Malaysia

Ex-Post Evaluation of Japanese ODA Loan Project
"Port Dickson Power Station Rehabilitation Project (2)"

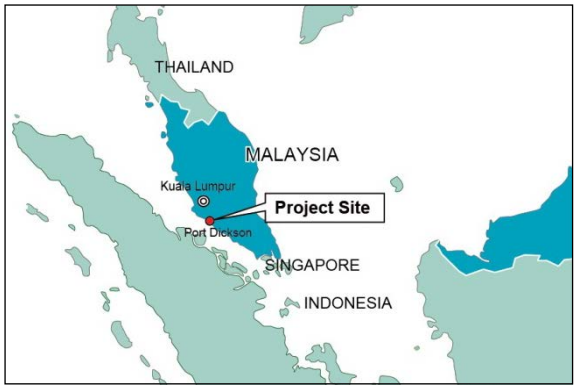
External Evaluator: Mitsue Mishima, OPMAC Corporation

0. Summary

The Project aimed at stable electric power supply and a reduction in greenhouse gas by replacing the existing obsolete 360MW (Unit 5, 6 and 7) TNB thermal power plant with a highly efficient gas combined cycle thermal power plant in Port Dickson Power Station in the state of Negeri Sembilan. The Project required time for a re-examination of the needs of the project during its implementation due to a surplus in the reserve margin for generation capacity, which differed greatly from that predicted. Nevertheless, the needs for the Project still exist at present and the Project has been relevant to Malaysian and Japanese policies, therefore, the relevancy of the Project is high. A re-examination of the needs for the Project, however, became the main reason for the large delay in the project period, and thus the efficiency of the Project is fair. On the other hand, the operation status of the Project power generation facility has been excellent and the Project is considered to be managed most efficiently responding to the base load of power generation. Effects for improved environment were revealed in terms of reductions in CO_2 emission in comparison to the old power generation plants. The project also contributed to the stable power supply and to the avoidance of heavy dependence on one energy source. Thus, effectiveness and impact are high. In addition, sustainability is high in terms of organization and technical and financial capacity of TNB.

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

1. Project Description



Project Location

TNB Port Dickson Power Station
(Project target power plant)

1.1 Background

In 1990s, power demand in Peninsular Malaysia dramatically increased due to high economic growth and an increase in foreign companies investing in Malaysia. Peak demand increased 1.9 times and electricity sale more than doubled during 1992-1998. Thereafter, peak demand was expected to achieve to 12,000MW-14,000MW by year 2005, with a growth rate of about 5-7% per year, while the volume of electricity sales was estimated to increase to 70,000GWh-85,000GWh in the same year, with a growth rate 5-8% per year. Power system demand in Peninsular Malaysia is mainly concentrated in the Kuala Lumpur metropolitan area, in Putrajaya, southwest of Kuala Lumpur, and in areas subject to the Multimedia Super Corridor.

Power demand in these areas was expected to increase further. Amid expectations for investment in information related industries, there was great demand for a high quality power generation facility without the occurrence of power failures.

In 1998, the total capacity of power supply facilities in the Peninsula was 12,617MW, of which Tenaga Nasional Berhad (TNB), a Malaysian power utility, owned 62% with Independent Power Producers (IPP) owning the remaining 38%. Due to the influence of the currency crisis at that time, financing for IPP projects became very difficult and caused substantial delays in the project implementation. With this background, the government of Malaysia prioritized the development of TNB power sources.

1.2 Project Outline

The objective of this project is to demolish oil-fired power plant facilities which seriously deteriorated and became inefficient, and to replace them with highly efficient combined cycle gas turbine power generation facilities with low emissions of greenhouse gas at the TNB Port Dickson power station in the state of Negeri Sembilan, thereby contributing to stabilization of the power system and the diversification of energy sources in Peninsular Malaysia.

Prior to this project, the "Port Dickson Power Station Rehabilitation Project" (ODA loan agreement signed in March, 1999) had been implemented in order to demolish 240MW oil-fired power generation plants (No.1 to 4) and then to construct new 750MW gas combined cycle power plants. These power plants started to operate after June, 2005 (hereinafter referred to as "Phase 1 project"). This present project was also to demolish the remaining 360 MW gas and oil co-fired power generation plants (No.5 to7) and to construct 750 MW gas combined cycle power generation plants, which was the same output capacity as the Phase 1 project.

Loan Approved Amount/ Disbursed Amount	53,764 million yen / 48,984 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March, 2000 / March, 2000
Terms and Conditions note)	Interest Rate: 1% Repayment Period: 40 years (Grace Period: 10 years) General Untied
Borrower / Executing Agency(ies)	Tenaga Nasional Berhad (TNB) / Guarantor: Government of Malaysia
Final Disbursement Date	March, 2010
Main Contractor (Over 1 billion yen)	Sumitomo Corporation (Japan)・Toshiba Corporation (Japan)・GE Power Systems Sdn. Bhd (GEPSM) (Malaysia)・General Electric Co. (United States of America)・General Electric Power Systems Inc. (GEPSI) (JV)
Main Consultant (Over 100 million yen)	Tokyo Electric Power Service Corporation (TEPSCO) (Japan)
Feasibility Studies, etc.	"Report to Economic Planning Unit The Federation of Malaysia: Engineering Services for Tuanku Jaafar Power Station Rehabilitation Project" TEPSCO, October, 1998
Related Projects	ODA Loan Project "Port Dickson Power Station Rehabilitation Project"

Note: The project is a Special ODA loan that usually sets the procurement condition of Japan Tied. However, as the project target country was Malaysia, which is classified as an upper-middle income country, the procurement condition was in general untied.

2. Outline of the Evaluation Study

2.1 External Evaluator

Mitsue Mishima, OPMAC Corporation

2.2 Duration of Evaluation Study

Duration of the Study: August, 2011 -August, 2012
Duration of the Field Study: October 20 - 27, 2011, March 5 - 9, 2012

2.3 Constraints during the Evaluation Study (if any)

No particular constraints

3. Results of the Evaluation (Overall Rating: A[1])

3.1 Relevance (Rating: ③[2])

3.1.1 Relevance with the Development Plan of Malaysia

The Project was relevant to the Development Plan of Malaysia from the time of project appraisal to that of the ex-post evaluation. At the time of the ex-post evaluation, the promotion of power generation with less of an environmental burden and high efficiency plants is still important.

The policy objectives of the energy sector in the 7th five year plan (1996- 2000) were: (a) efficient use of energy, (b) diversification of energy sources, (c) minimization of environmental impacts. The Project was relevant to those objectives and its necessity was high. This was especially the case in the context of the diversification of energy sources. The "Four Fuel Diversification Policy", that is, avoiding heavy dependence on oil and dispersing into the four energy sources, natural gas, hydropower and coal, in addition to oil, was formulated, placing importance on the development and use of natural gas.

The 8th five year plan (2001-2005) subsequently addressed the promotion of gas and renewable energy as energy sources and improvements in the productivity and efficiency of the power supply. The 9th five year plan (2006-2010) placed importance on the reliability of the energy supply, cost effectiveness etc. The same policies were followed and the importance of environmental and social considerations has also been discussed in the current 10th five year plan (2011-2015) and the new energy policy (2011-2015). The Project is relevant to the main context of energy strategy in Malaysia because it is highly efficient and better in terms of cost-effectiveness, as well as in the reduction of negative environmental impacts, when compared to the obsolete thermal power generation plants.

After the 9th five year plan, it should be noted that coal-fired thermal power generation was emphasized in order to alleviate excessive emphasis on gas as a power generation energy source. After 2002, gas supply to the power sector was indicated as being 1,350 mmscfd[3]. As of November 2011, the actual gas supply volume was revealed to be 1,050 mmscfd and when it became 900 mmscfd and lower, the plant increased power generation by the use of DFO (Distillate Fuel Oil). Due to TNB, however, the gas supply has been again increasing during the fiscal year 2011 to 2012 and power generation by gas will be maintained at a certain level.

3.1.2 Relevance with the Development Needs of Malaysia

The Project was relevant to the development needs at the time of project appraisal and this is unchanged at present. The needs for the Project were, however, reconsidered when there was

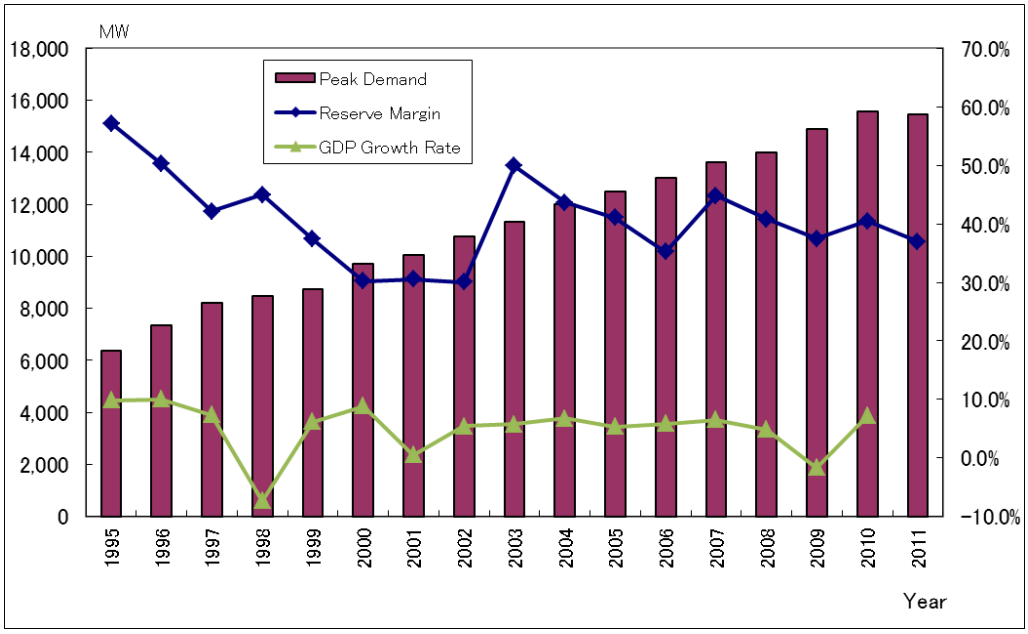
[1] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[2] ③: High, ② Fair, ① Low
[3] Abbreviation of "million standard cubic feet per day", a unit of gas flow volume.

a temporary surplus of reserve margins at the time of bidding by the contractor for civil works. As discussed later in "Efficiency", this was the reason for the significant delay in the commencement of civil work for the Project.

Upon project appraisal, while it was forecasted that the power demand would increase steadily, there was a delay and some uncertainty in the development plan for new power plants by IPP due to the currency crisis. Thus, the reserve margin of the power system was predicted to become lower than 30% in 2001, and then to be lower than 6% without the phase 1 project, or only 11% even with it, in 2004. It was foreseen that a stabilized power supply would be impossible, and thus reinforcement of the power supply facilities was required.

As shown in Figure 1, the actual reserve margin did not reduce to lower than 30%, in fact at one point it increased to about 50% in 2003, becoming 43% in 2004, and then remaining more or less at 40%. Peak demand has been increasing every year. The medium and long-term peak demand forecast at the time of project appraisal showed an approximate yearly average growth rate of 5 to 7%. The actual power demand increased by a yearly average of about 5% from 1999 to 2011, which was within the range of the forecast. Therefore, the main reason for the surplus of reserve margin at the time was a rapid increase in the power plant capacity of IPP. Because of this surplus of the reserve margin, after the deadline for bidding for the contractors for civil work in August 2002, the Malaysian government started examining whether or not the Project should continue, and time was required to reach a final decision. As a result, it took nearly 2 years from bidding to the contract.

At the time of ex-post evaluation, in the Tenth 5 Year Development Plan, GDP growth rate is predicted to be at a yearly average of 6% and an increase in the power demand is expected. Therefore, the necessity for the Project is clear.



Source: TNB data and Malaysia Statistic Office data.

Note: Peak Demand and reserve margin data provided by TNB is from September to August according to the TNB fiscal year. Therefore, the data for each year includes the time after September in the previous year and August in the said year. Real GDP growth rate is the calendar year.

Figure 1: Peak Demand, Reserve Margin, and GDP Growth Rate

3.1.3 Relevance with Japan's ODA Policy

The Project is considered to be relevant to the ODA policy for Malaysia at the time of project appraisal (Year 2000). Japanese Development Assistance for Malaysia by the Ministry

of Foreign Affairs (MOFA) in 1999 (Japanese ODA: ODA White Paper; the second volume) and Medium-Term Strategy for Overseas Economic Cooperation Operations (December, 1999) addressed the assistance policy for Malaysia, considering it is upper-middle income country requiring environmental protection, poverty eradication, rectification of the income gap, small and medium-size enterprise development, and human resource development. The Project contributed to environmental conservation through a reduction in the emission of CO_2 and dust by the rehabilitation of the obsolete thermal power plant. The ODA policy also placed importance on support for strengthening the base for production for recovery of the economy in the short term. The Project contributed to a strengthening of the base of production through a stabilized power supply.

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

3.2 Effectiveness (Rating: ③)

3.2.1 Quantitative Effects (Operation and Effect Indicators)

(1) Stabilized Power Supply

The ISO installed output of the Project power plant is 750 MW, while the tested annual available capacity (TAAC) is 694 MW under the environment of Malaysia which is affected by site conditions such as temperature and humidity. The monthly maximum output has fluctuated from 694MW to approximately 730MW. As indicated in Table 1, the plant load factor and the availability factor have been about 80% or over, while the gross thermal efficiency has been more than 55%. The operation status of power plants has been excellent. Figure 2 shows that net electric energy production of the power station has been beyond the plan of the beginning of the fiscal year ever since its first commercial operation in January 2009

Photo 1: Panorama of TNB Port Dickson Power Station

The percentage of unplanned outage hours has been relatively small, at around 2-4%. The power station reports that unplanned outage hours by human error have been zero. There was no significant machine trouble, and thus the quantitative effect of the Project is high.

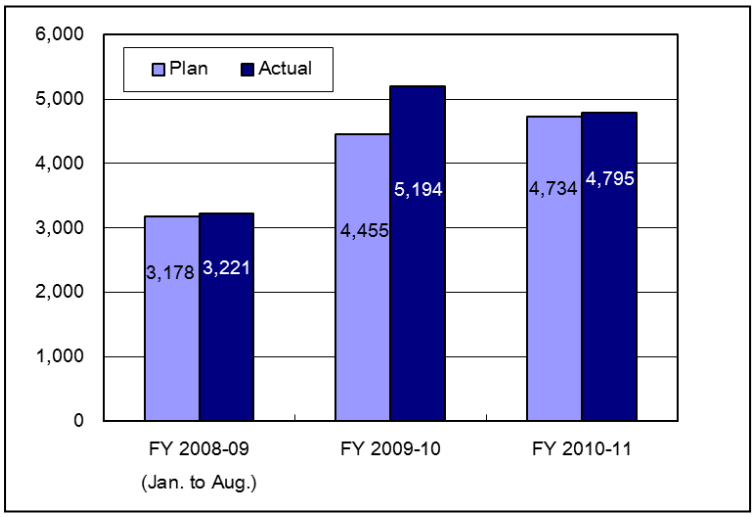
Table 1: Operation Performance of the Project Power Plant

Indicator	FY 2008-09	FY 2009-10	FY 2010-11
Plant Load Factor (%)	79.6	85.4	78.9
Availability Factor (%)	81.7	91.0	86.3
Auxiliary Power Ratio (%)	2.0	1.9	1.7
Gross Thermal Efficiency (%)	56.45	56.61	55.47
Percentage of Unplanned Outage Hours (%)	2.1	4.0	3.8

Source: TNB

Note: TNB's Fiscal Year is September to August. The plant load factor and the availability factor are calculated based on tested annual available capacity. The auxiliary power ratio is the percentage of electricity consumption of the power station to total electric energy production.

Unit: GWh



Source: TNB

Figure 2: Power Generation of the Project Power Plant

(2) Reduction of Greenhouse Gas Emission

The reduction effect of greenhouse gas (CO_2) was predicted to be 31.4% in comparison with existing gas-fired power plants, at the time of project appraisal. As a result of calculations based on the average figures of actual performance from 2009 to 2011, greenhouse gas reduction was seen to be 37.7%, slightly beyond the predicted indicators. According to the TNB annual report in 2011, the CO_2 emission volume was 0.44 MT/MWh, the least among the thermal power stations of TNB.

3.2.2 Qualitative Effects

There was no particular qualitative effect as the main effect of the Project was quantitative. As in the evaluation of the Phase 1 project, at the time of project appraisal, the expected qualitative effect was better view since the stack of the new power plant had become lower, in comparison to the one at the existing power plant. The Project power plant was constructed as planned and thus the same qualitative effect can be observed.

3.3 Impact

3.3.1 Intended Impacts

(1) Stabilization of the Power System in Peninsular Malaysia

The electricity supply volume in Peninsular Malaysia, which serves about 20 million people, was 95 thousand GWh when the Project power plant started to supply electricity. This decreased to 89 thousand GWh with the slowing down of economic growth in fiscal year 2009 -10, increasing again in 2010 - 11. As indicated in Table 2, out of the total electric power supply to Peninsular Malaysia, the share of the Project facilities was actually about 5% in 2010-11, while that of TNB Port Dickson Power Station was 10%. According to TNB, the Project Power Plant is in a position to be operated with the highest priority, even during night time, as the most efficient and reliable base load[4]. Therefore, the Project is evaluated to have contributed to the stabilization of power supply in Peninsular Malaysia to a certain level.

[4] Electric power supply is categorized as base, middle, and peak load. Base load indicates a minimum load of power source which is required during a certain period.

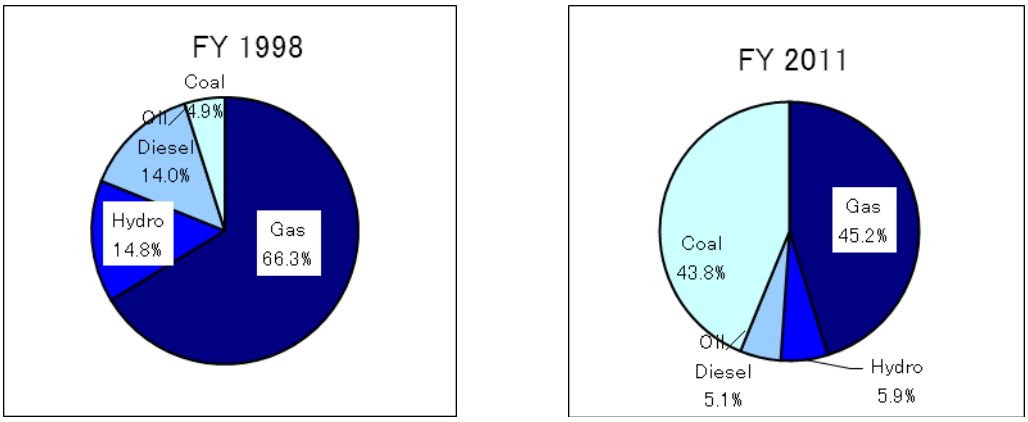
Table 2: Share of the TNB Port Dickson Power Station Electric Power Supply to the Total in Peninsular Malaysia

Indicators	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11
Electricity Supply in the Peninsular Malaysia Power System (GWh)	82,214.80	95,331.57	89,910.80	98,112.92
Share of Electricity Supply of the TNB Port Dickson Power Station Within in the above (%)	6.3	5.8	9.7	10.0
Share of Electricity Supply of the Project Power Plant in the above (%)	-	0.04	3.6	5.3

Source: TNB

(2) Contribution to the Diversification of Energy Sources in the Peninsular Malaysia Power System

Examining the share of energy sources to the total in Peninsular Malaysia (plant capacity base), in fiscal year 2011, it can be seen that gas turbine or gas combined cycle accounted for 45.2%, while coal-fired thermal power accounted for 43.8%. While these were the main energy sources, others were oil and hydro power (Figure 3). Compared to the situation in 1998, the share of oil-fired thermal power had decreased and that of gas-fired thermal power generation had also decreased in total.



Source: TNB

Figure 3: Share of Plant Capacity by Energy Source in the Peninsular Malaysia Power System

Under these circumstances, the power generation volume by gas has been sustained at more than 20 thousand GWh for the last 5 years, with the contribution of power generation by the TNB Port Dickson Power Station. As a result of this contribution, in the fiscal year 2009, out of the total gas-fired power generation of TNB, the Project contributed 22 %, while the total power generation of TNB Port Dickson Power Station accounted for 45% of the total.

In Malaysia, while not relying on one source of energy, but at the same time promoting coal-fired thermal power generation, gas-fired power generation has been sustained to some extent, with the consideration of its environmental impact. Gas causes less of an environmental burden with lower emissions of CO_2 dust etc. The Project has contributed to sustaining more highly efficient gas-fired power generation through the replacement of existing oil and gas-fired power generation plants. In this sense, the Project has contributed to the diversification of energy.

3.3.2 Other Impacts

(1) Impacts on the natural environment

The demolished power plant was given over to the contractor, and was recycled of or disposed of appropriately. As far as impact after the beginning of operation of the Project facilities is concerned, the officer in charge of environmental monitoring was interviewed and an examination made of the monitoring reports submitted periodically to the Department of Environment (DOE) of the Negeri Sembilan State government. Results of ambient air monitoring which was conducted by a sampling method in the power station three times during the year prior to this ex-post evaluation study shows that TSP (Total Suspended Particles), PM10 (Particulate Matter equal and less than 10μm) NO_2 and SO_2 have remained under the standard indicators (refer to Table 3). As for the monitoring data submitted by the power station, there is no record that the DOE of Negeri Sembilan State have found this figure to be a problem. Neither has any problem been observed in the annual water quality monitoring data. Thus it can be judged that there has been no serious negative impact caused by the power station at the present time.

Table 3: Results of Ambient Air Monitoring (August 2010, February and May, 2011)

Item	Pollutant	Standard [1)]	Observation Result
Ambient Air Monitoring [2)]	TSP (Total Supended Particles)	260 μg/m^3 (24 hours)	≤22
	PM_{10} (Particulate Matter 10)	150 μg/m^3 (24 hours)	≤19
	NO_2	0.075 ppm (24 Hour)	<0.02 (ppm)
	SO_2	0.04 ppm (24 Hour)	<0.02 (ppm)

Source: Data provided by TNB Port Dickson Power Station
Note 1: Standard referred to in Malaysia
Note 2: Results of monitoring in three locations near to the oil tank, the administration building, and the area between PD gate and Seremban gate within the Power Station

(2) Land Acquisition and Resettlement

The Project has utilized land within the existing power station and there has been no new land acquisition. Thus, there has been no resettlement of residents.

This project has largely achieved its objectives, therefore its effectiveness and impact are high.

3.4 Efficiency (Rating:②)

3.4.1 Project Outputs

Outputs of the Project were the demolition of the existing 360MW (Unit No.5, 6 and 7) power plant and the construction of 750 MW gas combined cycle power generation facilities. These were implemented almost as planned. Changes in comparison to the original plan, were the shift in location from the area near to the fuel tank to the north of the phase 1 project site, and the addition of new constructions for the storage of waste and spare parts. There was also the addition of spare gas turbine parts and an extension of the CW intake channel. All these were deemed as appropriate revisions in accordance with necessity.



Photo 2: From the left, gas turbine, steam turbine generator and transmission facilities

3.4.2 Project Inputs

3.4.2.1 Project Cost

The project cost was lower than planned, at 90% of the plan. This was an actual total cost of 60,762 million yen (of which the ODA loan was 48,984 million yen) in comparison to 67,864 million yen (of which the ODA loan was 53,764 million yen) at the time of appraisal. While there had been additional construction costs caused by the change in project site, the main reason for the 10% or so cost reduction was that the estimated tax and tariffs at appraisal time on the Malaysian side were reduced by about 5 billion yen. Furthermore, the cost for demolition of the existing facilities, 969 million yen, was offset with the revenue gained from selling those facilities and thus no expenditure was necessary for this portion.

3.4.2.2 Project Period

The planned period was 63 months from the loan agreement to the end of warranty period of the power plant facility. The period, however, was significantly longer than planned, at 118 months, 187 % of the planned period. Accordingly, the loan implementation period of the Project was extended twice. Comparing the planned and actual period as in Figure 4, while there was a delay at each phase from the preparation period for the bidding, the most significant delay was caused by the postponement of project implementation by the Malaysian side due to the need to examine the Project needs because of the high reserve margin. In the end, the civil work contract agreement was signed around the end of 2004, about two years after the deadline for its proposal.

The demolition of the existing power generation facility was initiated after the civil work contract agreement was expected to be signed. Since the new power plant was to be constructed on the same site as the old power plant, the start of civil works was postponed for seven months, not commencing just after the loan agreement. The project period for the civil works was also extended to 39 months from 32 months due to the change of the Project site. Regarding this point, however, a TNB officer in charge of the construction work reported that although there was a large delay in the completion of the Project, the contractor made efforts to minimize the delay in the project period, and managed to coordinate the implementation of works which could be carried out earlier than scheduled. Without these efforts, the project period would have been extended even further.

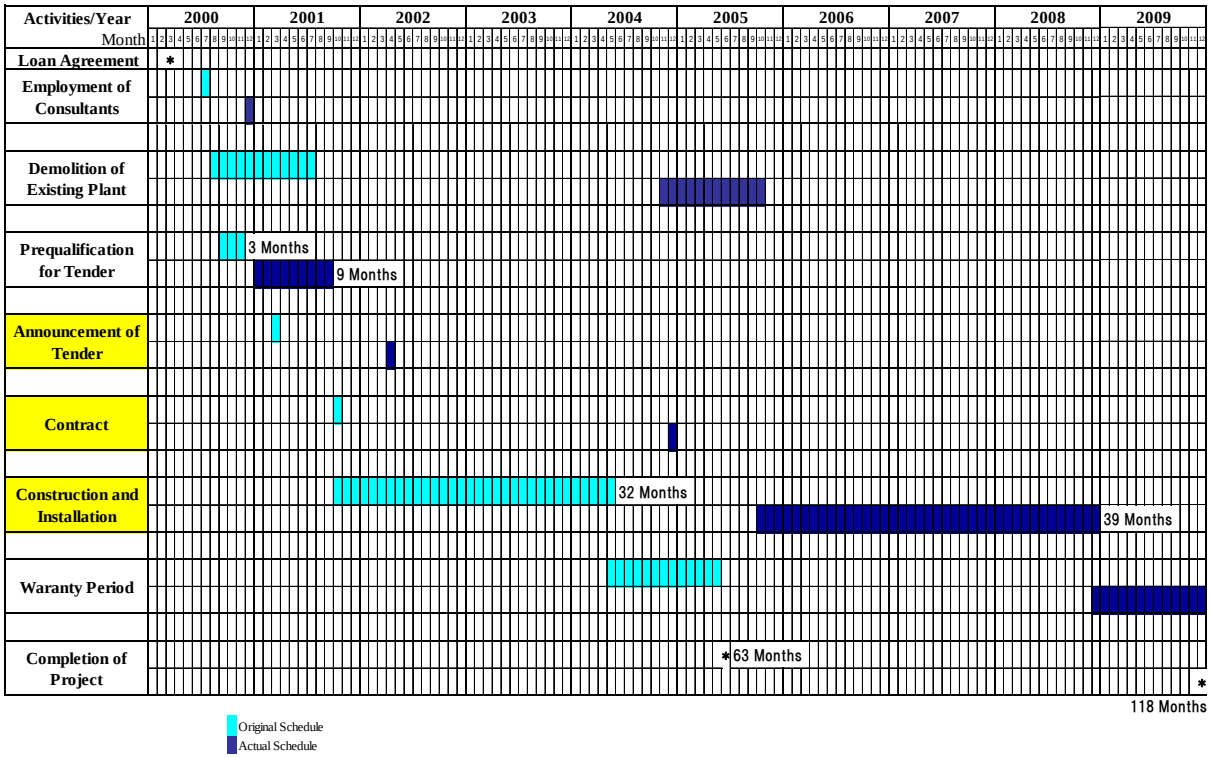


Figure 4: Comparison of the Planned and Actual Project Period

3.4.3 Results of Calculations of Internal Rates of Return (IRR) (Reference)

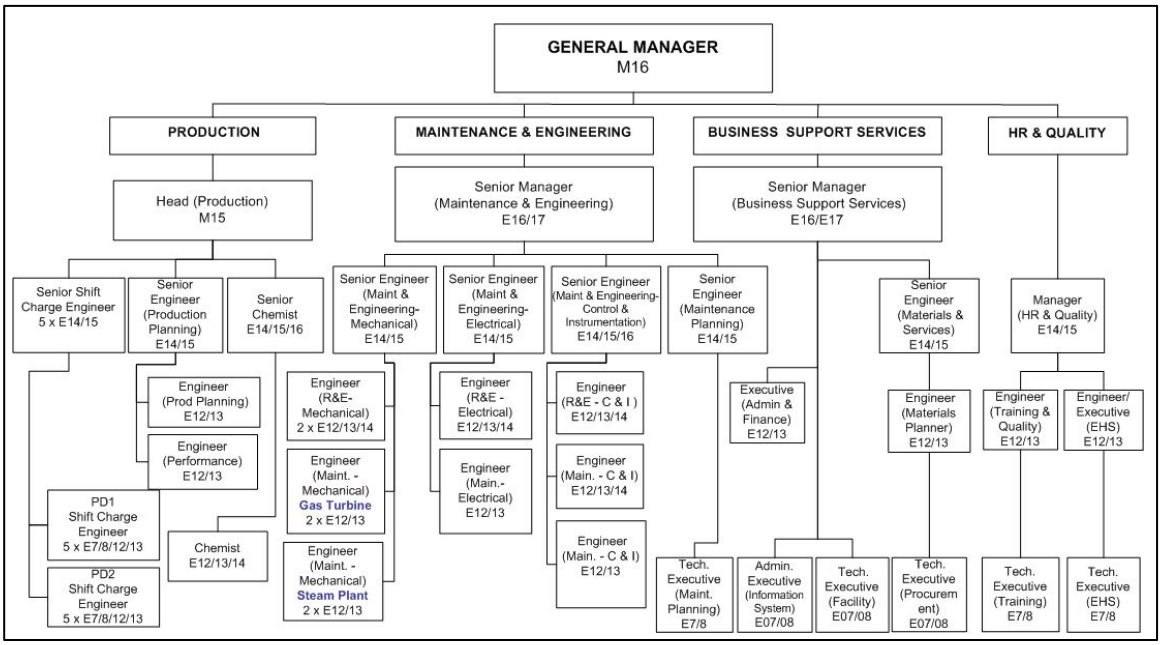
At the time of project appraisal, the economic internal rate of return (EIRR) was not calculated. However, the financial internal rate of return (FIRR) was calculated, and thus the FIRR was recalculated for the same items. The FIRR at the time of the project appraisal was estimated at 9.01%. The result of calculations based on actual figures was an estimated 12.03%, which was more than the original estimation. The reason for this is that in comparison to the estimated basis, there have been more electricity sales due to higher gross thermal efficiency, more electric power production, and less transmission and distribution loss.

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

3.5 Sustainability (Rating: ③)

3.5.1 Structural Aspects of Operation and Maintenance

The Port Dickson Power Station of TNB is directly in charge of the operation and maintenance of the Project facility. An organization chart for the Power Station is shown in Figure 5. As of October 2011, the total number of personnel was 185. There were four departments: Production, Maintenance & Engineering, Business Support Services, and Human Resources and Quality. Among these departments, those staff who are involved in operation and maintenance of the project facility include 35 personnel in the Production Department (of which 10 are engineers) and 58 personnel in the Maintenance Department (of which 17 are engineers). In total nearly 100 personnel are assigned to these departments. Daily inspections are the duty of the Maintenance and Engineering Department, and it is in this was that the organizational structure for operation and maintenance is established. Periodical maintenance such as overhauls is implemented under contracts with a subsidiary company of TNB, TNB Repair and Maintenance Sdn. Bhd: REMACO).



Source: Document provided by TNB Port Dickson Power Station

Figure 5: Organization Chart of Power Dickson Power Station

3.5.2 Technical Aspects of Operation and Maintenance

Officers trained by the contractor conduct operation and maintenance and manuals are available. As with the evaluation for the Phase 1 project, technical training for officers in the power station has been implemented according to job position every year. Periodical training has also been conducted, such as technical training for new officers in charge of maintenance and refreshers' training for experienced technicians and engineers. Other training also takes place, such as system operation training by on the job training (OJT).

Photo 3: Control Room

The annual operation plan (maintenance and overhaul) has been implemented almost as planned. Preventive maintenance (PM) and corrective maintenance (CM) have been conducted, making efforts to prevent disorder and troubles.

TNB evaluates the performance of power station staff by key-performance indicators. Through evaluation at both power station and individual levels for technical capacity, it is envisaged that consciousness of problems will be enhanced, followed by the promotion of improvements in performance. REMACO, which is in charge of overhaul, is an organization established in 1979 and has much experience in the O&M of not only domestic, but also overseas power plants, in countries such as Indonesia, Pakistan, and Saudi Arabia. No problem was observed in the technical capacity of personnel. Technical capacity transferred through the Project is considered to be sustainable.

3.5.3 Financial Aspects of Operation and Maintenance

It was confirmed that the necessary operation and maintenance costs for the TNB Port Dickson Power Station had been allocated as planned every year. In the financial statement of TNB as a whole (excluding subsidiary companies), revenue has shown an increasing trend for the last four years and a certain level of operational profit had been sustained. In the fiscal year

2010-11, however, expenditure increased due to rising fuel costs and this resulted in a decrease in operational profit and profit before tax.

The gas supply for the TNB Port Dickson Power Station has been assured by the Malaysian Oil and Gas Company of Malaysia (PETRONAS) based on agreement. However, since the Power Station increased its use of DFO during fiscal year 2010 - 11, due to the reduction in the gas supply in recent years, then the O&M costs for the power station have increased. In the fiscal year 2009 -10 the operation cost of TNB Port Dickson Power Station itself was within the electricity sales revenue but in the fiscal year 2010 -11 the cost for TNB Port Dickson Power Station surpassed the electricity sales revenue.

However, according to the Power Station, their gas supply volume for the fiscal year 2011 - 12 has already increased again, assuring 1,050mmscfd and more. As a countermeasure for a shortage of gas to the power station, it is expected that the gas supply will be increased with the construction of the LNG import terminal and regasification system in Melaka State by PETRONAS, starting operation in 2012, and also the development of a new gas field off the west coast of Sabah state.

In terms of gas price, the Energy Commission of the Malaysian government have shown an intention to gradually decrease the subsidy for gas gradually in the long term; therefore, it can be predicted that gas prices will increase. It is difficult to forecast that how the fluctuation of fuel prices might affect to the operation of the power station. However, fuel prices are managed by the headquarters of TNB and at present there is no issue which could significantly affect the operation and maintenance of the Project in the short term.

Table 4: Main Financial Indicators of TNB

Unit: Million RM

Items	FY 2007-08	FY 2008-09	FY 2009-10	FY 2010-11
(1)Revenue	23,069.2	26,743.6	28,362.3	30,157.1
(2)Other Operating Income	1,187.4	590.7	350.5	752.9
(3)Finance Income	301.0	308.3	356.6	404.6
(4)Operating Expeses	-20,631.4	-24,250.5	-25,416.7	-30,110
Depreciation in the above	-2,595.2	-2,899.4	-3,301.1	-3,395.0
(5)Finance Cost	-811.1	-822.5	-757.6	-594.2
(6)Foreign Exchange gain/loss	-11.1	-882.9	606.9	-208.7
Operating Profit	3,625.2	3,083.8	3,296.1	800.4
Profit / Loss before Taxiation	3,104.0	1,686.7	3,502.0	402.1
Profit for the Financial Year	2,663.6	1,070.7	2,703.6	418.6

Source: TNB Annual Report 2008, 2009, 2010, 2011.
Note: Revenue is from electricity sales and goods & services.

3.5.4 Current Status of Operation and Maintenance

According to the field survey on the power station, the current state of the facilities is good. There was a requirement for the replacement of parts in the steam turbine, but the parts had already be procured and the changes were planned at the time of the periodic inspection. As evaluated at the time of the Phase 1 project, the storage of spare parts is well managed and the operation and maintenance of the project facility is excellent. Daily maintenance, checked items and frequency, was conducted according to the plan, and overhaul is conducted every 24,000 operation hours for gas turbines and every 3 years for steam turbines. .

Photo 4: Storage of Spare Parts

It should be noted that the TNB Port Dickson Power Station, as the most efficient power generation plant in Malaysia, has received many visitors both from inside the country and also from overseas (such as from neighboring countries in Asia). There were 892 visitors in 2009,

1,299 in 2010, and 488 in 2011, more than 1,000 visitors depending on the year.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The Project aimed at stable electric power supply and reduction in greenhouse gas by replacing the existing obsolete 360MW thermal power plant with a highly efficient combined cycle gas turbine power plant in Port Dickson Power Station in the state of Negeri Sembilan. The Project required time for a re-examination of the needs of the project during its implementation due to a surplus in the reserve margin for generation capacity, which differed greatly from that predicted. Nevertheless, the needs for the Project still exist at present and the Project has been relevant to Malaysian and Japanese policies, therefore, the relevancy of the Project is high. A re-examination of the needs for the Project, however, became the main reason for the large delay in the project period, and thus the efficiency of the Project is fair. On the other hand, the operation status of the Project power generation facility has been excellent and the Project is considered to be managed most efficiently responding to the base load of power generation. Effects for improved environment were revealed in terms of reductions in CO_2 emission in comparison to the old power generation plants. The project also contributed to the stable power supply and to the avoidance of heavy dependence on one energy source. Thus, effectiveness and impact are high. In addition, sustainability is high in terms of organization and technical and financial capacity of TNB.

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

(1) Considerations for Power Demand and Supply Forecast

The Project was delayed by the Malaysian government for two years at the point of evaluation on contractor bidding for the civil work, as it was expected that there would be a surplus in power generation capacity. This was the main reason for the significant extension of the project period. At the same time, this also meant additional coordination work for JICA, the executing agency, and the bidder companies. Generation capacity for the project was forecasted on the premise that implementation of the IPP project would not be in prospect due to large delays in progress. Thus, a very low reserve margin was predicted. However, in fact, there was a surplus which was a deviation from the predicted indicator. There was only one year difference in project appraisal between Phase 1 and the Project, there were almost no revisions in the forecast of generation capacity. Nevertheless, there is a high possibility of delay in the preparation of bidding documents, as in the case of the Project, but during such a delay, the situation may change.

In case of a country which promotes IPP, it is important to follow updates on progress constantly and to forecast total plant capacity more realistically. This should include how the implementation of IPP progresses and to show clearly the position and significance of the

Project in the power development plan from the view point of the long-term power demand. This should be fully agreed with the aid recipient country before the project and it is critical that in the future, in similar countries power sector projects are designed with ODA.

(2) Demonstration of the Technical Capacity of Japanese Companies

The TNB Port Dickson Power Station, the target of the Project, has become a model of efficiency and has a received many visitors from inside and outside the country. The construction of two power generation blocks in the power station was supported by Japanese ODA,,and Japanese companies employed Japanese technology on the Project. It can be thus said that this was a demonstration of the highly efficient thermal power technology of Japan. In addition, TNB recognized that the consultant and contractor in charge made efforts in schedule management to complete the Project as soon as possible. In this sense, support for the power station of the Project is significant as an example of Japanese assistance.

On the formation of ODA loan projects in upper-middle countries which are noted as a model for neighboring countries, it is better to select a project or to design the project's contents bearing in mind the side effect that an "extensive demonstration effect can be expected, in the case of introducing advanced technology by Japanese enterprises in power stations, which have an important position within the country".

End

Comparison of the Original and Actual Scope of the Project

Item	Original	Actual
1. Project Outputs	(1) Demolition of existing power plant (360MW: 120MW X 3) (2) 750MW class Gas Combined Cycle Power Plant: Power Generation Plant: Gas turbine 2, Heat Recovery Steam Generator 2, Steam Turbine 1 and accessories Civil Work: Site preparation, Foundation work, Replacement of the road, Drainage work, etc. Construction Work: Main Power house building, Auxiliary building etc. (3) Transmission and Substation facilities Construction of New Transmission Line (Power Station- Olak Lempit Substation, 275kV, 2 lines, Total 70km), Olak Lempit Substation, two additional 275kV Outlet Lines) (4)Consulting Service Basic Studies and Detailed Design, Project Management, Construction Supervision, etc.	(1) As planned (2) As planned (3) As planned (some additional work due to project site change and changes in design details, etc) (4) As planed
2. Project Period	March, 2000 - May, 2005 (63 months)	March, 2000 - December, 2009 (118 months)
3. Project Cost Amount paid in Foreign currency Amount paid in Local currency Total Japanese ODA loan portion Exchange rate	 40,641 million yen 27,223million yen (861 million RM) 67,864 million yen 53,764 million yen 1 RM= 31.6 yen (As of August, 1999)	 33,419 million yen 27,344 million yen (905 million RM) 60,762 million yen 48,984 million yen 1RM = 30.2 yen (Average between January, 2001 and December, 2010)