 6 ( 4.8%) |
| (2) Among facilities which were improved by the project, which facility was the most beneficial to you? | 1. Access Roads to the Port 103 (82.4%)<br>2. Elevated East and West Quaywalls 7 ( 5.6%)<br>3. Rehabilitated Breakwaters 3 ( 2.4%)<br>4. Improved Drainage 3 ( 2.4%)<br>5. Newly Constructed Auction Hall 2 ( 1.6%)<br>6. Improved Solar Outdoor Lighting 2 ( 1.6%)<br>7. Constructed Port Authority Office 1 ( 0.8%)<br>8. Newly established Waste Yard 1 ( 0.8%)<br>9. No Answer 3 ( 2.4%) |
| (3) Besides above (2), which facility was beneficial to you? | 1. Elevated East and West Quaywalls 72 (57.6%)<br>2. Monitoring and Control System 10 ( 8.0%)<br>3. Constructed Port Authority Office 8 ( 6.4%)<br>4. Rehabilitated Breakwaters 6 ( 4.8%)<br>5. Access Roads to the Port 6 ( 4.8%)<br>6. Improved Drainage 4 ( 3.2%)<br>7. Sea Water Cleaning System 4 ( 3.2%)<br>8. Improved Solar Outdoor Lighting 2 ( 1.6%)<br>9. Newly Established Waste Yard 2 ( 1.6%)<br>10. Water Supply to Newly Established Auction Hall 2 ( 1.6%)<br>11. No Answer 9 ( 7.2%) |
| (4) Do you think the JFP became user friendly after the project? | 1. Yes 101 (80.8%)<br>2. Same as before 21 (16.8%)<br>3. No Answer 3 ( 2.4%) |

Source: Results from the beneficiary survey

## 3.4 Impacts

### 3.4.1 Intended Impacts

#### 3.4.1.1 Promotion of Fishery and Fishery Processing Industry

Figure 6 shows the trends of labor forces and fishery companies inside JFP. At the time of the ex-post evaluation, 352 fishery companies were operating fishery processing factories such as for bonitos, frozen shrimps, frozen tuna, minced fish, and so on, and as much as 46,000 employees were working in JFP. The number of fishery companies has increased nearly three times over three years from 133 in 2010 to 352 in 2013. The labor force also has increased by 10,000 employees (about 26.5% increase) from the 2004 figure of about 36,000 which was before the project to the 2013 figure of about 46,000. In this way, it is understood that fishery production activities have become more active after the project completion. In addition, as shown in Figure 7, more than 70% of employees are working in

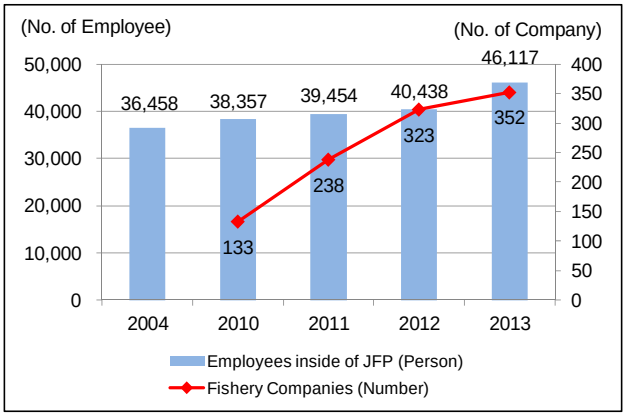
private sector, which means that JFP has been providing a large labor market. Therefore, it can be considered that the project has contributed to the production activity and job creation in JFP.

According to the fishing port management organization of JFP called “UPT” which is under the direct control of DGCF, Ministry of Marine Affairs of Fisheries (MMAF), many fishery companies had left JFP since their operations were affected by the flood before the project. However, after the project, demands for investment in JFP were increasing seeing the fact that many companies came back to resume the operation in JFP as a results of the restoration of function by the project. The number of new comers is on the increase since JFP improved convenience by the project. Besides, as stated in the column below, since the fishery processing industry employs overwhelmingly women workers, the restoration of function by the project made great impacts on increasing job opportunities and generating income for women living near JFP.

Photo 13: Beneficiary Survey (Fishermen)

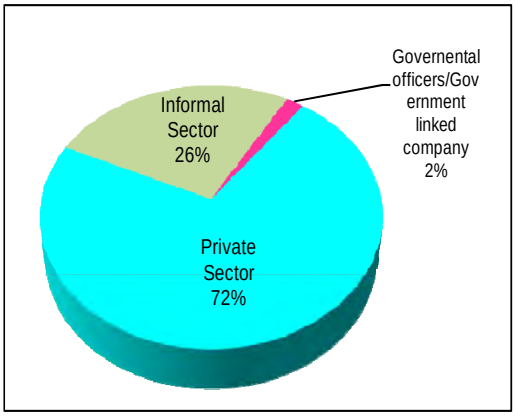
Photo 14 : Beneficiary Survey (Cafeteria Worker inside JFP)

In light of the above, it can be considered that the restoration of the function of JFP by the project, being the largest fish handling port of Indonesia, contributed to the promotion of fishery and fishery processing industry to a certain extent.




Source: Results from questionnaire survey to DGCF

Figure 6: Labor force and Fishing Company in JFP




Source: Statistics of JFP, DGCF (2013)

Figure 7: Breakdown of Labor force in JFP (2013)

<Column : Creating new employment for women living near JFP by the expansion of fishery business>

（Case 1）

Company F is the cultured shrimp processing company and their products are exported to the United States. In 2008 when the serious flood had occurred, the water reached about 1 m outside of the factory and entered up to about 50 cm inside of the factory. This caused problems in operation. Employees without any choice commuted by using the high height buses and trucks due to the flooded access roads. Some of them who could not use those transports had to resign from the factory. As a result, there was time the company temporary stopped operation since the trucks to distribute the products also could not be operated.

Shrimp processing work is a woman's work. About 85% of Company F's employees are female. Those female workers are mostly contract employees. Therefore, the suspension of the factory operation means an immediate loss of revenue opportunity for them.

According to the Company F, after the project which prevented JFP from the flood, it was possible to increase the production volume without considering about distribution problem, which led to the improvement of the business. As a result, Company F newly employed additional 300 female workers. Most of them were residents near the Fishing Port. At the time of the ex-post evaluation, there were about 850 female employees in Company F.

（Case 2）

Company K started operation in JFP since 2009 and has exported frozen and canned fish to Europe and Asia. At the time of the flood, the roads in front of Company K were flooded up to the knee level. There had also been a difficult time even to access to the company. In addition, the status of flood inside of the Fishing Port gave a bad impression on hygiene when the buyers coming from outside saw the situation, so that Company F was severely damaged since the business could not be materialized.

After the project, although still small scale of floods occurred at the time of high tides, the business got better by the great improvement of access and hygienic situation. As a result, Company K entered the new business of bonito processing and additionally employed about 50 female workers around the Fishing Port for processing. According to the interview to those female workers, there were many similar responses such as followings; "It was very helpful to find the job close to the house since the previous working place was far and transportation cost me a lot", "At the time of the flood, I had to change jobs because the flood forced me move the house far from JFP since the water even entered into the house. I could come back and find a job at the factory of JFP since the flood has not occurred any more". Some women pointed out the increase of income by working at this factory.

As described above, since the role of women is of great importance in the work at the fishery processing factories, it was confirmed that the promotion of fishery industry by the project contributed to the increase in employment opportunities and income generation of women.

Photo 15：Shrimp Processing at Company F
(At the time of the Ex-post Evaluation)

Photo 16: Bonito Processing at Company K
(At the time of the Ex-post Evaluation)

3.4.2 Other Impacts

3.4.2.1 Impacts on the Natural Environment

According to the interview to the executing agency, the environment monitoring during the implementation period of the project was conducted periodically mainly by DGCF and UPT. There has been no negative impact on the natural environment by the project.

On the other hand, the project gave positive impact on natural environment. Project constructed the breakwaters utilizing mangroves which are the local vegetation. It gave the good impression on scenery and it has established recognition as “environmentally friendly fishing port”. The interview at the time of the beneficiary survey revealed that many people highly evaluated the beauty of the JFP which was maintained with lots of green like a park.

3.4.2.2 Land Acquisition and Resettlement

There were no land acquisition or resettlement issues in the project.

3.4.2.3 Other Impacts

（1） Prospect for the approaches which were adopted in JFP to become popular

As referred to above, the project adopted unique ideas such as breakwaters utilizing mangroves and sea water cleaning system[19] which was rehabilitated by the project. Those

[19] It is the system to clean sea waters inside of the port using the difference of tidal levels, not utilizing heavy pumps and other equipment. It is efficient and easy for maintenance since only using the mechanism of tidal levels. At the time of incoming tide, sea waters are allowed to flow into the reservoir together with

ideas were generated by the implementing consultant. These methodologies are unique even in the world and the ideas were presented at the academic conferences by the consultant[20]. The approaches that were adopted to JFP including revetments and breakwaters utilizing piles and mats made of bamboo which were constructed in the Phase 1 project, are identified as efficient and have drawn attentions domestically and internationally as applicable methodologies for developing countries. Although these approaches have not been yet applied to other fishing ports domestically and internationally, there is possibility for those approaches adopted in JFP to become popular in the future. These approaches actually are the fruits of ideas of the Japanese consultant who has been involved since the Phase 1 project and brought the passion into enforcement of functions of JFP. It is well noticed by the executing agency as well as people involved in the Fishing Port, which also contributed to the strengthening the trust and tie with Japan.

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

### 3.5 Sustainability (Rating: ②)

#### 3.5.1 Institutional Aspects of Operation and Maintenance

Jakarta Fishing Port is maintained and operated by two organizations; UPT and state-owned public fishery corporation under the Ministry of State-Owned Enterprises (MSOE), called PERUM. In principle, UPT is responsible for operation and maintenance (O&M) of public facilities and PERUM is responsible for commercial facilities. In this regard, most of the facilities which were improved by the project are maintained by UPT. However, it was identified that the division of work and responsibility between the two organizations in terms of detailed maintenance activities at the operational level remained unclear which had been pointed out since the time of appraisal[21]. For example, under the contract with PERUM, the private company which is newly established in the Fishing Port is expected to construct drainages next to the premises. However, the detailed information on the drainages such as the capacity and procedures of maintenance in the contract is not shared with UPT since the contents of the contract between the private company and PERUM are not open to UPT. Although the drainages are maintained by UPT in principle as public facilities, the

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floating wastes and oils, and then the wastes are accumulating at the screen. If those wastes at the screen are cleared appropriately, the sea waters are cleaned and flowed into the reservoir. If those wastes at the screen were not cleaned, sea waters remain stagnant. At the time of the falling tide, cleaned sea waters are drained away to the sea outside of the port.
（https://libportal.jica.go.jp/fmi/xsl/library/public/ProjectHistory/jakarta/2003.pdf (in Japanese)

[20] https://libportal.jica.go.jp/fmi/xsl/library/public/ProjectHistory/jakarta/jakarta-p.html (in Japanese)

[21] JICA has made proposals several times to the MMAF about clearing division of works between the two organizations such as formulation of comprehensive guideline of maintenance. However, it was not materialized.

responsibility on who should do the improvement and repair of the drainage is vague when the drainages were built with low capacity and overflowed waters at the time of high tides.

Another example is the waste water management. Waste waters from the factories are discharged to the sea either through the waste water treatment plant which was improved by the project or after being treated by the own equipment of the factory. However, according to UPT, a small number of factories have been discharging waste waters without treatment. UPT has given the warning to those factories; however, neither UPT nor PERUM, have rights to stop operation of such factories although PERUM is the one which has responsibility of commercial facilities. In this way, even one issue of waste management raises problems of operation and maintenance.

Since similar issues on the division of works between UPT and PERM are observed not only in JFP but also other DGCF administered fishing ports, MMAF recognized it as a problem and drafted an agreement between the two organizations. At the time of the ex-post evaluation, the agreement has not been reached; however, the direction for improvement has been confirmed[22].

The number of staff in UPT was 207 as of December 2014, of which staff members in charge of maintenance were 107. Table 7 shows the O&M staff allocation and frequency of maintenance of facilities which were improved by the project. It is assumed that ample number of staff members for cleaners is allocated by actually observing them working every day for roads, vegetation, drainage, and garbage collection inside of the port at the time of the ex-post evaluation. Regarding operators[23], however, the number of staff members was not sufficiently allocated. There was no staff member residing at the sea water cleaning system, and only two staff members cannot conduct 24 hours monitoring from the control tower as stated the above. Therefore, it is expected to allocate necessary number of staff for effective use of the facilities. For example, it is considered that two staff members on the rotation basis will be necessary for the sea water cleaning system, and four to six staff members will desirably work in shifts for 24 hours monitoring from the control tower.

On the other hand PERUM (JFP branch) had 104 staff members as of December 2014. Since most of the facilities which were improved by the project are public facilities so the maintenance is done by UTP. Auction hall is the only facility where PERUM is in charge of maintenance. According to the interview to PERUM, there are enough staff members in maintenance and there was no particular problem observed.

In light of the above, some concerns were observed in institutional aspects of operation and

[22] Information is according to the interview with DGCF officers.
[23] For example, the role of operator of seawater cleaning system is to open and close the drainage by manually. The role of operator of waste water treatment system is to operate waste treatment equipment considering volume of drained water.

maintenance since it was found that detailed division of work and responsibility between the two organizations of operation and maintenance of JFP have not been clearly articulated and there were some staff shortage in O&M.

Table 7: O&M Staff Allocation and Frequency

| | Items | Frequency | Number of Workers (person) | |
|---|---|---|---|---|
| | | | Operator | Cleaner |
| 1 | Quaywalls | Daily | ― | 20 |
| 2 | Breakwaters | ― | ― | ― |
| 3 | Control Tower and UPT | Daily | 2 | 6 |
| 4 | Access Roads | Daily | | 15 |
| 5 | Revetments | ― | ― | ― |
| 6 | Main Drainage, Ponds, Pumping Station, Pumps and Power Supply | Daily | 3 | 2 |
| 7 | Sea Water Cleaning System | Daily | ― | 2 |
| 8 | Auction Hall | Daily | ― | 6 |
| 9 | Sewage Treatment System, Pumps, Drainage | Daily | 6 | 2 |
| 10 | Manhole House, Pumps, Panel | Daily | 3 | 2 |
| 11 | Piped Liquid Sewage System | Daily | ― | 6 |
| 12 | New UPT Office | Daily | | 6 |
| 13 | Waste Collection Yard | Daily | ― | 2 |
| 14 | Solar Cell | Daily | 3 | ― |
| 15 | Electrical System | Daily | 3 | ― |
| 16 | Drainage | Daily | ― | 10 |

Source: Information provided by JICA

### 3.5.2 Technical Aspects of Operation and Maintenance

Technical problems of O&M were not observed in the basic infrastructure such as quaywalls and revetments. However, there are some concerns in technical aspects for O&M of other facilities. According to the interview to UPT, although there are three to four staff members in UPT who can conduct simple repairs, there is shortage of technical personnel who have specific O&M knowledge. The capacity building is done mostly through OJT and training opportunity for strengthening technical capacity is limited. Although there is not much problem in O&M at the usual time by referring to the manuals; however, when problems occurred, immediate actions could not be taken. For example, there is no technician who could judge to take appropriate actions by assessing the report on the environmental monitoring related to the drained water from waste water treatment system, which is outsourced to the external research institution. It is desirable that monitoring of water quality not only for drained water of the waste water treatment system but also for sea water of inside and outside of the JFP should be done internally. It is also expected that technical personnel should be developed to make decision for appropriate measures.

In addition, for further effective use of sea water cleaning system and waste water

treatment system, rather than simply operating by the determined volume and time of drained water automatically, it is recommended that the operators who could adjust and predict the volume and time of drainage and cleaning of water by assessing weather information, amount of rainfall, and situation of tides, should be developed and allocated. In this way, it can be said that there is room for improvement.

In light of the above, although there is no major problem in technical aspects, however, there are minor concerns in it considering insufficient experience on preventive maintenance and necessity of allocation of appropriate personnel for effective utilization of the facilities that were improved by the project.

### 3.5.3 Financial Aspects of Operation and Maintenance

The budget of UPT is allocated by the national budget through DGCF since UPT is under DGCF. Entering fee for JFP is administered by UPT; however, the fees are put into the national budget and UPT cannot use it directly for JFP. Table 8 shows the maintenance cost for the facilities rehabilitated by the project. According to DGCF and UPT, although the budget is not sufficient overall, the budget to maintain the current situation has been secured.

As seen in Table 8, the budget allocated from DGCF to UPT for the facilities rehabilitated by the project was 1.45 billion rupiah in 2013 and 1.69 billion rupiah in 2014. Considering the necessary annual maintenance budget for the facilities in the JFP was estimated at 1.6 billion rupiah[24], the maintenance budget can be said as fulfilled. Actually, the maintenance budget is mostly for cleaning and purchase of spare parts, and there is no particular financial problem to obstacle operations for this routine maintenance. At the time of the ex-post evaluation, budgets for rehabilitation and improvement of drainages and revetments became necessary in order to prevent further floods from happening. Those improvements require the construction works; however, there is no budget for such construction works. It means that if such needs for construction works arise, it was identified that the immediate arrangement could not be possible. On the contrary, vulnerable parts for flooding should be maintained in advance since the land subsidence has been progressing even at the time of the ex-post evaluation.

PERURM runs on a stand-alone basis. Its financial sources are coming from most income generated activities inside of JFP including rents for land to the private companies, quaywall usage fees, workplace usage fees, income from water supply and gas station. Since the investment in the port has been increasing, there is no problem in finance for PERUM. Annual budget for PERUM secures about 1 billion rupiah and it is mainly used for maintenance, repair and rehabilitation of external walls for cold storage and warehouses, etc.

[24] Report for the ex-post evaluation on "Jakarta Fishing Port/Market Development Project (IV)" (http://www.jica.go.jp/english/our_work/evaluation/oda_loan/post/2005/pdf/2-04_full.pdf).

In light of the above, some concerns remain in financial aspects since cost for maintenance that requires a certain level of construction has not been secured although enough finance to maintain the current level is ensured.

Table 8: Maintenance Cost for the Facilities Rehabilitated by the Project (Actual)

(unit: Rupiah)

| | Facility | 2013 | | 2014 | |
|---|---|---|---|---|---|
| 1 | UPT Office and Control Tower | Building<br>Lift<br>Water pump | —<br>24,000,000<br>5,000,000 | Building<br>Water pump | 137,500,000<br>5,000,000 |
| 2 | Main drainage, Pump house, Power supply for western side | Water pump<br>Pond | 241,500,000<br>22,500,000 | Water pump | 10,000,000 |
| 3 | Sea water cleaning system | Building | 34,000,000 | | |
| 4 | Main drainage, Pump house, Power supply for eastern side | Water pump<br>Power supply<br>Pond<br>Building | 64,250,000<br>12,589,000<br>15,000,000<br>120,000,000 | Water pump | 75,000,000 |
| 5 | Fish landing center | Building<br>Drainage<br>Water system | 20,000,000<br>55,350,000<br>13,500,000 | | |
| 6 | Machine, Power supply, Pump | Water pump<br>Power supply<br>Panel | 106,000,000<br>16,637,000<br>100,090,000 | Power supply<br>Water pump | 28,200,000<br>12,000,000 |
| 7 | CCTV system | System | 9,000,000 | System | 10,000,000 |
| 8 | New UPT office | Building<br>Lift | 48,000,000<br>24,000,000 | Building<br>Water pump<br>Lift | 175,000,000<br>5,000,000<br>54,000,000 |
| 9 | Power House, Power supply | Power supply | 18,225,000 | Power supply | 29,600,000 |
| 10 | Solar Cell | — | — | — | — |
| 11 | Piped liquid sewerage system, Manhole house | Pump & Panel,<br>Manhole<br>Sewerage system | 60,000,000<br><br>70,695,000 | Pump & Panel<br>Building<br>Sewerage system | 210,000,000<br>60,000,000<br>715,982,000 |
| 12 | Fresh water supply system, Ground tank/Reservoir | — | — | — | — |
| 13 | Temporary landfill | — | — | — | — |
| 14 | Landscape for port’s garden | Maintenance | 200,000,000 | Maintenance | 100,000,000 |
| 15 | Drainage | Dredging | 60,000,000 | Dredging | 60,000,000 |
| | **Total** | **1,446,836,000** | | **1,687,282,000** | |

Source: Information provided by JICA

3.5.4 Current Status of Operation and Maintenance

Current status of maintenance of facilities improved by the project was generally good. However, as stated above, it was noted that there was room for improvement such as in

operation of control tower and sea water cleaning system. Another improvement point was found in control berthing of ships. Since the berthing of ships entering into JFP has not been controlled, the ship which could not park alongside the quaywalls but next to other ship had to land and relocate fish to the other ship which berthed next to the quaywalls.

On the other hand, it was confirmed that there were some damaged parts in revetments and drainages, and broken roads which had puddles. Furthermore, although UPT monitors water quality of drained water from the waste water treatment plant, monitoring of water quality of sea water after drained in and outside of JFP has not been conducted. As stated above, although only a few, some companies has been discharging waste water from their factory directly to the sea without treatment, It is, therefore, beneficial to conduct periodical water quality monitoring of sea water in and outside of JFP. As Photo 19 shows, land subsidence which continues severely at present has not been monitored by UPT. It shows that concrete around the standard pile installed in 2009 in the project was torn off about 80 cm down at the time of the ex-post evaluation due to the influence of land subsidence.

In light of the above, the current status of maintenance is generally good; however, there were some issues since some problems and points of improvement were observed.

Photo 17: Puddle caused by the broken roads inside of JFP
(At the time of the Ex-post Evaluation)


Photo 18: Garbage collection using Backhoe procured by the project
(At the time of the Ex-post Evaluation)

Photo 19: Standard Pile installed inside of JFP (Installed in 2009)
(At the time of the Ex-post Evaluation)

Photo 20: Cleaning and Vegetation inside of JFP (At the time of the Ex-post Evaluation)

Some minor problems have been observed in terms of the institutional and financial aspects. Therefore, sustainability of the project effect is fair.

## 4. Conclusion, Lessons Learned and Recommendation

### 4.1 Conclusion

The project aimed to restore the function of the JFP and to make effective use of related facilities by elevating quaywalls and other major facilities which have sunk down by the land subsidence effect. The target quaywalls were constructed by the Phase 1 project (completed in 1982). In addition to the quaywalls, the project rehabilitated breakwaters, revetments and roads which were also affected by the land subsidence, and constructed a control tower.

The project is well consistent with the development policy and development needs of Indonesia, as well as with the Japan's ODA policy; thus, the relevance of the project is high. All of the operation and effect indicators, i.e., fish landing volume, fish landing value, total berthing income and total number of operation days for Control Tower reached the target level, thus, the restoration of the function of JFP was confirmed. A beneficiary survey also confirmed the improvement of quality of fishery products by better sanitary and hygienic conditions of JFP and the enhancement of convenience for port users by the project. In addition, JFP has been expanding with having more than 300 fishery companies and 46,000 employees. This contributed to the promotion of fishery industry in Indonesia. In particular, impact was observed on the generation of employment for women living close to JFP after restoring the functions by the project. Therefore, effectiveness and impact of the project are high. Although the project cost was within the plan, the project period significantly exceeded the plan. Therefore, efficiency of the project is fair. In regard to operation and maintenance,

the clear divisions of work and responsibility have not been made between the two organizations, “UPT” under the Ministry of Marine Affairs and Fisheries and “PERUM” under the Ministry of Ministry of State-Owned Enterprises. Therefore, some issues were observed in the institutional aspects. It was also found that there was room for improvement in staffing and financial aspects; thus, sustainability of the project is fair.

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

### 4.2 Recommendations

#### 4.2.1 Recommendations to the Executing Agency

(1) Clarification of role and responsibility between UPT and PERUM

In principle, UPT is responsible for public facility and PERUM is in charge of commercial facility. Therefore, general clarification of role and responsibility between UPT and PERUM has been established. However, when it comes to the issue of specific operational works such as waste water management from factories, improvement of drainage near factories, and security management inside the port, division of role and responsibility between UPT and PERUM are ambiguous in many points.

MMAF (directly control UPT) and MSOE (directly control PERUM) have already been discussion on this issue; however it is desirable that agreement should be reached urgently on the role and responsibility of UPT and PERUM for the smooth operation and maintenance of the fishing ports. In addition, the detailed guideline and manuals should be developed for the specific operational works immediately after the agreement has been reached.

(2) Immediate implementation of necessary reinforcement in case of land subsidence and thorough monitoring

Quaywalls elevated by the project was designed that there was no need to rehabilitate for about 30-50 years. However, considering the rapid progress of land subsidence both at JFP and the surrounding areas at the pace that is faster than expected at the time of appraisal, it is necessary to periodically monitor it at various locations inside the Fishing Port. In concrete terms, the periodical monitoring is required to know to what extent the major facilities have been sinking, with the standard pile as a reference. It is also desired to allocate the staff for this periodic monitoring. Measures such as reinforcement of fragile ground parts beforehand would also be necessary.

(3) Development of a medium and long term plan for operation and maintenance

Considering the land subsidence has been currently in progress, it is assumed that rehabilitation works will be necessary in the medium and long term. It is, therefore, required to formulate the medium and long term plan for operation and maintenance including the

accumulation of budgets for reinforcement and rehabilitation of the facilities. When formulating such a plan, involvement of PERUM from the planning stage should be considered for effective and efficient operation and maintenance, although it is subject to the agreement between MMAF and MSOE.

(4) Further enhancement of functions of JFP

By the placement and training of necessary personnel, further enhancement of functions of JFP could be realized, including, enhancement of safety management by utilization of control tower and efficient utilization of sea water cleaning system. Apart from the monitoring of the settlement mentioned above, periodical monitoring of water quality of sea water inside and outside the JFP is desirable. Some companies, though a few, have drained waste water without treatment. The negative environmental impact has not been confirmed at the time of the ex-post evaluation; however, the periodic monitoring should be urgently implemented.

### 4.3 Lessons Learned

Prior consultation on the difference on the procurement guidelines between the partner government and Japan

In this project, it took an extra time to reconcile the procurement regulations between JICA and the executing agency on the submission period of proposal. This caused delay of the commencement of the project. Since the new procurement regulation of Indonesia was developed in 2003 when the assessment for this project was on the table, the prior consultation might have been difficult to be conducted. Nevertheless, if the new procurement regulation is formulated in the future, it is important to identify the difference between the regulations of two governments before starting the project and confirm the way of reconciliation.

Comparison of the Original and Actual Scope of the Project

| Items | Original | Actual |
|---|---|---|
| 1. Project Outputs | 1） Civil Works<br>1． Elevation of East and West Quaywalls (West: 574m、 East: 775m、 Total: 1,349m）<br>2． Rehabilitation of West Breakwaters (600m)<br>3． Construction of Control Tower<br>4． Rehabilitation of roads near the main gate (length: 300m、Width: 6m）<br><br>2） Consulting Services<br>a) Survey and preliminary design stage<br>b) Detailed design and preparation of tendering documents<br>c) Pre-qualification and Tender evaluation<br>d) Monitoring and promotion of discussion of relevant organizations on ground water taking<br>e) Supervisory services<br>f) Alternative study of the access roads<br>g） Technical Transfer<br>①Analysis of the cause of the land subsidence due to the excessive pumping underground water<br>②Structure design of quaywalls (including breakwaters)<br>③Proper operation and maintenance method of fishing port<br>④Collection of operation and effective indicators<br>⑤Planning of breakwaters<br>⑥Information System<br>⑦Method of environment monitoring with dispatched experts | 1） Civil Works<br>1． West: 614m, East: 775m, Total: 1,389m<br><br>2． 594m<br><br>3． As planned<br>4． Extended (length: 6,250m, width: 6～18m)<br>5． Additional construction<br>①Improvement of East and West Breakwaters (West: 745m, East: 272m)<br>②Dredging in front of -4.5m quaywalls<br>③Construction of Port Authority Office<br>④Rehabilitation of west revetments (1,113m)<br>⑤Rehabilitation of east revetments(1,500m)<br>⑥Improvement of existing drainage system<br>⑦Increase quaywalls<br>⑧Improvement of Sea water cleaning system<br>⑨Construction of revetments near ship yard<br>⑩Improvement of waste water treatment system<br>⑪Improvement of fresh water supply system<br>⑫Installment of waste yard (including procurement of backhoe and compressor)<br>⑬Construction of Auction Hall<br>⑭Extension of UPT office<br>⑮Installment of solar outside lightings<br>⑯Installing monitoring and control system<br>⑰Additional power supply<br><br>2） Consulting Services<br>Intended services except “⑦ Method of environment monitoring with dispatched experts” were implemented. |
| 2. Project Period | April, 2004 – December, 2008 (57 months) | April, 2004 – July, 2012 (100 months) |

| | | |
|---|---|---|
| 3. Project Cost<br>Amount paid in Foreign currency | 1,826 million yen | 1,973 million yen |
| Amount paid in Local currency | 2,230 million yen<br>（159,286 million rupiah） | 2,083 million yen<br>（231,444 million rupiah） |
| Total | 4,056 million yen | 4,056 million yen |
| Japanese ODA loan portion | 3,437 million yen | 3,382 million yen |
| Exchange rate | 1 rupiah＝0.014 yen<br>（as of October 2003） | 1 rupiah＝0.009 yen |

Republic of Indonesia

Ex-Post Evaluation of Japanese ODA Loan Project

"Maritime Telecommunication System Development Project (IV)"

External Evaluator: Keiko Watanabe

Mitsubishi UFJ Research & Consulting Co., Ltd.

## 0. Summary

The project aimed to fulfill the requirement of 1974 Safety of Life at Sea Convention[1] (hereinafter referred as "SOLAS") to secure the safety of maritime navigation, and to respond promptly to maritime accidents by facilitating Global Maritime Distress and Safety System[2] (hereinafter referred to as "GMDSS") and Automatic Identification System[3] (hereinafter referred to as "AIS") at 33 and 4 Coastal Radio Stations (hereinafter referred to as "CRS") respectively in Indonesia. The project is well consistent with the development policy and development needs of Indonesia, as well as with the Japan's ODA policy; thus, the relevance of the project is high. The operation/effect indicator that targeting 24 hours of operation hours of GMDSS at newly installed stations by the project has been achieved at almost all target CRS. Moreover, the project expanded the coverage areas of maritime communication of GMDSS and contributed to the Indonesia's obligation to fulfill the requirement of SOLAS Convention. A beneficiary survey confirmed that the benefits of the project (improvement of navigation safety, increase of access to weather and navigation information, and acceleration of emergency distress response) were recognized by the GMDSS users. Furthermore, the project contributed to the service of CRS as well as the promotion of maritime business. However, the training center and the comprehensive maintenance center were not utilized after the completion of the project and the effectiveness produced by these two centers were limited; thus, the project's effectiveness and impact are fair. The project efficiency is fair because the project period exceeded the plan although the project cost was within the plan. In regard to operation and maintenance, no major problems have been observed. However, there is room for improvement on the operation of the two centers mentioned above, as well as institutional and technical aspects; thus, sustainability of the project is fair.

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

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[1] SOLAS Convention (Safety of Life at Sea Convention) is an international maritime safety treaty.

[2] GMDSS (Global Maritime Distress and Safety System) is a communications system for maritime rescue and safe navigation based on the regulation of international convention (SOLAS convention) which aims to contribute to secure the safety of life. Upon occurrence of the maritime accident, the radio operator of the ships used to send an SOS call and request for rescue. However, GMDSS enables to request rescue immediately and reliably to search and rescue organizations and ships nearby when ships had accidents at any of sea areas utilizing satellite and digital communication facilities. In addition, the information of navigation provided from onshore could be obtainable by automatic receptive system.

[3] AIS (Automatic Identification System) is automatic tracking system for identifying static, dynamic and voyage-related information such as vessel identifications, kinds, position, speed, course and status of vessels.

## 1. Project Description


Project Location

GMDSS Monitoring Room
(Palembang Coastal Radio Station)

### 1.1 Background

Indonesian waters are a strategic point for maritime traffic connecting East Asia with Europe and the Middle East (an average of more than 300 ships daily pass through four sea lanes), but an average of 204 (1982–2000) shipping accidents, and 103 (2002) incidents of piracy, take place per year. Meanwhile, in its 1988 revision, SOLAS Convention obliged the signatory nations to ensure that shipping using international sea lanes and onshore telecommunications stations conform with the GMDSS by February 1999. In addition, the 2002 revision obliged ships using international sea lanes to install AIS by December 2004.

In view of these circumstances and its obligations to the international community, the Indonesian government has been promoting the development of maritime telecommunications stations to establish safety at sea. As part of this, Japan International Cooperation Agency (hereinafter referred to "JICA") had disbursed ODA loans for the Maritime Telecommunications System Development Project since 1981. However, there were still many stations which were not equipped with receiving Digital Selective Calling (DSC) function, especially at 3$^{rd}$ and 4$^{th}$ class stations. In addition, even stations where improvement was realized by the previous projects, the equipment has become decrepit. Accordingly, there was an urgent need to expand the coverage to receive DSC by equipping GMDSS system and to improve CRS in order to establish safety at sea.

### 1.2 Project Outline

The objectives of the project are to meet the requirement of the SOLAS convention, to secure the navigation safety of ships navigating in Indonesian territorial sea, and to expedite

the response to maritime accidents by installing GMDSS (at 33 coastal radio stations) and AIS (at 4 coastal radio stations), thereby contributing to the promotion of the maritime business.

| | |
|---|---|
| Loan Approved Amount/<br>Disbursed Amount | 5,567 million yen /<br>5,382 million yen |
| Exchange of Notes Date/<br>Loan Agreement Signing Date | March 2004 /<br>March 2004 |
| Terms and Conditions | Interest Rate: 1.3 %<br>Repayment Period: 30 years (Grace Period: 10 years)<br>Condition for Procurement: General Untied |
| Borrower/<br>Executing Agency(ies) | The Government of Indonesia /<br>Directorate General of Sea Transportation (DGST), Ministry of Transportation |
| Final Disbursement Date | September 2012 |
| Main Contractor<br>(Over 1 billion yen) | Japan Radio Co., Ltd (Japan) / Toyota Tsusho Corporation (JV) (Japan) |
| Main Consultant<br>(Over 100 million yen) | Consortium of three companies:<br>Japan Telecommunications Engineering and Consulting Service (JTEC) (Japan) / Pantel International Co., Ltd. (Japan) / P.T. KONSTEL NUSANTARA (Indonesia) |
| Feasibility Studies, etc. | ・Development Study "Study for the Maritime Traffic Safety System Development Plan" (March 2001) |
| Related Projects | ＜Yen Loan Project (L/A date)＞<br>・ Marine and Coastal Radio Communication Project (January 1969, May 1970, August 1971, May 1972, and December 1973)<br>・ Maritime Telecommunication System Development (I) (September 1981)<br>・ Maritime Telecommunication System Development (II) (February 1985)<br>・ Maritime Telecommunication System Development (III) (September 1991)<br>・ Equipment Supply for Medium Wave Radio Boacon Stations (October 1983)<br>・ Maritime SAR Telecommunications System Project (June 1984)<br>・ Disaster Prevention Ships Procurement Project (December 1995)<br><br>＜Technical Cooperation Project＞<br>・ Dispatch of Expert to DGST on "Maritime Safety |

| | |
|---|---|
| | System" (May 2008 – May 2011)<br>・ Project on BAKOMKAMLA (Indonesian maritime Security Coordination Body) Structural Enhancement (May 2008 – May 2011)<br>・ Senior Volunteer on "Maritime Telecommunication System" (two terms since 2000)<br>＜Grant Aid (E/N Date)＞<br>・ Project for enhancement of Vessel Traffic System in Malacca and Singapore Straits (November 2008)<br>・ Project for Construction of Patrol Vessels for the Prevention of Piracy, Maritime Terrorism and Proliferation of Weapons (June 2006)<br>・ Project for enhancement of Vessel Traffic System in Malacca and Singapore Straits (Phase 2) (October 2010)<br><br>＜Other donors and International Organization＞<br>・ Basic Training and Introduction of VTS by Singapore, Australia, Denmark, Norway, International Maritime Organization (IMO), and China. |

## 2. Outline of the Evaluation Study

### 2.1 External Evaluator

Keiko Watanabe, Mitsubishi UFJ Research & Consulting Co., Ltd.

### 2.2 Duration of Evaluation Study

Duration of ex-post evaluation study was conducted as follows;

Duration of the Study: September 2014 – July 2015

Duration of the Field Survey: November 26 – December 23, 2014, March 7 – March 21, 2015

### 2.3 Constraints during the Evaluation Study

Under the limited time and budget of the study while most of the target CRS of the project were located in remote areas, only 5 target stations, namely, Jakarta, Surabaya, Palembang, Kalianget and Cilacap, were visited for this study instead of all 33 stations. Besides, the results of questionnaires were collected limitedly, however, information was complemented by conducting telephone and mail interviews, and collecting data from the executing agency. Furthermore, the sample size of beneficiaries collected during the beneficiary survey was limited because the number of ships equipped with GMDSS was lower than expected at the survey ports. Besides, the survey at the port had to be conducted under some restriction.

## 3. Results of the Evaluation (Overall Rating: C[4])

### 3.1 Relevance (Rating: ③[5])

#### 3.1.1 Relevance to the Development Plan of Indonesia

As a member state of International Maritime Organization[6] (hereinafter referred to as "IMO"), the government of Indonesia is liable for compliance with the SOLAS Convention. SOLAS Convention after the amendment in 1988 required member countries to introduce GMDSS to vessels of 300GT[7] and upwards as well as all passenger ships by February 1999. Directorate General of Sea Transportation (hereinafter referred to as "DGST") extended the deadline up to February 2009 to obligate to install GMDSS to domestic passenger ships as well in order to enforce the installment of the domestic ships. Therefore, the expansion of GMDSS coastal-based facilities covering whole area of Indonesian territorial sea should be completed urgently before 2009.

Furthermore, the revised SOLAS Convention in 2002 required ships engaged on international voyages to fit with AIS by December 2007. The Government of Indonesia recognized the SOLAS obligation to introduce GMDSS and AIS as essential base for maritime security for Indonesia as well as international society.

At the time of the ex-post evaluation, Indonesia, as a signatory state of SOLAS Convention, is still responsible for implementing the convention including operation of GMDSS and AIS. Moreover, the new Indonesian administration since October 2014 launched "maritime doctrine" highlighting importance of maritime security and safety.

#### 3.1.2 Relevance to the Development Needs of Indonesia

In order to fulfill SOLAS Convention, the Government of Indonesia has promoted GMDSS facilities at CRS; as a result, the coverage of GMDSS network in the Indonesian territorial sea expanded up to about 60%. However, there was an urgent need to cover the rest of areas, in particular, A1 sea areas[8] where VHF communications could not be received. In addition, there was a need to upgrade existing aging facilities since some installed equipment has reached the lifetime and some equipment whose spare parts were no longer produced by the manufacturers.

Indonesian waters are a strategic point for maritime traffic connecting East Asia with

[4] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[5] ③: High, ②: Fair, ①: Low
[6] Indonesia joined in IMO in 1961 (at that time it was Inter-governmental Maritime Consultative Organization (IMCO)).
[7] GT: Gross Tonnage
[8] Sea areas are classified from A1 to A4 depending on the distance from the coast. Each sea area has different communication system depending on the 1) distance from the coast, and 2) frequency as follows; A1: 1) about 25 nautical miles, 2) VHF (Very High Frequency), A2: about 150 nautical miles, 2) MF (Medium Frequency), A3: 1) Effective coverage where static communication satellite can transmit except A1 and A2 sea areas, 2) HF (High Frequency) and Inmarsat, A4: 1) Sea areas except A1, A2 and A3 sea areas, 2) HF.

Europe and the Middle East, but an average of 204 (1982–2000) shipping accidents, and 103 (2002) incidents of piracy, take place per year. At the time of the ex-post evaluation, shipping accidents reduced to an average of 29 (2008-2013) although the number varied in year. However, incidence of piracy and armed robbery against ships including actual and attempted attacks has still high figures as 106 in 2013. Therefore, there is still high need to establish security measures for navigation safety.

### 3.1.3 Relevance to Japan's ODA Policy

According to the appraisal reports, JICA prepared the "Mid-Term Strategy for Overseas Economic Cooperation Operations" in April 2002, based on the Japan's assistance policy to Indonesia. In this document, "infrastructure development for economic growth" was put as one of priority areas and "economic infrastructure development" was promoted as country specific assistance to Indonesia. In addition, assistance in improvement of the logistics for sustainable economic growth was listed in the "Country Assistance Strategy for Indonesia" (October 2003). In regard to the distribution of goods by sea, JICA has been contributed to securing the safety of maritime traffic by facilitating maritime telecommunication system since 1980's. This project enabling to ensure maritime safety in the world's pre-eminent piracy-prone areas including four sea lanes of Indonesia contributes directly to the economic growth of Indonesia. Since many Japanese vessels have been subjected to attacks by the pirates in these areas, it was expected to contribute to the stabilization of the Japanese economic activities.

### 3.1.4 Appropriateness of Project Plan and Approach

As stated below in the "effectiveness" and "sustainability", the comprehensive maintenance center and the training center which were established by the project have not been utilized after the completion of the project. Both centers were considered to be established from the lessons learned of the previous projects, which included the establishment of a centralized maintenance function from the view of efficiency and the increase of training opportunity for smooth operation of the equipment which was provided by the project. Therefore, the idea of setting up the two centers was relevant to meet demands. However, as stated in 3.3.1 and 3.5.1, the utilization of these two centers was constrained by the operational and financial regulations. Therefore, some problems were identified in the appropriateness of the project approach which did not consider these regulations fully in the project design.

Although these two centers were not operational after the project completion, as stated later, it was confirmed at the time of the ex-post evaluation that a certain level of effectiveness had been produced during the project period and equipment provided for these centers were kept reasonably in terms of sustainability. Furthermore, judging from the portion of total cost of

the project, this problem did not seriously hamper the objective of the project.

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

### 3.2 Efficiency (Rating: ②)

#### 3.2.1 Project Outputs

Comparison of planned and actual project outputs is summarized in Table 1. The project location map which indicates 33 newly installed GMDSS coastal radio stations is in Figure 1.

Table 1: Comparison of Planned and Actual Project Outputs

| | | Planned | Actual |
|---|---|---|---|
| 1. Installation of GMDSS | | | |
| 1-□ Installation of MF/DSC for Sea Area A2 | Class *1 | **Total 19 CRS** | **Total 22 CRS** |
| | 1st | Palembang (1) | 3 CRS (Semarang, Ambon, Jayapura) were added (4) |
| | 2nd | Sabang,<br>Teluk Bayur, Banjarmasin (3) | As planned |
| | 3rd | Samarinda, Bau-bau (2) | As planned |
| | 4th | Tapak-tuan, Natuna, Pangkal Balam, Bengkulu, Ende, Bima, Ketapang, Sampit, Poso, Toli-toli, Tual, Saumlaki, Agats (13) | As planned*2 |
| 1-② Installation of VHF/DSC for Sea Area A1 | Class | **Total 33 CRS** | **Total 33 CRS** |
| | 1st | Palembang (1) | As planned |
| | 2nd | Sabang,<br>Teluk Bayur, Banjarmasin (3) | As planned |
| | 3rd | Tanjung Ubang, Jambi, Tegal, Samarinda, Bau-bau (5) | As planned |
| | 4th | Tapak-tuan, Lhokseumawe, Kuala Tanjung, Kuala Enok, Natuna, Pangkal Balam, Muntok, Bengkulu, Manado, Kalianget, Meneg, Bima, Ende, Maumere, Ketapang, Sampit, Kumai, Batulicin, Pare-pare, Poso, Toli-toli, Saumlaki, Tual, Agats (24) | As planned*3<br><br>* The name of Kuala Enok station changed into Kuala Tungkal since the location moved, but the station covers same sea areas. |
| 2. Improvement of CRS for enabling to cover GMDSS | 1) Separation of transmitting and receiving stations (Between Teluk Bayur and Benoa) | | As planned |
| | 2) Improvement of environment for Surabaya and Makassar stations | | As planned |
| | 3) Improvement of VHF coverage areas for Dumai and Samarinda stations. | | As planned. For Samarinda, new station was constructed at different location to improve the coverage areas. |
| | 4) Replacement of aged engine-generators at 1st and 2nd class stations. (total of 14 stations) | | As planned. |
| | 5) Replacement of aged antennas at 1st and 2nd class stations (total of 12 stations) | | As planned |

| | | |
|---|---|---|
| | 6) Additional works | ・Tower for Dumai station were strengthened.<br>・Modified the tower design for Ende and Maumere stations.<br>・Additionally purchased Antenna for NAVTEX for Jakarta station. |
| 3. Commencement of National NAVTEX*4 | Four (4) stations from Jakarta, Makassar, Ambon and Jayapura, where international NAVTEX has been implemented. | Same four (4) stations were implemented. However, after preparation of the detailed design, IMO instructed member countries not to use same international NAVTEX frequency for the national NAVTEX. Therefore, additional equipment which can change frequency automatically were procured. |
| 4. Installation of AIS | Belawan, Dumai, Sabang, Jakarta (4) | Four (4) stations were implemented, but instead of Belawan and Jakarta stations, Lhokseumawe and Cilacap were implemented. |
| 5. Establishment of Comprehensive Maintenance Center | Establish at Jakarta station<br>1) Provision of spare parts for GMDSS to the GMDSS newly installed stations.<br>2) PC/Net based O&M network is established linking 1st and 2nd stations with maintenance center in Jakarta for asset management of spare parts. | As planned |
| 6. Reinforcement of Training Center | Establish at Jakarta station<br>1) Installation of radio and measurement equipment<br>2)Installation of GMDSS simulator<br>3) Installation of AIS simulator | As planned |
| 7. Training of Operators and Technicians for relevant CRS | 1) Training at Manufacturer in Japan: 30 participants for 1 month<br>2) Management training in Japan<br>3) Domestic training: 45 participants for 1.5 months<br>4) Training for the staff for the Comprehensive Maintenance Center: 5 participants for 3 weeks | 1) As planned<br>2) As planned. Management training was conducted at Japan Coast Guard;<br>10 participants for 21 days<br>3), 4) Almost as planned<br>・In total of 60 GMDSS operators were trained in the following two trainings;<br>i) 15 participants x 2 times = 30 participants for 15 days<br>ii) 15 participants x 2 times = 30 participants for 8 days<br>・In total of 10 AIS operators were trained;<br>5 participants x 2 times = 10 participants for 8 days<br>・Trainings for technicians including staff for the Comprehensive Maintenance Center; |

| | | |
|---|---|---|
| | | 10 participants x 4 times = 40 participants for 20 days |
| 8. Consulting Services | Foreign: 132.5 M/M<br>Indonesia: 136.5 M/M<br>Total: 269 M/M | Foreign: 129 M/M<br>Indonesia: 158 M/M<br>Total: 287 M/M |

*1 : Coastal Radio Stations are divided into four classes depending on administered sea areas, importance of ports and contents of services. 1st class stations meet all services required to coastal radio stations.
*2 : 13 stations where they were 4th class stations at the time of appraisal, upgraded to 3rd class stations at the time of ex-post evaluation.
*3 : 22 stations except Kuala Enok (Kuala Tungkal) and Manado where they were 4th class stations at the time of appraisal, upgraded to 3rd class stations.
*4 : Navigation Telex (NAVTEX) is an international automated medium frequency direct-printing service for the delivery of navigational and meteorological warnings and forecast as well as urgent marine safety information to ships. Coastal Radio Stations deliver the information six times a day (every four hours).

Source: Information from JICA at the time of appraisal, results from questionnaire survey of executing agency, and interview survey results from the field survey

Intended outputs were realized mostly as planned. The main reasons for addition and modification from the plan are as below. Those changes are deemed appropriate since all of them were intended to enhance effectiveness of CRS.

＜Main additional and modification items＞

- MF/DSC equipment for Sea Area A2 was additionally installed into three 1st class stations, namely, Ambon, Semarang and Jayapura. Ambon station was out of scope at the time of the appraisal since the assessment survey could not be conducted due to the security reasons. However, during the implementation period, the need to improvement of Ambon station was identified after surveying the situation. Regarding Semarang and Jayapura stations, at the time of the assessment the GMDSS, the equipment was functioning well; however, during the installment period, the equipment had some problems due to the aging. Since manufacturers no longer produced spare parts, the equipment needed to be replaced to the new ones. This additional work was utilizing foreign exchange gains from the strong yen and depreciation of Indonesia rupiah.
- The additional equipment which can select frequency automatically was procured for NAVTEX. At the time of the appraisal, the plan was to use same frequency as International NAVTEX (518 kHz). However, after 2 years of the appraisal, IMO requested member countries to use 490 kHz for National NAVTEX, therefore, installing automatic frequency changers were required to meet the IMO request.

In regard to the consulting services, intended scope of services was implemented as planned. The reason for the increase in the input of total services was due to the additional installation, change of sites and modification of design as stipulated in the Table 1. It was also found that actual man months (hereinafter referred to as “M/M”) of foreign consultants was

decreased and M/M of local consultants was increased. This was found that foreign consultants had difficulties to visit some project sites due to the security reasons at the time of detailed study[9]. Instead, local consultants alone implemented survey. Accordingly, the change of inputs of consulting services was deemed appropriate in light of the actual situation at the time of implementation.

GMDSS（VHS/DSC）Equipment (Kalianget CRS)

AIS Equipment (Cilacap CRS)

NAVTEX Transmitter (Jakarta CRS)

Moved Transmission Station of Surabaya

[9] In 2006 when the field survey was conducted, situation and condition of east Indonesia were not conducive for foreigners to travel due to the internal conflict. Japanese were restricted to travel these areas at that time.


Figure1: Project Locations (GMDSS newly installed 33 CRS)

### 3.2.2 Project inputs

#### 3.2.2.1 Project Cost

Total project cost was initially planned to be 6,550 million yen (out of which 5,567 million yen was to be covered by Japanese ODA loan). In reality, the total project cost was 5,908 million yen (out of which 5,382 million yen was covered by Japanese ODA loan) which was lower than planned (90% of the planned amount).

The reason why the project cost was within the plan despite the additional outputs was mainly due to the exchange gains from the strong yen[10].

#### 3.2.2.2 Project Period

The overall project period was planned as 67 months, from April 2004 (conclusion of Loan Agreement) to November 2009 (completion of consulting services). In reality, the overall project period was 96 months, from April 2004 (conclusion of Loan Agreement) to March 2012 (completion of consulting services), which was longer than planned (143%).

Table 2 shows the comparison of planned and actual project period.

[10] Exchange rate at the time of the appraisal was ¥1 = Rp. 71.4, while actual exchange rate during the implementation period was ¥1 = Rp. 110, which produced gains about 54% from the strong yen.

Table 2: Comparison of Planned and Actual Project Period

| Item | Planned (At Project Appraisal) | Actual (At Ex-post Evaluation) |
|---|---|---|
| 1. Selection of consultants | Apr. 2004 – Mar. 2005 | Apr. 2004 – Apr. 2006 |
| 2. Consulting Services | Apr. 2005 – Nov. 2009 | Aug. 2006 – Mar. 2012 |
| 3. Tender/Contract | Apr. 2005- Dec. 2006 | Jan. 2007 – Feb. 2009 |
| 4. Installation/Training | Feb. 2007 – Nov. 2008 | Feb. 2009 – Nov. 2011<br>(Jan. – Nov. 2011 for Additional installation) |
| 5. Defect Liability | Dec. 2008 – Nov. 2009 | Dec. 2011 – Nov. 2012 |
| Total | Apr. 2004- Nov. 2009<br>(67 months) | Apr. 2004 – Mar. 2012<br>(96 months) |

Source: Information from JICA at the time of appraisal, results from questionnaire survey of executing agency, and interview survey results from the field survey

The main reasons of delay are listed below;

- In selection of consultants, the number of bidders was lower than the procurement regulation of Indonesia (Presidential Decree 80 (Keppres 80)), which regulates minimum number of bidders. Based on the Keppres 80, prequalification (P/Q) process had to be carried out again from the beginning. In addition, according to the Keppres 80, the project with more than 100 billion rupiah (about 10 million US dollars) had to go through minister's authorization, which took some extra time.
- Additional works were emerged due to the additional outputs.
- Regarding relocation of Samarinda CRS, the site had to be changed since the roads to the planned location became impassable due to other development works during the implementation period. As a result, it took some time to select location of stations.
- Ende and Maumere CRS were supposed to be relocated to the new locations since they were thought to be situated on the land of port authorities. However, during the implementation period new regulation were issued and identified that those lands were belonging to the DGST. Therefore, there was no need to relocate the places; however, the design of system had to be modified to improve the communication system at the existing place.
- Due to the delay in revising Minister's decree in 2011, the approval to carry over the budget from 2010 to 2011 which was meant for construction of facilities took long period.

3.2.3 Results of Calculations of Internal Rates of Return (Reference Only): Economic Internal Rates of Return (EIRR)

The assessment of monetary value of human life is difficult. Therefore, EIRR was not calculated in this project.

Although the project cost was within the plan, the project period exceeded the plan.

Therefore, efficiency of the project is fair.

### 3.3 Effectiveness[11] (Rating: ②)

#### 3.3.1 Quantitative Effects (Operation and Effect indicators)

（1） Operation Hours of GMDSS Coastal Radio Stations

Below table shows the baseline and target which were set at the appraisal and actual figure of operation hours of GMDSS newly installed stations by the project. Stations which are equipped with GMDSS are mandated to operate 24 hours by the regulation of DGST.

The target stations have been improved with necessary system to operate 24 hours such as ensuring power supply by the project. In fact, according to the results from interview with the executing agency and questionnaire to the target stations, it was confirmed that most of the target stations have been operating 24 hours a day, thus, it can be regarded that the original goal has been achieved. However, at the time of the ex-post evaluation, GMDSS equipment of 4 out of 33 target stations was damaged and not functioning well. Some have struck by the lightning and some GMDSS connected computers have been infected by virus[12].

Table 3: Operation Indicator

| Indicator | Baseline*1 (2004) | Target*1 After 2 years of completion (2011) | Actual (2012) Completion Year | Actual (2013) After 1 year of completion | Actual*2 (2014) |
|---|---|---|---|---|---|
| Operation Hours of GMDSS (at 33 stations which GMDSS were newly installed by the project) (hours/day) | N/A | 24 hours/day | 24 hours/day | Almost 24 hours/day | Almost 24 hours/day |

Source: *1: information from JICA at the time of appraisal *2: DGST and questionnaire/telephone interview results

（2） Compliance with the SOLAS Convention

DGST has been improved CRS by equipping GMDSS through assistance from the previous JICA's projects "Maritime Telecommunication System Development" (Phase I - III) as well as the projects from its own finance; however, the requirement of SOLAS Convention has not been fully met. Indonesian government had submitted a plan to equip GMDSS with 84 stations in accordance with the agreement with IMO at the time of appraisal. With this project which equipped GMDSS for 33 stations, in total 70 coastal radio stations have become

[11] Sub-rating for Effectiveness is to be put with consideration of Impact.

[12] In Kalianget CRS which was observed during the field visit, a computer connected to the GMDSS system had infected by virus in 2012. The equipment was sent for repair through the district office once but the virus could not be cleared completely. As a result, the computer connected to the GMDSS system has been left un-functioned until the time of the ex-post evaluation.

GMDSS stations. Accordingly, it could be said that the project contributed to the expansion of GMDSS coverage of Indonesian territorial sea and the Indonesia's obligation to meet the SOLAS Convention. According to the executing agency, after the agreement with IMO, Indonesia has established new ports around her coasts. Due to the establishment of new ports, it is required to equip additional GMDSS at other 19 stations at the time of the ex-post evaluation. DGST has a plan to improve these stations by 2016 with the national budget.

（3） Effectiveness of a Training Center

The training center was strengthened aiming to build capacity for the GMDSS/AIS operators and technicians for maintenance by introducing GMDSS and AIS simulators and others. The trainings for operators and technicians were conducted during the project period as shown in Table 1.

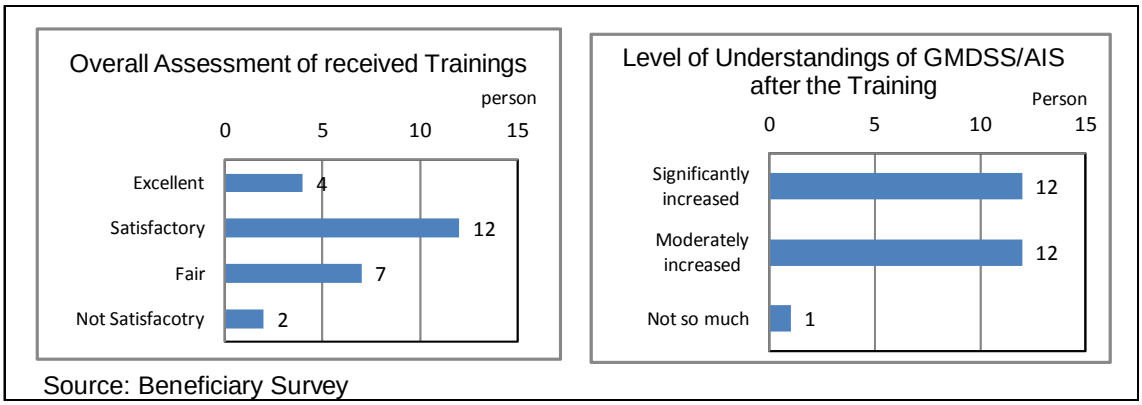



Figure 2: Assessment of Trainings Conducted during the Project Period (25 respondents)

The questionnaire for the ex-trainees[13] revealed that the level of satisfaction on the trainings was high as seeing from the results that 23 out of 25 ex-trainees (92%) responded positive to the trainings as shown in Figure 2. Many answered that they "understood how to use GMDSS and AIS equipment by the training" and "understood what should be done when the equipment was in need of repair or changing spare parts" as the reasons for satisfaction. For the question asking whether they have increased knowledge of GMDSS and AIS, almost all answered "Increased" to some degree. In addition, 20 out of 25 ex-trainees answered that the trainings using simulators were effective. Accordingly, the effectiveness of the training carried out during the project can be confirmed. The trainings were conducted at the training center which was enforced with the simulators provided by the project. It was also identified that the training became very effective for GMDSS/AIS operation and maintenance since they

[13] Questionnaires were distributed to 110 ex-trainees. However, only 25 ex-trainees answered the questionnaires. Out of 25 ex-trainees, 7 were technicians, 8 for operators, and 10 for management staff such as Chief CRS and DGST staff.

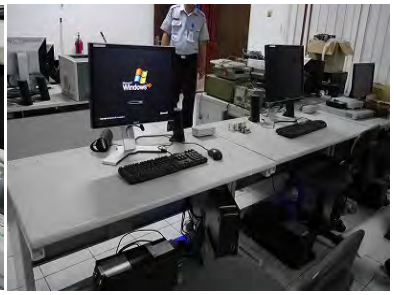
were practical and meeting the needs of trainees. Interviews with the executing agency and officials at the visited coastal radio stations confirmed that there was no particular problem in operation of the equipment which was provided by the project because of the trainings conducted during the project period. Furthermore, it was noted that the knowledge and skills on operation were shared by the ex-trainees to their colleagues at their stations after the training.

However, the training center has not been utilized after the completion of the project according to the interviews to the executing agency and Jakarta stations where the training center located. Last training course was carried out in 2011. As stated above, the effectiveness produced by the training center was high during the project period; however, at the time of the ex-post evaluation, effectiveness of the training center including equipment which was provided by the project has not been demonstrated. (The reason is covered in the "3.5.1 Institutional Aspects of Operation and Maintenance".)

（4） Effectiveness of a Comprehensive Maintenance Center

The comprehensive maintenance center was meant to be established to be a core maintenance center which served to all CRS by receiving repair request and providing technical advice. In addition, it was also meant to become a practical and efficient maintenance system such as through the web-based stock management of spare parts linking with 1st and 2nd class stations. As stated in "3.2.1 Project Output" above, the maintenance center was established at the Jakarta station and installed necessary equipment for maintenance such as GMDSS spare parts and radio measurement. Furthermore, a web-based network was set up between 1st/2nd stations with the maintenance center in Jakarta. However, according to the interviews to the executing agency, Jakarta station and examination of Surabaya station (1st station) where web-based network was established, it was found out that the expected roles have been played neither during the project period nor at the time of the ex-post evaluation. Accordingly, the effect as a maintenance center has not been demonstrated. (The reason is covered in the "3.5.1 Institutional Aspects of Operation and Maintenance".)

Training Center
(GMDSS Simulator)



Training Center
(AIS Simulator)

Measurement Equipment
provided for
Maintenance Center

### 3.3.2 Qualitative Effects

A beneficiary survey was conducted to assess effectiveness and impact by the project. The survey targeted captains, radio operators, navigation officers of ships which equipped with GMDSS, AIS or NAVTEX and who were using the services of CRS. The total of 87 samples was collected[14].

#### （1） Satisfaction level of beneficiaries

According to the results of the satisfaction survey on the improvement of CRS by the project targeting the maritime service providers who were utilizing GMDSS, AIS and NAVTEX, as shown in the Figure 3 below, 28% of respondents (24 respondents) rated “Very much satisfied”, followed by “Satisfied” for 70% (61 respondents) and “To some extent” for 2 respondents. There was not any respondent who answered “Not so much” or “Not at all”. Therefore, it can be said that all of the respondents satisfied to some degree with the improvement of services provided by CRS. It can be assumed that the project has met the needs of the beneficiaries.

#### （2） Ensuring the security of life and property of ships navigating in Indonesian waters

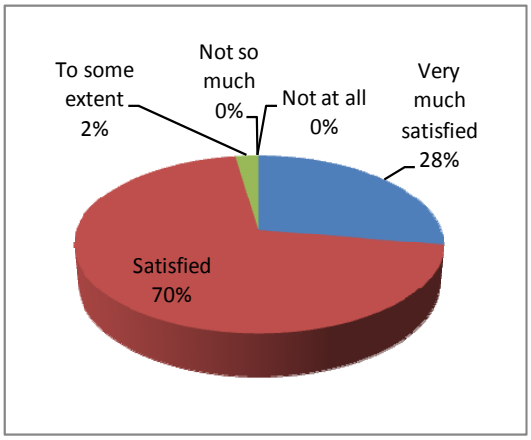
According to the beneficiary survey, as shown in the Figure 4 below, most of the respondents, 75 out of 87 respondents (86.2%) answered “Increase in safety for navigation” for the changes after the introduction of GMDSS/NAVTEX. In fact, judging from the replies of radio operators at the interviews, it was found that the installation of GMDSS/NAVTEX at CRS brought a sense of safety. Radio operators replied to the interviews that they felt “much safer knowing that the GMDSS has been installed at CRS”. Others answered that “although they communicate with the company to which they belong at the regular situation, they felt safer knowing that CRS could respond to the emergency situation”.

In the case of emergency, GMDSS alert is transmitted by terrestrial communication to CRS. Those CRS which received GMDSS alert communicate the National Safety and Rescue Agency (BASARNAS) and port authorities for rescue activities. The ship can also communicate directly with BASARNAS by satellite communication. In the actual situation where the ships send emergency signal, maritime safety and rescue activities can be ensured using either terrestrial or satellite communications complementarily. In this way, the coverage

[14] A beneficiary survey for GMDSS users were conducted at Surabaya, Kalianget and Palembang ports. The sample was collected from 49 shipmen. For NAVTEX users, the survey was conducted at Jakarta Port (Tanjung Priok) with sample of 38 shipmen. Therefore, a total of 87 samples was collected at random with face to face interview. The occupation groups of the sample were; Ship captains (13, 14.9%), Radio operators (44, 50.6%), Chief officers (5, 5.8%), Second officers (22, 25.3%), and Others (3, 3.4%). The shipping categories were; Cargo (81, 93.1%), and Passenger ships (6, 6.9%). The shipping operation were; International (30, 34.5%) and Domestic (57, 65.5%).

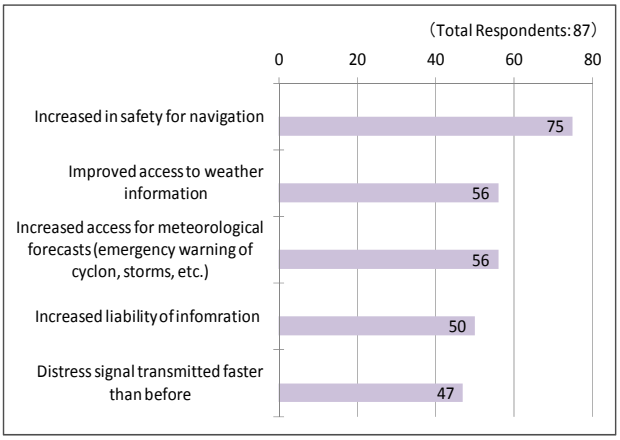
of GMDSS terrestrial transmitted areas were increased, thus, the project contributed to enhancing the total safety for the ships.

From the above, it can be said that the project has contributed to ensuring the security of life and property of ships navigating in the Indonesian waters.




Source: Results from the beneficiary survey

Figure 3: Satisfaction level of Beneficiaries to the project




Source: Results from the beneficiary survey

Figure 4: Changes after the introduction of GMDSS/NAVTEX (Multiple Answers)

<Actual Examples that had an Effect by GMDSS >

- When the ferry (Ro-Ro ship) was on fire off the coast of Jakarta in 2012, Jakarta CRS promptly communicated with BSARNAS and the port authority after receiving GMDSS alert, which led to the rapid rescue activities.
- According to the captain of Ro-Ro ship anchoring at the Kalianget port, he could manage to travel avoiding the damaged ship by receiving those information from the Kalianget CRS. Kalianget CRS received GMDSS alert from the damaged ship and the navigation information on this was delivered to the nearby ships. It is one of the effects of GMDSS.
- When the cargo travelling between Surabaya, Sampit and Batulicin was hijacked, by sending emergency signal by GMDSS to the CRS and nearby ships, the cargo was rescued immediately.
- When the GMDSS equipped ship happened to find a small boat towing the damaged ship, the GMDSS equipped ship sent an alert to the CRS by GMDSS. The CRS which has received the signal requested the rescue to the relevant organizations such as port authority and BASARNAS, and assured the security by sending the risk information to the ships travelling near those ships.

( From the interview results at the beneficiary survey)

Kalianget CRS

Cargo which equipped GMDSS
(Surabaya Port)

## 3.4 Impacts

### 3.4.1 Intended Impacts

#### 3.4.1.1 Promotion of Maritime Industry

Table 4 shows the number of passengers, volume of cargo and ships entering into Indonesian ports. The number of passengers was maintained around 16 million people between 2009 and 2013. On the other hand, both volume of cargo and entry number of ship have an increasing tendency. This is indicating that maritime business in Indonesia is by and large expanding.

Table 4: Volume of Passenger, Cargo and Number of Ships entry into Indonesia

| Item | Unit | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|
| Number of Passenger | （1,000 persons） | 15,620 | 15,548 | 17,441 | 17,620 | 16,127 |
| Volume of Cargo | （1,000 TEU*） | 9,260 | 10,530 | 11,693 | 13,295 | 13,527 |
| Ships entry | （Number） | 250,244 | 259,197 | 280,408 | 268,686 | 272,780 |

Note：TEUS：Twenty-foot Equivalent Unit
Source: DGST

The result of beneficiary survey on the promotion of the maritime business is shown in the Table 5.

Table 5: Impact on the Promotion of Maritime Business

| **Questions** | **Responses (n=87 respondents)** |
|---|---|
| (a) After the project, has your business improved by the services provided by CRS? | 1. Very much improved 13 (14.9%)<br>2. Improved 58 (66.8%)<br>3. No relation 7 ( 8.0%)<br>4. I don't know 9 (10.3%) |
| (b) What services of CRS do you think most relevant to the improvement of your business? (free opinion) | ・Updated weather information and navigation information are very useful for the business since the timing of departure and arrival could be planned accurately. (28, 32.2%)<br>・The business chances have been increased with safer navigation by getting reliable information from CRS (passengers feel safer) (13, 14.9%)<br>・Increased safety by accurate information (11, 12.6%)<br>・The communication with CRS became increased (4, 4.6%)<br>・The communication with other ships increased and shared information (3, 3.4%) |

Source: Results from the beneficiary survey

81.7 % (71 respondents), of shipping operators answered that after the project their business has been increased either "very much" or "much" by the improvement of services provided by CRS. 32.2 % (28 respondents) of shipping operators raised that the business became efficient by making an accurate plan of departure and unloading through obtaining updated weather information and navigation information. 14.9% (13 respondents) answered that they could appeal customers for safe navigation with obtaining accurate information. 12.6% (11 respondents) raised the increase in the navigation safety with reliable information. The increase in communication with CRS and other ships were also pointed out by some respondents.

Although the promotion of maritime business has been not only led by services of CRS but

also by other factors, in light of the above, it is considered that the improvement of facility at CRS by the project brought the enhancement of the level of services and contributed to a certain extent to the promotion of maritime business.

### 3.4.2 Other Impacts

#### 3.4.2.1 Impacts on the Natural Environment

Environmental Impact Assessment has not been required for the project based on the law and regulations in Indonesia. It was confirmed by the executing agency that there has not been any impact on the natural environment at the time of ex-post evaluation even during the construction period.

#### 3.4.2.2 Land Acquisition and Resettlement

The project required land acquisition for relocation of Surabaya, Makassar, Benoa, Manado, Kupang, Kuala Enok (Kuala Tungkal) and Samarinda CRS. However, there was no resettlement issue. The land acquisition for the project was implemented in accordance with the procedures of "Land Acquisition Law" in Indonesia. Some delays occurred in some of the sites, but there were no particular problems.

Although it was noted that the training center and the comprehensive maintenance center have not been utilized after the project, this project has to some extent achieved its objectives. Therefore, effectiveness and impact of the project are fair.

## 3.5 Sustainability (Rating: ②)

### 3.5.1 Institutional Aspects of Operation and Maintenance

The coastal radio stations which are managed by DGST have 154 stations. Each CRS is operated and maintained under district navigation offices which they have 25 offices across the country under the Directorate of Navigation (DON), DGST. Table 6 shows the number of staff who are related to CRS. In total, about 1,300 staff are allocated in the country.

Table 6: Number of Staff related to CRS

| Type of Employment | Staff Number |
|---|---|
| Directorate of Navigation | 23 |
| Chief CRS | 154 |
| Operator | 966 |
| Maintenance technician | 151 |
| Total | 1294 |

Source: DON, DGST

In 2005, DON established a standard number of staff according to the class of CRS and specific qualification based on the job category. However, in reality, "an ideal number of staff" is separately established taking into account the situation of each CRS. If compared the ideal number and actual number of staff, upper class CRS such as 1st class are fulfilled their requirement. However, most of lower class CRS do not reach the ideal number of staff. In particular, the 4th class CRS has such tendency and in many cases there are only operators allocated, but no technicians. As examples, standard number, the ideal number and actual number of staff of Kalianget (3rd class) and Sabang (2nd class) CRS are exhibited in Table 7 and Table 8 respectively.

Table 7: Number of Staff in Kalianget CRS

| Category* | Standard | Ideal | Actual |
|---|---|---|---|
| SRE I | 1 | 0 | 0 |
| SRE II | 6 | 2(Admin) | 1 |
| ORU | 22 | 12 | 2 |
| TTP I | 0 | 5 | 0 |
| TTP II | 1 | | 0 |
| TTP III | 2 | | 0 |
| Montir | 3 | | 1 |
| 合計 | 35 | 19 | 4 |

Table 8: Number of Staff in Sabang CRS

| Category * | Standard | Ideal | Actual |
|---|---|---|---|
| SRE I | 7 | 4 (Admin) | 2 (Admin) |
| SRE II | 10 | | |
| ORU | 17 | 25 | 19 |
| TTP I | 1 | 17 | 4 |
| TTP II | 2 | | |
| TTP III | 7 | | |
| Montir | 8 | | |
| 合計 | 52 | 46 | 25 |

*Note: SRE: Electronic Radio Certificate (I: Diploma on Electronic engineer (more than 3 years), II: Diploma on Electronic engineer (2 years), ORU: General Operator Certificate (1 year diploma)), TTP: Marine Telecommunication Technician (I: Diploma on Engineering (more than 3 years), II: Diploma on Engineering (2 years), III: Diploma on Engineering (1 year)), Montir: Assistant Technician (Graduates from Vocational school/High school)
Source: "Manual for Marine Telecommunication", January, 2005, DGST

CRS which equipped with GMDSS is obliged to operate 24 hours. It is assumed that operators work in three shift forming in four groups (one group for stand-by). However, there are stations that have only four operators like Kalianget CRS. It was noted that even those stations with limited number of staff could manage to operate 24 hours establishing an emergency response system, such as having staff quarters next to the CRS.

One of the reasons for the shortage of staff was pointed out that the Indonesian government, in principle, has frozen the new recruitment during the period of moratorium on staff recruitment for budget squeeze since 2009. Some vacancies due to separation or retirement will be filled but not all of them. It was noted that there was a problem of understaffing although it did not affect seriously for the standard operation of CRS.

As stated above, the reasons why the training center and the comprehensive maintenance center have not been utilized are largely due to the organizational issues such as operational

procedure and budget allocation system of the Ministry of Transport. After the completion of the project, both centers were registered as "assets" of Tanjung Priok district office which administers Jakarta station. As discussed later in the "Financial Aspects of Operation and Maintenance", the budget for CRS is allocated to 25 district offices. Tanjung Priok district office has neither budget nor responsibility for trainings and repairs for stations that are not under its jurisdiction. Therefore, it was not able for Tanjung Priok district office to meet the intended works that the project had expected[15].

Besides, regarding the trainings for CRS staff at the training center, DON and district offices do not have mandate to carry out trainings from their own, and they do not have qualified staff who can conduct trainings. The budget for Tanjung Priok district office where the training center is belonging covers only the CRS which are under its jurisdiction. Therefore, the staff are belonging to the CRS which have been equipped with GMDSS/AIS by the project but are not under Tanjung Priok district office would be excluded. Therefore, the training center has not been utilized.

While, there is Human Resources Development of Sea Transportation Center (HRDSTC) under the Ministry of Transport which has a mandate to conduct trainings and education. HRDSTC conducts a part of trainings for CRS staff as well[16]. Simulators for GMDSS and AIS are found to be effective tools for trainings. If the project had discussed about inviting trainers from HRDSTC and budget issues, the training center could have been utilized effectively even after the project.

The comprehensive maintenance center was designed to have a central maintenance function at Jakarta in mind. However, technicians and budget for this purpose were not allocated to the Tanjung Priok district office. Besides, Tanjung Priok district office does not have mandate to make repairs for the equipment of CRS other than its jurisdiction. Therefore, the maintenance center has not been utilized.

Although some problems were found in operation procedures in each of the training center and the comprehensive maintenance center, at the time of the ex-post evaluation, the discussion on the future modality and effective use of both centers has been started among stakeholders and the improving trend was observed in the situation.

In light of the above, regarding the personnel issues, the shortage of staff, especially in the 3rd and 4th class CRS, remains the challenge as having been pointed out in the previous phase I to phase III projects. However, it was confirmed that a minimum number of personnel had

[15] When the training was conducted during the project period, the training center had not been registered as asset of Tanjung Priok district office. The trainings were arranged by the project with project finance and trainers from contractors.

[16] HRDSTC has the role as the technical monitoring and authority for all maritime education, academies and training schools in Indonesia. There are 10 institutions for maritime education and training under HRDSTC. Among them, BPPTL is for civil servants and the staff of coastal radio stations can receive the trainings.

been secured to operate CRS for 24 hours. The training center and the comprehensive maintenance center were identified as idle due to the organizational issues. However, considering that basic technical skills to operate GMDSS and AIS have been established in CRS and that some degree of system for maintenance exists, it was confirmed that those issues did not hamper greatly for operation and maintenance of the project outputs.

### 3.5.2 Technical Aspects of Operation and Maintenance

The staff fulfills technical level which requires for his job category. Regarding GMDSS and AIS equipment which the project provided, the trainings were conducted during the project period to the target CRS staff; therefore, no major problem in the operation of those equipment can be seen. As stated in the "effectiveness", the trainings utilizing simulators were very effective. The manuals for the equipment were kept in the target CRS and they were referred when necessary.

However, the trainings were conducted for 2-3 staff from each target CRS and technical transfer to other staff was done by only OJT through those trained staff. DGST has been arranging the short-term training courses for operators and technicians of CRS as their human recourses development. Those trainings are done at the educational institute under the Ministry of Transport, or at outsourced organizations such as universities and private institutes, but the number of trainees is limited due to the availability of budget of DON. In 2013, DON, DGST organized short courses for about 30 staff each from operators and technicians respectively[17]. Considering the fact that there are 966 operators alone in the country, the opportunity to receive the training seems very limited. Besides, according to the interviews to the CRS staff at the field visits, they pointed out the strong needs for practical training since most of trainings organized by DGST were theoretical. It was also found that opportunities for training for technicians to update repair skills and new technology were very limited and the technicians usually implement simple routine maintenance.

The equipment of the training center and the comprehensive maintenance center were maintained periodically by the technicians of Jakarta CRS and it was confirmed that most of them were kept in good condition.

In light of the above, it can be said that the technical level of CRS staff at the time of the ex-post evaluation has sufficient for actual operation and maintenance. However, it was identified that there were rooms for improvement for future technical transfer. Utilization of the training center could be effective since the training opportunities are limited.

[17] According to the executing agency, in 2013, 30 operators (commissioned to the private institute), 25 technicians (commissioned to Indonesia State University) were trained, and the trainings for Vessel Traffic Services (VTS) center (a part of AIS training was included) were conducted with assistance of Australian government.

### 3.5.3 Financial Aspects of Operation and Maintenance

DON, DGST allocates budget for operation and maintenance of CRS to 25 district offices. District offices are administered operation and maintenance cost for CRS which are under their jurisdiction. In the case that the CRS has a maintenance problem, CRS request the budget for repair to the district office. Figure 5 shows budgetary status for operation and maintenance of CRS which are allocated to the 25 district offices[18]. "Routine expenditure" is the cost for the small scale repair and purchase of spare parts. "Capital expenditure" is the cost for purchase of goods and equipment and improvement of facilities. It is allocated only for those which will be necessary to invest for that year.

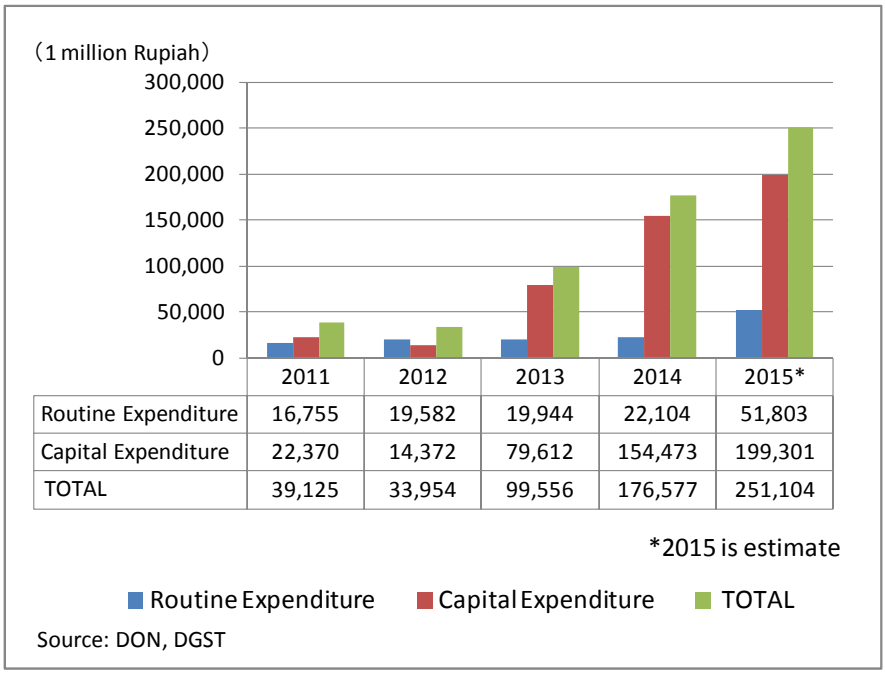



Figure 5: Budgetary Status for Operation and Maintenance of CRS (2011-2015)

Note: 1,000 Rupiah = about 10 yen (Rate: December 2014)

The actual expenditure has been increasing year by year between 2011 and 2014. The reason for increase is largely on the increase in "Capital expenditure". The routine expenditure has been also increasing year by year; however, only 10% increase can be achieved from 2013 to 2014.

It was confirmed from the interviews to the executing agency and the CRS at the field visits there was no major obstacle to operate CRS with the current routine maintenance

[18] At the time of appraisal, it was expected that lighthouse tax which had been collected since 2000 would become a part of maintenance budget for CRS. However, related taxes and fees such as lighthouse tax and public telecommunication fee flows into the national account and allocated to the Ministry of Transport as general budget since 2010. Therefore, the light house tax which was thought to be a financial source for maintenance was not exactly secured.

budget. However, the current routine maintenance budget only covers the minor repair, therefore, the funds sometimes had to be diverted from the capital budget when it was necessary. Usually, the budget is allocated from DON to the district offices without delay, however, when the necessity to make repair which exceeds the usual budget arises, the excess budget cannot be disbursed timely. So the request has to make the following financial year for that repair. The interview to the CRS also revealed that ensuring necessary budget timely for repair and spare parts was difficult.

In light of the above, there are some concerns in financial aspects of operation and maintenance of the project.

#### 3.5.4 Current Status of Operation and Maintenance

Although the questionnaires on the status of installed equipment were not able to be collected from all targeted CRS, through the telephone interviews to the CRS to the extent possible, it was confirmed that the GMDSS system was operating without much problems except four stations. Regarding AIS and NAVTEX equipment installed at the four stations respectively were operating without any problem.

Three out of the four stations whose GMDSS system had problems at the time of the ex-post evaluation, were damaged by the lightning and operated only 12 hours a day. GMDSS at Ende station was hit by the lighting recently in December 2014; however, in the other two stations, namely Pare-Pare and Tegal stations GMDSS equipment were damaged in January 2014 and November 2011 respectively. Since then, those damaged equipment have been left unrepaired. The other damaged GMDSS system was at Kalianget station. The computer which was connected to the GMDSS system was infected by virus since 2012 and the GMDSS system could not be utilized fully. Since GMDSS system contributes to the safety of navigation, it is expected for the executing agency that monitoring of the operation and maintenance status of CRS through district offices should be strengthened. In addition, immediate response should be considered with providing appropriate budget according to importance and urgency.

Some minor problems have been observed in terms of institutional, technical and financial aspects. Therefore, sustainability of the project effect is fair.

## 4. Conclusion, Lessons Learned and Recommendations

### 4.1 Conclusion

The project aimed to fulfill the requirement of 1974 SOLAS Convention, to secure the safety of maritime navigation, and to respond promptly to maritime accidents by facilitating GMDSS and AIS at 33 and 4 coastal radio stations respectively in Indonesia. The project is

well consistent with the development policy and development needs of Indonesia, as well as with the Japan's ODA policy; thus, the relevance of the project is high. The operation/effect indicator that targeting 24 hours of operation hours of GMDSS at newly installed stations by the project has been achieved at almost all target CRS. Moreover, the project expanded the coverage areas of maritime communication of GMDSS and contributed to the Indonesia's obligation to fulfill the requirement of SOLAS Convention. A beneficiary survey confirmed that the benefits of the project (improvement of navigation safety, increase of access to weather and navigation information, and acceleration of emergency distress response) were recognized by the GMDSS users. Furthermore, the project contributed to the service of CRS as well as the promotion of maritime business. However, the training center and the comprehensive maintenance center were not utilized after the completion of the project and the effectiveness produced by these two centers were limited; thus, the project's effectiveness and impact are fair. The project efficiency is fair because the project period exceeded the plan although the project cost was within the plan. In regard to operation and maintenance, no major problems have been observed. However, there is room for improvement on the operation of the two centers mentioned above, as well as institutional and technical aspects; thus, sustainability of the project is fair.

## 4.2 Recommendations

### 4.2.1 Recommendations to the Executing Agency

・ Expand the practical training opportunities utilizing the training center

The simulators for GMDSS and AIS which were installed by the project were found to be very effective for the training since they could conduct practical trainings which have high demands. Although at the time of the ex-post evaluation, discussion has been initiated regarding the future operation of the equipment between the executing agency and HRDSTC, it is expected that the effective utilization of the equipment by the project should be considered in early manner. It should be noted that detailed operational methodology including which budget should be used, contents, and certificates for the trainings should be discussed and agreed among stakeholders.

・ Effective utilization of equipment which were provided to the comprehensive maintenance center

Since it cannot be expected that the assumed role of the comprehensive maintenance center is realized due to staff and technical issues, there is need to develop a strategy for effective use of the equipment and spare parts which were provided by the project. Continuing discussion between Tanjung Priok district office where the center belongs to and the relevant officers such as DON, it is expected that measures should be considered to benefit the target

CRS by the project. In fact, there are CRS whose GMDSS equipment is damaged such as by the lightning. Operational procedures and budgetary provision which could be preferentially granted to such CRS should be considered.

- Immediate implementation of necessary repair for damaged GMDSS and strengthening of monitoring

At the time of the ex-post evaluation, GMDSS equipment of four stations was found to be damaged. Some were recently damaged but others have been left unrepaired more than two years. In view of the importance of GMDSS, monitoring of the equipment of CRS should be further strengthened through district offices and repair of damaged GMDSS system is expected to be made promptly.

#### 4.2.2 Recommendation to JICA

None.

### 4.3 Lessons Learned

- Clarification of regulations, budget and mandate for provided equipment to be utilized practically after the project

In the Ministry of Transport in Indonesia, the directorates and departments are organizationally independent each other. Provided equipment is registered as asset of recipient directorates or district offices separately. Therefore, institutionally it is difficult to transfer the asset from one directorate to another or to manage it commonly. Since the training equipment was installed in the office which did not have mandate, personnel, nor budget to conduct trainings, the equipment was not utilized after the project completion. In the same manner, maintenance equipment was registered at one district office, therefore, the delivery of spare parts to other offices could not be allowed. Therefore, when the project includes equipment provision, the scope and approach of the project should be decided and agreed only after thorough examination and discussions with relevant organizations ensuring whether the equipment is surely utilized under the current arrangement in terms of operational regulations, mandate and budget.

END

Comparison of the Original and Actual Scope of the Project

| Items | Original | Actual |
|---|---|---|
| 1. Project Outputs | 1) Installation of GMDSS<br>1. MF/DSC for Sea Area A2<br>19 stations<br>2. VHF/DSC for Sea Area A1<br>33 stations<br>2) Improvement of CRS for enabling to cover GMDSS<br>1. separation of transmitting and receiving stations(Teluk Bayur and Benoa)<br>2. Improvement of environment for Surabaya and Makassar stations<br>3. Improvement of VHF coverage areas for Dumai and Samarinda stations<br>4. Replacement of aged engine-generators at 1st and 2nd class stations (total of 14 stations)<br>5. Replacement of aged antennas at 1st and 2nd stations (total of 12 stations)<br>6. Additional works<br>3) Commencement of National NAVTEX (4 stations: Jakarta, Makassar, Ambon and Jayapura)<br>4) Installation of AIS (4 stations: Belawan, Dumai, Sabang, Jakarta)<br>5) Establishment of a Comprehensive Maintenance Center<br>6) Reinforcement of a Training Center<br>7) Training of Operators and Technicians for relevant CRS<br>8) Consultancy Services<br>a) Detailed design<br>b) Contract Assistance Services<br>c) Factory Inspection Services<br>d) Installation Supervision Services<br>e) Maintenance Advisory and Final Acceptance Services<br>f) Technical Transfer and Training | 1) Installation of GMDSS<br>1. MF/DSC for Sea Area A2<br>22 stations<br>2. VHF/DSC for Sea Area A1<br>As planned<br>2) Improvement of CRS for enabling to cover GMDSS<br>1. As planned.<br>2. As planned.<br>3. As planned. (For Samarinda, location was changed)<br>4. In addition to the original plan, aged engine-generators of 3rd and 4th stations were replaced. (total of 41 stations)<br>5. As planned<br>6. Tower for Dumai station was strengthened. Modified the tower design and location of tower for Ende and Maumere stations. Additionally purchased Antenna for NAVTEX for Jakarta station.<br>3) As planned.<br>4) 2 stations were changed (Lhokseumawe, Cilacap, Dumai, Sabang)<br>5) As planned.<br>6) As planned.<br>7) As planned.<br>8) Consultancy Services<br>Necessary tasks have been implemented as planned. |
| 2. Project Period | April, 2004 – November, 2009<br>(67 months) | April, 2004 – March, 2012<br>(96 months) |

| | | |
|---|---|---|
| 3. Project Cost<br>Amount paid in Foreign currency | 4,342 million yen | 5,371 million yen |
| Amount paid in Local currency | 2,208 million yen<br>(157,714 million rupiah) | 532 million yen<br>(59,072 million rupiah) |
| Total | 6,550 million yen | 5,908 million yen |
| Japanese ODA loan portion | 5,568 million yen | 5,382 million yen |
| Exchange rate | 1 rupiah ＝0.014 yen<br>(As of October, 2003) | 1rupia＝0.009 yen |