Socialist Republic of Vietnam

FY2019 Ex-Post Evaluation of Japanese ODA Loan

"Nghi Son Thermal Power Plant Construction Project (I) (II) (III)"

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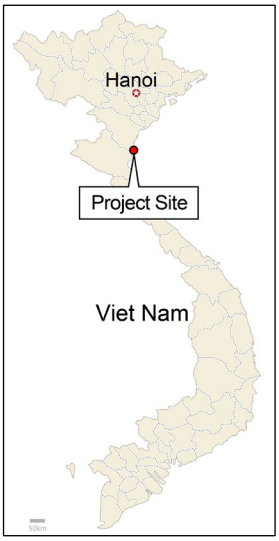
0. Summary

The objective of the project was to construct a new coal-fired Thermal Power Plant with capacity of 600 MW (300 MW × 2 Units) in the Nghi Son Economic Zone, in order to meet the increasing power demand in the north part of Vietnam, thereby contributing to the promotion of economic growth and strengthening of the international competitiveness of the region. According to Vietnam's development plan, the development of new power sources, including thermal power as base-load power, is an important issue and, since the power demand in the north part of Vietnam has been increasing since the JICA Phase I appraisal, development needs remain high. Japan's ODA policy also includes the strengthening of power generation as one of the priorities of the power sector. The relevance of the objective is high, as it is consistent with Vietnam's development plan and development needs, as well as with Japan's ODA policy. The project cost exceeded the plan, since the contract amount for constructing the power plant increased, due to the rise of equipment and labor costs, and land acquisition for the Nghi Son 2 thermal power plant and its port facility was included into the scope of the Project from Phase II. The project period was significantly longer than planned, since the bid was rejected for the employment of the contractor and because various technical issues arose during the construction period. Therefore, the efficiency of the project is low. The operation and effect indicators of the project facilities, such as the maximum output, the net electric energy production, and the plant load factor, have mostly achieved the targeted values. In addition, the stability of the power supply in the Northern and North Central regions of Vietnam has been improving every year and the project has contributed to this improvement to some extent. In addition, this improvement of the stability of the power supply has contributed to the encouragement of private investment in the Northern and North Central regions of Vietnam and, furthermore, to strengthening of the international competitiveness of Vietnam. No negative impact on the natural environment was observed, and land acquisition and resettlement due to the implementation of the project were properly conducted in accordance with the relevant laws and regulations of Vietnam. For these reasons, the effectiveness and impact are high. No major problems have been observed in the institutional/organizational, technical, financial aspects and current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

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

1. Project Description



Project Location


Nghi Son 1 Coal-fired Thermal Power Plant

1.1 Background

Vietnam has recorded a high growth rate of around 7% in its Gross Domestic Product (GDP) since 2000. Reflecting this rapid economic growth, the nationwide demand for electricity increased at an annual average rate of 13.5% over the five years from 2005 to 2009, with peak demand increasing 1.5 times from 10,500 MW to 15,386 MW. Though this trend was affected by the global economic crisis and concurrent recession in 2008, it was expected that high economic growth in Vietnam would recover as a mid- and long-term trend. The 6th National Master Plan for Power Development approved in 2007 estimated that the power demand would increase annually by 17% until 2015, requiring nearly 30,000 MW in power development. However, due to the delay in investment plans for the power development described in the master plan, the balance of electric power supply and demand in Vietnam became strained, forcing the implementation of rolling blackouts during peak demand periods.

For these reasons, the Vietnamese government planned to construct power stations with a capacity of 1,800 MW including investment by a private Independent Power Producer (IPP) in the Nghi Son Economic Zone, Thanh Hoa province.

1.2 Project Outline

The objective of the project was to construct a new coal-fired thermal power plant with a capacity of 600 MW (300 MW × 2 Units) and related facilities in the Nghi Son Economic Zone, to meet the increasing power demand in the Northern and North Central regions of Vietnam, thereby contributing to the promotion of economic growth and the strengthening of the international competitiveness of the region.

Phase	Phase I	Phase II	Phase III
Loan Approved Amount/ Disbursed Amount	20,943 million yen/ 20,941 million yen	29,852 million yen/ 29,776 million yen	40,330 million yen/ 37,855 million yen
Exchange of Notes Date/ Loan Agreement Signing Date	March 2007/ March 2007	January 2011/ January 2011	October 2011/ November 2011
Terms and Conditions	Interest Rate: 1.3% Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General Untied	Interest Rate: 1.2% (Consultant Interest Rate: 0.01%) Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General Untied	Interest Rate: 1.4% (Consultant Interest Rate: 0.01%) Repayment Period: 30 years (Grace Period: 10 years) Conditions for Procurement: General Untied
Borrower/ Executing Agency	The Government of the Socialist Republic of Vietnam (GOV)/ Vietnam Electricity Holding Company (EVN)		
Project Completion	May 2015		
Target Area	Tinh Gia District, Thanh Hoa province		
Main Contractors (Over 1 billion yen)	• Marubeni Corporation (Japan) • Construction Corporation No. 1 One Member Co., Ltd. (Vietnam) • Phu Xuan Consulting & Construction JSC Co. (Vietnam) / Truong Xuan Construction JSC Co. (Vietnam) / Phu Nguyen Hai Co., Ltd. (Vietnam) / Mien Trung Consulting & Construction JSC Co (Vietnam) • Trung Dung Transport and Trade Joint Stock Company (Vietnam) / Bao Linh Limited Company (Vietnam) • Vietnam National Coal-Mineral Industries Holding Corporation (Vietnam)		
Main Consultants (Over 100 million yen)	• Electric Power development Co., Ltd (Japan) / AF-Consult Switzerland Ltd. (Switzerland)		
Related Studies (Feasibility Studies, etc.)	• Feasibility Study on Construction Investment Project (Power Engineering & Consulting Company No.3, 2006) • Special assistance for project formation for Nghi Son Thermal Power Plant (I) Construction Project (JBIC, 2006) • Special Assistance for Project Implementation for Reducing Greenhouse Gas Emission from Major Coal-fired Thermal Power Plants in Vietnam (JBIC, 2011)		
Related Project	[Technical Cooperation] • The Project on Development Plan of Training Center for Electric Power Sector in Vietnam (2007-2009) • Electric Power Technical Standards Promotion in Vietnam (2010-2013)		

2. Outline of the Evaluation Study

2.1 External Evaluators

Keishi Miyazaki, Kazuhiro Nakagawa (OPMAC Corporation)

2.2 Duration of Evaluation Study

This ex-post evaluation study was conducted with the following schedule.

Duration of the Study: August 2019 - October 2020

Duration of the Field Study: December 1, 2019 - December 14, 2019

2.3 Constraints during the Evaluation Study

Due to the global epidemic of COVID-19, the 2nd field survey was canceled, although it had been planned in March 2020. As an alternative, the External Evaluators conducted a supplemental study remotely, supported by a local consultant.

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

3.1 Relevance (Rating: ③[2])

3.1.1 Consistency with the Development Plan of Vietnam

Both *the Five-Year Socio-Economic Development Plan (2006-2010)* at the time of Phase I appraisal, and *the Five-Year Socio-Economic Development Plan (2016-2020)* at the time of the ex-post evaluation had the goals of developing energy sources as well as expanding the social and economic infrastructure, including electricity infrastructure.

In *the 5th National Master Plan for Power Development (2001-2010)* at the time of Phase I appraisal, to the consequent *the 6th National Master Plan for Power Development (2006 – 2015), the 7th National Master Plan for Power Development (2011-2020),* and *the Revised 7th National Master Plan for Power Development (2011-2020),* the development of new power sources, including thermal power as base-load power, was listed as an important issue. This project was implemented in accordance with this policy and, therefore, it was consistent with the development policy.

The Revised 7th National Master Plan for Power Development (2011-2020), the current plan at the time of the ex-post evaluation, targeted an expansion of the total capacity of power plants to 60,000 MW by 2020, of which it was planned that 25,600 MW, 42.7% of total capacity, would be generated by coal-based thermal power. The share of renewable energy-based power was expected to expand continuously against the total capacity to 9.9% by 2020, 12.5% by 2025, and 21% by 2030. However, the share of coal-based thermal power was expected to be 49.3% at 2025 and 42.6% at 2030, which means that coal-based thermal power would still have the largest

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

[2] ③: High, ②: Fair, ①: Low

share of total capacity in Vietnam in the future.

Furthermore, the Nghi Son Economic Zone where the project site is located is recognized by the GOV and Thanh Hoa province as a supply center of petrochemical products, not only to a nationwide market, but also to an international market including the south part of Laos and the northeast part of Thailand. Therefore, several privileges, such as the exemption of the land and water surface use charge and the reduction of corporate income tax, are granted to companies which invest in the Nghi Son Economic Zone. As a result, more than 200 investment projects, with a total investment amount of 18 billion United States dollars (US dollars) have been invited. The Nghi Son Economic Zone is the most developed coastal economic zone in Vietnam and is positioned as an important economic zone in terms of industrial development in the Northern and North Central regions of Vietnam.

3.1.2 Consistency with the Development Needs of Vietnam

Vietnam has recorded a high growth rate of around 7% in its GDP since 2000. Reflecting this rapid economic growth, the nationwide demand for electricity demand was increasing rapidly at the time of the Phase I appraisal. In order to satisfy the increasing electricity demand, it was planned that coal-based thermal power plants would be constructed as a short-term measure, with nuclear-based and pumped-storage hydroelectric plants planned as middle and long-term measures. Since natural resources are unevenly located in Vietnam, electricity is generated by hydraulic power and thermal power using anthracite coal in the north part of Vietnam, while thermal power is generated using natural gas in the south part of Vietnam. Total installed capacity was 17,669 MW, excluding off-grid power, at the end of 2009 of which the share of hydraulic power was 38.4%. However, the share of thermal power, mainly coal-based, was increasing after 2009, and further development of thermal power was expected with the import of coal from abroad.

In order to satisfy the increasing demand in the Northern and North Central regions of Vietnam after 2007, the GOV planned to develop the project site as a power generation base with 1,800 MW of installed capacity, taking into consideration the investment of IPPs. Therefore, common facilities for the potential IPPs for power stations such as a discharge channel for cooling water and an ash pond were included in the scope of the project in addition to development and construction of 2 units of power plants with a capacity of 600 MW in total. The common facilities were expected to reduce the project risk of further power plant construction by IPPs and to encourage private investment.

Even at the time of the ex-post evaluation, the electricity demand in the north and north central part of Vietnam was increasing and was estimated to reach 46,338 MW in 2030 from 18,048 MW in 2018, while the total installed capacity in the north part of Vietnam was 22,463 MW in 2018. Although the total installed capacity exceeded the demand in 2018, a shortage of

electricity supply was expected in the future. The electricity demand in Thanh Hoa and Nghe An provinces was 1,500 MW at the time of the ex-post evaluation and was estimated to reach 2,000 MW in the near future. Therefore, the development of electric power sources in the north and north central part of Vietnam is highly required and there has been a pressing need for the development of this project at the time of the ex-post evaluation.

3.1.3 Consistency with Japan's ODA Policy

At the time of the Phase I appraisal, the Ministry of Foreign Affairs *Japan's Country Assistance Program for Vietnam 2004*, had the "promotion of growth" as one of its key areas, in which infrastructure development including that of the power sector was one of the subjects. In revisions to the updated *Country Assistance Program for Vietnam* in July 2009, the strengthening of power generation, especially base-load power generation, was seen as a priority in the power sector.

In addition, JICA's *Overseas Economic Cooperation Strategy (2005)* prioritized "infrastructure development for sustainable growth" and stated that development of the social and economic infrastructure, including electricity for promoting sustainable growth was subject to assistance. JICA's *Country Assistance Strategy for Vietnam (2006)* also stated that Japanese ODA loan support was discussed in cases where an ODA loan project supported energy development (such as in gas fields) or adjacent power station construction by private fund, and was prioritized in cases where it was difficult for the IPP to respond in a tight power supply and demand situation.

This project was to construct a coal-fired thermal power plant in Thanh Hoa province in order to satisfy the increasing demand for electricity in the Northern and North Central regions of Vietnam and was therefore consistent with Japan's ODA policy.

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

3.2 Efficiency (Rating: ①)

3.2.1 Project Outputs

This project involved the construction of the Nghi Son 1 coal-fired thermal power plant (NS1) with 600 MW of installed capacity (300 MW x 2 Units) and the construction of common facilities with the Nghi Son 2 coal-fired thermal power plant (NS2)[3]. The planned and actual outputs are shown in Table 1.

[3] Nghi Son 2 coal-fired thermal power plant has 1,200 MW of installed capacity (600 MW x 2 Units). Nghi Son 2 Power Limited Liability Company (NS2PC), a Vietnamese company partially invested in by Japanese companies, has commenced construction work since July 2018 and is expected to commence operation of Unit 1 from January 2022 and Unit 2 from July 2022. NS2PC engaged a 25 years power purchase agreement with EVN and was expected to supply electricity to the North / Mid-North part of Vietnam for stability of the power supply.

Table 1: Planned and Actual Project Outputs

Item	Plan		Actual
	At Phase I Appraisal	At Phase II and III Appraisal	
1. Construction of Thermal power plant			
Package 1: Dredging and Land Reclamation Works (EVN Portion)	• Dredging, Reclamation (Depth -9.0 m)	• Dredging, Reclamation (Depth -9.0 m)	Same as planned scope at Phase II and III appraisal
Package 2: Temporary Construction (EVN Portion)	• Temporary Roads for Construction • Power Facilities for Construction • Water Facilities for Construction • Workshop for Construction • Yard for Materials, Equipment • Site Office • Other Related Facilities, like Temporary Housing	• Temporary Roads for Construction • Power Facilities for Construction • Water Facilities for Construction • Site Office • Construction of Accommodation for Operation Workers	Same as planned scope at Phase II and III appraisal
Package 3: Civil and Architecture (EVN Portion)	• Ash disposal pond (80 ha) • Estate Housing	• Ash disposal pond (49 ha) • Estate Housing	Same as planned scope at Phase II and III appraisal
Package 4: Power Plant EPC Works	• Boiler with associated equipment (300 MW x 2) • Steam turbine generator and condenser with associated equipment • Coal supply and processing system • Wet flue gas desulfurization (FGD) system (Included Gas Heater) • 220 kV Switch yard • Electrical components including switchgear and motors • Instrument and control system • Water intake and cooling water system (incl. Discharge channel) • Water treatment system • Wastewater treatment system • Jetty (Coal, HO, Equipment) and associated equipment	• Boiler with associated equipment (300 MW x 2) • Steam turbine generator and condenser with associated equipment • Coal supply and processing system • Wet flue gas desulfurization (FGD) system (Excluded Gas Heater) • 220 kV Switch yard • Electrical components including switchgear and motors • Instrument and control system • Water intake and cooling water system (incl. Discharge channel) → Separate Package • Water treatment system • Wastewater treatment system • Jetty (Coal, HO, Equipment) and associated equipment • Fuels for Commissioning → Separate Package	Same as planned scope at Phase II and III appraisal
Package 5: Cooling Water Intake and Intake Channel	—	• Intake Capacity: 80 m^3/s (NS1: 25 m^3/s; NS2: 55m^3/s) • Length of Intake Channel: 785m	Same as planned scope at Phase II and III appraisal

Item	Plan		Actual
	At Phase I Appraisal	At Phase II and III Appraisal	
Package 6: Discharge Channel and Output	—	• Discharge Capacity: 80 m^3/s (NS1: 25 m^3/s; NS2: 55 m^3/s) • Length of Pipeline: 2,700 m	Same as planned scope at Phase II and III appraisal
Package 7: Fuels for Commissioning	—	—	Coal: 633,272 tons Heavy Fuel Oil: 36,814 tons Diesel Oil: 2,515 m^3 Limestone: 7,315 tons
2. Consulting Services	• Tender Assistance • Construction Supervision • Environmental Monitoring Assistance incl. planning(Note)	Same as planned scope at Phase I	Same as planned scope at Phase I
	(Work Volume) • International Consultant: 259 MM • Local Consultant (incl. Supporting staff): 506 MM		(Work Volume) • International Consultant: 274 MM • Local Consultant (incl. Supporting staff): 531 MM

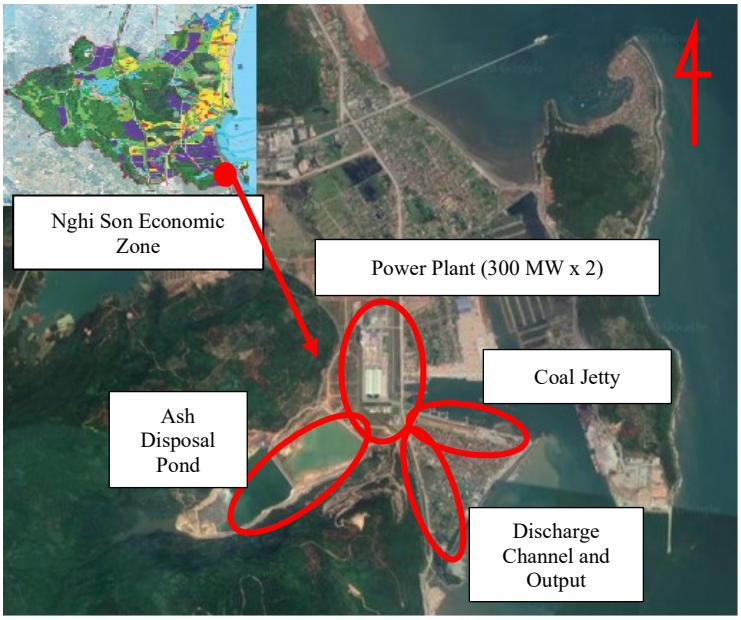
Source: Documents provided by JICA, Project Management Board 2 (PMB2), NS1
Note: Environmental Monitoring Assistance includes assistance of environmental monitoring trouble shooting during construction period, and assistance of resettlement monitoring.

Regarding package 4: Power Plant EPC[4] Works, as the contractor's bid price was much higher than the budget, EVN and the contractor agreed at the contract negotiation that some specifications would be modified to the extent that the original capacity and output would not deteriorate. As the contract price of package 4 increased, Power Plant EPC Works, the cooling water intake and intake channel, the discharge channel and output, and fuels for commissioning were excluded from package 4 and procured by separate packages at the time of Phase II and III appraisal. Regarding package 3: Civil and Architecture, an 80 ha of ash disposal pond was planned to be constructed for both NS1 and NS2 at the time of Phase I appraisal. However, although the design of the ash disposal pond should be based on the technology of the power plant, it was not sure when NS2 project would be implemented and what technology would be applied. As the result, only construction of the ash disposal pond for NS1 as well as leveling of ground of the ash disposal pond for NS2 was implemented by the project. Therefore, the construction area decreased to 49 ha for NS1 only at the time of Phase II and the Phase III appraisal. Regarding the consulting services, the actual work volume increased from the original estimation at the time of the Phase I appraisal due to the delay in construction work.

Common facilities with NS2 such as the cooling water intake and intake channel, the discharge channel and output were also outputs of this project. The 25 year power purchase agreement between EVN and NS2PC stipulated that EVN provided and maintained the common facilities

[4] A type of construction contract including Engineering, Procurement and Construction.

for NS2PC at EVN's own cost. The land including the ash disposal pond for NS2 was provided by EVN to NS2PC after leveling and, therefore, NS2PC was not required to take any necessary action for land acquisition and resettlement. An EPC contractor hired by NS2PC is constructing a coal jetty and ash disposal pond, excluding the boundary with NS1, for NS2. NS2 was under construction as of December 2019 and the common facilities will be utilized by NS2 as planned after the commencement of operation.



Source: Google Map, Management Board of Nghi Son Economic Zone and Industrial Parks

Figure 1: Site Map of NS1

In parallel with the project, the GOV developed the necessary utilities, such as a water supply system and transmission lines, required for the operation of NS1.

The abovementioned modifications of the outputs did not have any negative influence on the project objective and impact.

3.2.2 Project Inputs

3.2.2.1 Project Cost

The actual project cost was 115,931 million yen, compared with the planned project cost of 85,150 million yen at the time of the Phase I appraisal. The actual project cost exceeded the plan by 136% as shown in Table 2. The reasons of the cost increase from the time of the Phase I appraisal were as follows. Firstly, the contract amount of package 4, Power Plant EPC Works, increased due to the increasing cost of the turbine and generator, materials and labor. Secondly, land acquisition for NS2 and its port facilities was added into the project scope at the time of the Phase II appraisal. As the result of reviewing the project cost for these reasons, the estimated project cost had increased to 119,352 million yen at the time of the Phase II appraisal and, due to the appreciation of the yen currency from the time of the Phase II, it had changed to 111,461 million yen at the time of the Phase III appraisal. Comparing the actual project with the estimations at Phase II and Phase III, the actual/plan ratio is 97% and 104 % respectively.

The major reasons for the cost increase lay in the construction costs of package 4, the Power

Plant EPC Works.[5] At the time of the Phase I appraisal, the project cost, in particular the cost of the main equipment such as the boiler, steam turbine and generator, was estimated by adjusting by price escalation the actual cost of past projects in Vietnam, such as the Ninh Binh II Thermal Power Plant Construction Project and the Pha Lai Thermal Power Plant Project. However, the estimated cost was much lower than the international market price. According to JICA's internal documents, this was because the price of the boiler manufactured by an American company had increased due to the rise in the construction cost of thermal power plant in Europe and the United States since 2003. However, the Vietnamese market was not much influenced by the price increase in the American and European markets at the time of construction of the power plants. Furthermore, the entering of Chinese manufacturers to Vietnamese market pushed down the construction cost in Vietnam at that time. Accordingly, the original construction cost estimated at the time of appraisal was calculated lower than the international market price mainly in Japan, Europe and the United States, and also the bid price was much higher than the estimate cost and, therefore, the contract amount increased and some of the works were procured by separate packages. However, the competition was considered to be assured since two bidders submitted bids among three prequalified bidders.

Table 2: Planned and Actual Project Cost

Item	Plan			Actual		
	Phase I	Phase II	Phase III			
	Total (Mill. Yen)	Total (Mill. Yen)	Total (Mill. Yen)	Foreign Currency (Mill. Yen)	Local Currency (Mill. Yen)	Total (Mill. Yen)
Construction Works	66,444	92,821	89,001	75,697	13,644	89,341
Price Escalation	3,643	3,309	1,944	0	0	0
Physical Contingency	3,504	4,501	4,547	0	0	0
Consulting Service	1,383	1,024	1,353	1,018	259	1,277
Interest during construction (ODA Loan Portion)	1,573	3,541	2,502	2,045	0	2,045
Interest during construction (EVN Own Portion) (Note3)	0	0	0	0	5,918	5,918
Land Acquisition and Compensation	340	2,795	2,079	0	2,291	2,291
Administration Cost	6,068	858	786	0	989	989
Other Expenses	0	0	0	19	2,236	2,255
Tax and Duties	2,195	9,909	8,894	0	11,691	11,691
Commitment charge	0	595	354	124	0	124
Total	85,150	119,352	111,461	78,904	37,028	115,931

Source: Documents provided by JICA and PMB2
Note 1: Exchange rates used: 1VND=0.007 yen (November 2016) for the Phase I appraisal, 1VND=0.00532 yen (May 2010) for the Phase II appraisal, 1VND=0.004 yen (June 2011) for the Phase III appraisal, 1VND=0.00514 yen (Average between 2007-2018) for ex-post evaluation.
Note 2: As the figures are rounded millions of yen, the total amount may not match the sum of each amount.
Note 3: Interest during construction (EVN Own Portion) is the interest rate on the loan which EVN borrowed from private banks in Vietnam for constructing EVN's own fund portion.

[5] Including price escalation.

3.2.2.2 Project Period

The actual project period was 99 months (March 2007-May 2015), significantly exceeding the planned project period of 62 months (March 2007-April 2012) by 160% compared to the Phase I appraisal. At the Phase I appraisal, project completion was defined as "the end of defect liability period", while at the Phase II and III appraisals it was defined as "the commencement of operation". In this ex-post evaluation, as the EVN recognized that the project had been completed at the commencement of operation, the planned and actual project period was compared using the same definition as shown in Table 3.

Table 3: Planned and Actual Project Period

Item	Plan (At Phase I Appraisal)	Actual
Signing of Loan Agreement	March 2007	March 2007
Selection of Consultant	April 2007–September 2007 (6 months)	April 2007–January 2008 (10 months)
Consulting Services	October 2007–April 2014 (79 months)	February 2008–May 2017 (112 months)
Selection of Contractor	October 2007–December 2008 (15 months)	February 2008–June 2010 (29 months)
Construction Work for Unit 1	January 2009–December 2011 (36 months)	July 2010–May 2015 (59 months)
Defect Liability Period for Unit 1	January 2012–December 2013 (24 months)	June 2015–May 2017 (24 months)
Construction Work for Unit 2	July 2009–April 2012 (34 months)	July 2010–December 2014 (54 months)
Defect Liability Period for Unit 2	May 2012–April 2014 (24 months)	January 2015–December 2016 (24 months)
Land Acquisition and Resettlement of People	April 2007–June 2008 (15 months)	April 2007–March 2011 (48 months)
Common Facilities with NS2	October 2007–April 2012 (55 months)	July 2010–December 2014 (54 months)
Project Completion at the commencement of operation	April 2012	May 2015

Source: Documents provided by JICA and PMB2

The launch of consulting services was expected for October 2007 at the Phase I appraisal, but it was delayed by 4 months due to the prolonged contract negotiations. The contract period for consulting services was expected to be 79 months at the Phase I appraisal, but this was also delayed by 33 months due to the delay in the main construction.

Regarding the selection of contractor for package 4: Power Plant EPC Works, although the bidding process was expected to be 15 months at the Phase I appraisal, it actually took 29 months, meaning 14 months of delay, as the bid was canceled due to the high bid price and EVN negotiated with the lowest evaluated bidder as an alternative to rebidding.

Bearing in mind the delay of the above-mentioned selection process, EVN mentioned the importance of the preparation of bidding documents, especially with regard to instructions to

bidders, and the evaluation of key experts during the selection process in the project completion report.

Construction work was delayed by 19 months from the plan at the Phase I appraisal. The actual construction period was therefore 59 months, while the plan had been for 40 months[6] at the Phase I appraisal. Although the delay of construction work was only 1 day, the project encountered many technical problems such as boiler tube rupture, fly ash silo clogging, boiler clinker, a solid material produced from limestone during combustion of coal, clogging and problems with the submerged drag chain conveyor problem and had to shut down the plant and modify and repair works during commissioning period. Consequently, it actually took 891 days from power receiving to take over the plant after passing reliability test, while it had planned 328 days, meaning 19 months of delay.

Facilities at the Nghi Son Coal-fired Thermal Power Plant developed by the Project


Turbine


Boiler


Flue Gas Desulfurization


Coal Storage


Ash Disposal Pond


Water Intake
(Common Facility with NS2)

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

(1) Financial Internal Rate of Return (FIRR)

The Financial Internal Rate of Return (FIRR) of this project was 6.2% at the time of the Phase I appraisal, 6.5% at the time of the Phase II appraisal and 5.03% at the time of the Phase III appraisal. However, the recalculated FIRR dropped to 4.56% at the ex-post evaluation. This was due to the increase in the project cost and the unit price of coal. Table 4 shows the preconditions for the FIRR.

[6] 24 months of the defect liability period is excluded.

Table 4: Financial Internal Rate of Return (FIRR) at the Times of Appraisal of this Project

Item	Phase I Appraisal	Phase II Appraisal	Phase III Appraisal	Ex-Post Evaluation
Financial Internal Rate of Return (FIRR)	6.2%	6.5%	5.03%	4.56%
Cost	Project cost, Operation and maintenance cost	Project cost, Operation and maintenance cost, Fuel cost, Limestone cost	Same as left	Same as left
Benefit	Power sales revenue	Same as left	Same as left	Same as left
Project Life	30 years	Same as left	Same as left	Same as left

Source: Documents provided by JICA, Recalculation at the time of ex-post evaluation is made by the evaluator.

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

3.3 Effectiveness and Impacts[7] (Rating: ③)

3.3.1 Effectiveness

3.3.1.1 Quantitative Effects (Operation and Effect Indicators)

Table 5 shows the operation and effect indicators of the project. In this ex-post evaluation, project completion has been deemed to be May 2015.

Table 5: Operation and Effect Indicators

Indicators	Baseline	Target 2 years after completion	Actual			
			2015 Project completion year	2016 1 year after completion	2017 2 years after completion (Note 1)	2018 3 years after completion
Maximum Output (MW)	-	600	600	600	600 (100%)	600
Net Electric Energy Production (GWh)	-	3232.8	2,518	2,887	2,389 (74%)	2,930
Plant Load Factor (%)	-	≥ 68.0	81.36	71.67	77.64 (114%)	82.35
Availability Factor (%)	-	92.0	91	86,11	90.4 (98%)	89.83
Auxiliary Power ratio (%)	-	≤ 10.2	10.01	9.16	9.45 (107%)	9.09
Gross Thermal Efficiency (%)	-	39.6	39.5	39.87	39.83 (101%)	39.74
Outage Hours by Human Errors (hours/year)	-	0	0	0	0 (100%)	0
Outage Hours by Human Errors (Times/year)	-	0	0	0	0 (100%)	0
Planning Outage Hours by Periodical Inspection (hours/year)	-	≤ 720	821.5	690	737.5 (98%)	747.5

Source: Documents provided by JICA, Answers to questionnaire from PMB2 and NS1
Note 1: The actual figures for 2017 in the brackets are the achievement rate against the target values.

[7] Sub-rating for Effectiveness is to be put with Consideration of Impacts.

All of the operation and effect indicators except the net electric energy production almost achieved their targeted values for 2017 (2 years after completion). NS1 belongs to Power Generation Corporation 1 (GENCO1), a subsidiary of EVN, and the electric energy production of each power plant under GENCO1 is determined based on the GENCO1 operation plan. Therefore, NS1 adjusts electric energy production based on instructions from GENCO1 every day and, as the result, NS1 did not achieve its targeted net electric energy production in 2017. Regarding the planning outage hours by periodical inspection, although the actual figure was slightly over the target one, it was within the normal range in EVN's internal regulations.

3.3.1.2 Qualitative Effects (Other Effects)

(1) Improvement of the stability of the power supply in the Northern and North Central regions of Vietnam

After project completion, the frequency of unplanned outages in the Northern and North Central regions of Vietnam decreased and the power supply was stabilized in terms of both volume and voltage. However, this was not only due to this project, but also because of EVN's continuous development of power sources.

The stable power supply enabled EVN to provide enough electricity to meet the industrial / domestic demand of the companies in the Nghi Son Economic Zone. In general, the electricity produced in a power plant goes to a transmission grid in each region and then the central or regional dispatch center distributes the electricity to consumers in each region, taking into consideration the demand in such regions at that time. The longer the transmission route, the bigger the transmission loss. Therefore, it is more efficient to consume electricity near the place where it is produced than to transmit it to far areas though the grid. According to the National Load Dispatch Center (NLDC), as NS1 is located in the Nghi Son Economic Zone where a lot of electricity is required, the majority of the electricity produced at NS1 is consumed in Thanh Hoa province and Nghe An province, a province contiguous with Thanh Hoa province, through the Nghi Son 220 kV Substation. NLDC also estimated that there was a reduction of 94.1 million kWh of transmission loss as of 2019 thanks to this project, since the electricity required in Thanh Hoa province and Nghe An province did not have to be transmitted from more distant provinces. The People's Committee in Thanh Hoa province, where the Nghi Son Economic Zone is located, and tenant companies in the Nghi Son Economic Zone also felt that the outages in the Northern and North Central regions of Vietnam had reduced year by year.

In accordance with the annual survey conducted by the Japan External Trade Organization (JETRO) with Japanese companies operating in Vietnam, although increasing labor costs and an insufficient legal system and enforcement have recently been pointed out as obstacles for Japanese companies doing business in Vietnam, infrastructure, including electricity, has been

less and less regarded as an obstacle since 2012 because of the development of infrastructure by the GOV.

Therefore, this project has contributed to the stability of the electricity supply in the Northern and North Central regions of Vietnam.

3.3.2 Impacts

3.3.2.1 Intended Impacts

(1) Economic Development in the Northern and North Central regions of Vietnam

The provincial GDP growth rate in Thanh Hoa province has been over 8% since 2015, and the rates in 2018 and 2019 were around 15-17% which was around double of other years as shown in Table 6. The provincial GDP per capita reached 2,000 US dollar in 2019. The Department of Planning and Investment of Thanh Hoa province pointed out that the commencement of the commercial operation of the Nghi Son oil refinery, the Nghi Son cooking oil production plant and the Nghi Son iron and steel factory contributed to this high economic growth.

Table 6: Provincial GDP Growth Rate and Per Capita in Thanh Hoa Province

	2015	2016	2017	2018	2019
Provincial GDP Growth Rate (%)	8.39	9.05	8.26	15.16	17.15
Provincial GDP per capita (USD)	NA	1,544	1,540	1,990	2,325

Source: Thanh Hoa Statistical Office

According to the Thanh Hoa province People's Committee, investment also increased with the economic growth and up to December 2019 there were more than 200 investment projects, of which the total investment amount reached 18 billion US dollars in the Nghi Son Economic Zone.

A stable electricity supply was essential for the encouragement of investment in the Nghi Son Economic Zone and the project contributed to this above-mentioned economic activization.

(2) Strengthening of International Competitiveness

The Thanh Hoa province People's Committee regarded the Nghi Son Economic Zone as the most developed coastal economic zone in Vietnam. The electricity demand in Thanh Hoa and Nghe An provinces was 1,500 MW in 2019 and was estimated to reach 2,000 MW in the near future. Under these circumstances, the capacity of 600 MW in NS1 contributed to meeting the increasing demand. As the electricity was supplied to the Nghi Son Economic Zone steadily, thanks to the project, private investment was active.

Moreover, according to the survey by JETRO, lack of electricity gradually became less and less regarded as an obstacle for Japanese companies operating in Vietnam, as stated in 3.3.1.2. Shortage of the electricity has not been a critical issue in the north / mid-north of Vietnam.

The electricity supplied by the project has therefore contributed to some extent to the stability of the electricity supply in Vietnam. The stability of the electricity supply in turn improved the investment environment and strengthened the international competitiveness of Vietnam.

3.3.2.2 Other Positive and Negative Impacts

(1) Impact on the Natural Environment

As part of the thermal power sector and with the characteristics of significant involuntary resettlement, this project was classified as Category A based on the JBIC Guidelines for the Confirmation of Environmental and Social Consideration (April 2002) for sensitive sectors. The Environmental Impact Assessment (EIA) report on this project was approved by the Ministry of Natural Resources and Environment (MONRE) in December 2005. EVN created an additional EIA, which was approved by MONRE in November 2006, for the changing of the location of some equipment such as discharge channel, outputs etc. of the project.

For environmental monitoring during project implementation, the contractor monitored environment parameters such as air and water quality, and noise and vibration level. After the results of monitoring had been checked by the consultant, the contractor submitted an environmental monitoring report every quarter to the Project Management Board 2 (PMB2), the project implementation body in charge of construction under EVN, in accordance with the environmental monitoring plan. In addition, the environmental monitoring results have regularly been reported to the Department of Natural Resources and Environment (DONRE) of Thanh Hoa province.

The environmental monitoring results during project implementation were generally within the environmental standards of Vietnam. Although the values for suspended solids in fresh water, dissolved oxygen in sea water, and dust, NO_2 and SO_X around the project site exceeded the country's standards, this was not directly attributed to the project. This is because the local residents discharged domestic wastewater near the place of sampling water. Also it was considered that exceedance of dust, NO_2 and SO_X in the Vietnamese environmental standard might be caused by other plants nearby since amount of dust, NO_2 and SO_X collected near the chimney of NS1 were within the standard.

In addition, NS1 installed a chemical injection system to control water quality in the boiler. This was proposed as a measure for reducing greenhouse gas emission in the "Special Assistance for Project Implementation for Reducing Greenhouse Gas Emission from Major Coal-fired Thermal Power Plants in Vietnam (2010-2011)" conducted by JICA.

Environmental monitoring after project completion has been carried out under the responsibility of NS1 as the power plant was transferred from PMB2. The environmental monitoring results have been reported to DONRE every quarter.

(2) Resettlement and Land Acquisition

While at the time of the Phase I appraisal, around 164 ha of land acquisition and the resettlement of 152 households was estimated, 230 ha of land acquisition and the resettlement of 579 households occurred with the actual implementation of the project including common facilities with NS2, as shown in Table 7. The resettlement was carried out appropriately in accordance with national and provincial regulations. The monitoring and evaluation committee in charged by Tinh Gia District people's committee chairperson was established, and compensation money and alternative land were provided to the affected residents by the committee according to the area of land to be acquired after they measured the land to be acquired and identified the land owners.

Table 7: Area of Land Acquisition

	Phase I Appraisal	Phase II Appraisal	Phase III Appraisal	Ex-post Evaluation
Land Acquisition (ha)	164	201	230	230
Resettlement (No. of Household)	152	579	579	579

Source: Documents provided by JICA

A total of 545 people from 159 households, out of which 134 households were from the Hai Ha commune and 25 households from the Hai Bin commune[8], were resettled in the new area prepared by the project which was placed 20-25 km from the project site in the Hai Bin commune. In addition to compensation, Hai Ha commune supported the cost of leveling the resettled land and the rent for temporary housing for the people resettled. Although an income restoration program for people resettled through the project was not conducted, the commune supported them in finding jobs in local companies. While the younger generation could find a new job after the resettlement, the elder generation who used to be a farmer or fisherman had difficulties to adjust themselves to a new life and it was not easy to get an employment at factories near the resettlement sites. There were no major complains from the resettled people.

(3) Measures Against Infectious Diseases such as AIDS

During construction for the project the EPC contractor prepared a preventive program for infectious diseases and conducted HIV/AIDS prevention measures such as health checkups for

[8] Both the acquired area and the resettled area are located in the Hai Bin commune.

workers, awareness campaigns including health education, and the free distribution of condoms through daily toolbox meetings[9] and seminars along with the program after PMB2's approval.

(4) Accidents during Construction

There were 7 accidents including 2 fatal ones during April 2012 and May 2013 and, accordingly, PMB2 ordered the contractor to improve the overall project management in August 2013. The first fatal case was that where a worker was hit by the edge of a steel beam dropped from above during trial fitting work. The second case was when a platform suspended by a crane fell with a worker on board. According to the accident report, one of the reasons for these accidents was that the contractor could not manage its local subcontractor.

The contractor reinforced the safety management system after these accidents by dispatching 4 safety management experts to review and improve the safety management policy and 7 safety managers to construction areas. A project manager was also stationed in the construction site and led safety patrols to enhance safety awareness. In addition, JICA separately dispatched a safety management expert to instruct the contractor on how to improve safety management and the JICA Vietnam office also visited the construction site for safety monitoring once or twice a month.

In light of the above, the implementation of the project has largely achieved the planned effects, and therefore its effectiveness and impact are high.

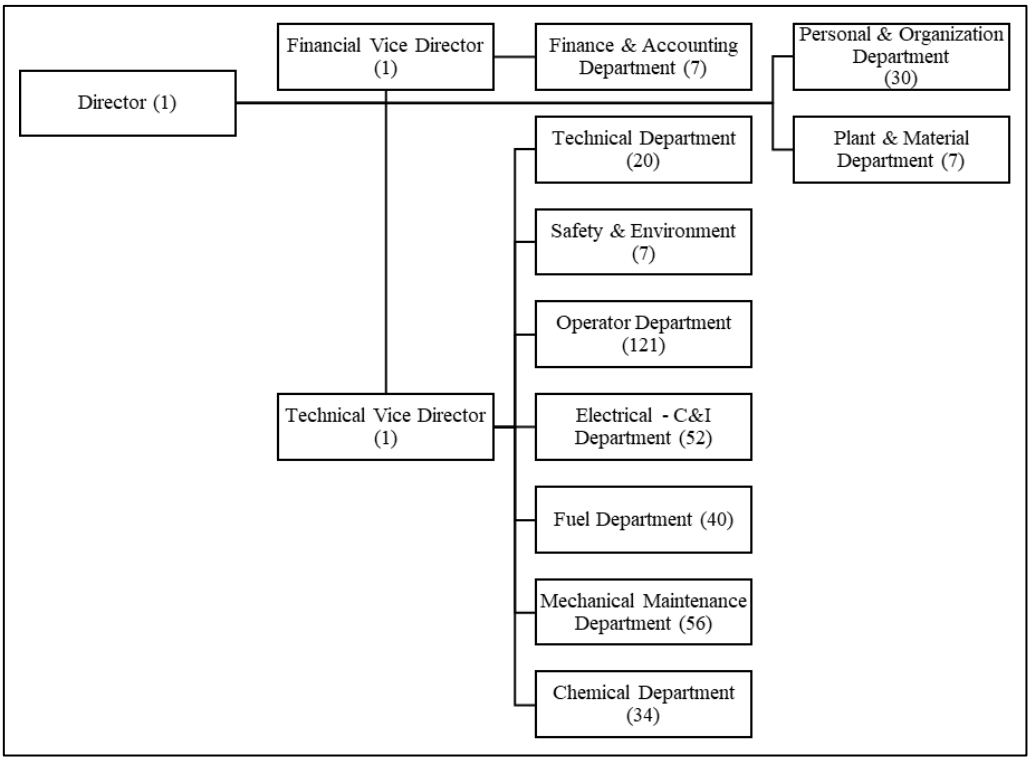
3.4 Sustainability (Rating: ③)

3.4.1 Institutional / Organizational Aspects of Operation and Maintenance

The coal-fired thermal power plant constructed by the project is operated and maintenance by NS1 to which PMB2 transferred project management upon the commencement of operation. NS1 is one of 10 power plants owned by GENCO1 under EVN.[10] The organization chart of NS1 is shown in Figure 2.

[9] The meeting held by all workers for sharing the tasks and points to be cautioned of the day before commencement of the work.

[10] EVN is a holding company, managing generation, dispatch center, transmission, distribution and wholesale companies. Regarding the generation section, in addition to the power plants directly owned by EVN there are 3 the generation corporations GENCO1, GENCO2 and GENCO3 which operate and maintain regional power plants.



Source: NS1

Figure 2: Organization Chart of NS1

At the time of the ex-post evaluation, the number of staff in NS1 was 392 which was below the approved number of 426. However, the plant was well operated and maintained by the current number of staff. GENCO1 is planned to be privatized by the end of 2020 and the GOV's stock share will be less than 50% in accordance with the Prime Minister's Decision No. 26/2019/QD-TTg of August 2019.

No major problems were observed in the institutional aspects of the operation and maintenance system.

3.4.2 Technical Aspects of Operation and Maintenance

NS1 has maintenance programs by type of equipment and the mechanical maintenance department in NS1 carries out daily inspections and 20 days of annual inspection. On the other hand, overhaul inspection is carried out by an outsourced contractor once in 2-4 years. NS1 and GENCO1 have training programs as mainly listed in Table 8 corresponding to trainees' skills and expertise.

Table 8: Major Training Programs of NS1 and GENCO1

Training Program	Number of trainees (persons)	Frequency	Target Participants
Intensive Presentations on Technical Systems	45	3/ year	Technical Managers, Operators, Repairing and Maintenance Staff
Alignment of equipment	9	1/ year	
RCM Training (Reliable Central Maintenance)	50	3/ year	
Economic Operation of Coal-fired Thermoelectric Set	5	1/ year	
Operation, Handling Abnormal Coal Burning Furnace	10	1/ year	
Operation and Handling Abnormal Steam Turbine	5	1/ year	
Analyzing, Standardizing, Handling Abnormal Problems of Supply Pump System	10	1/ year	
Experimental High-Pressure Equipment	6	1/ year	
Testing and Adjusting the Boiler of Coal-fired Thermal Power Plants	5	1/ year	
Competitive Electricity Trading Market	5	1/ year	
Application of Industry 4.0 Technology (Note)	5	1/ year	
Risk Assessment for Employees	7	1/ year	
Calculation of Heat Balance of Boiler-Turbine	14	1/ year	

Source: Documents provided by NS1
Note: Industry 4.0, generally recognized as the "fourth industrial revolution", is an industrial revolution project applied a next-generation technology. The German government adopted it in 2011 and implemented it with the industry. Industry 4.0 includes cyber-physical system, internet of things (IOT), cloud computing, cognitive computing etc.

NS1 utilizes the operation and maintenance manuals prepared by the contractor and manages spare parts based on a database.

No major problems have been observed in the technical aspects of the operation and maintenance system.

3.4.3 Financial Aspects of Operation and Maintenance

NS1 is not financially independent but is under GENCO1 together with the other power plants under GENCO1. The revenue from power generation in NS1 is controlled by GENCO1 and GENCO1 transfers the funds for operation and maintenance to NS1 after GENCO1 annual approval of budget requests from NS1. According to NS1, there are no major problems regarding the budget allocation for operation and maintenance.

GENCO1 sells the electricity to the Electric Power Trading Company (EPTC), an electricity wholesaling company under EVN based on their purchase agreement. The electricity output and price are determined in a spot market, since the wholesale electricity market has only been started since January 2019. As can be seen in the financial indicators and analysis of GENCO1 and EVN shown in Table 9, the return on assets and the net profit margin indicating the profitability of GENCO1 were 0.3%, and 0.9% respectively in 2018 which are low. The current ratio of GENCO1 is also low and is much less than 100% since GENCO1 has 10 power plants as fixed assets, although the risk of collecting receivables is low since GENCO1 sells the electricity to EPTC which is also a EVN group company. From these indicators, it can be considered that, although GENCO1 itself is not so profitable, EVN as a group which includes

generation, transmission, distribution etc. keeps the financial condition stable. However, since the revenue and net profit of GENCO1 are stable every year, GENCO1 can keep the funds for the operation and maintenance of GENCO1-owned power plants including NS1.

Table 9: Financial Indicators and Financial Anasysis of GENCO1 and EVN

Unit: Billion VDN

	GENCO1			EVN		
	2016	2017	2018	2016	2017	2018
Financial Indicator						
(1) Total Assets	106,794	125,996	112,706	692,216	701,580	706,504
(2) Current Assets	7,657	15,095	10,028	99,943	105,285	127,411
(3) Current Liabilities	24,966	25,604	20,082	121,192	115,557	121,623
(4) Equity	13,882	20,419	23,267	205,235	212,448	217,446
(5) Revenue	17,999	25,476	34,480	272,703	294,847	338,500
(6) Net Profits	208	442	321	4,431	6,593	6,817
Financial Analysis						
Return on Assets (%) (6)/(1)	0.2%	0.4%	0.3%	0.6%	0.9%	1.0%
Net Profit Margin (%) (6)/(5)	1.2%	1.7%	0.9%	1.6%	2.2%	2.0%
Current Ratio (%) (2)/(3)	30.7%	59.0%	49.9%	82.5%	91.1%	104.8%
Total Asset Turn Over (5)/(1)	0.2	0.2	0.3	0.4	0.4	0.5
Capital Adequacy Ratio (%) (4)/(1)	13.0%	16.2%	20.6%	29.6%	30.3%	30.8%

Source: GENCO1 Annual Report, EVN Annual Report

Regarding the consolidated financial indicators and analysis of EVN, the capital adequacy ratio and current ratio indicating financial stability in 2018 were 30.8% and 104.8% respectively and had been increasing since 2016. In addition, the value of these indicators is also better than that of a Japanese electric company[11]. Therefore, the financial condition of EVN group is considered as stable.

No major problems have been observed in the financial aspects of the operation and maintenance system.

3.4.4 Status of Operation and Maintenance

NS1 is operating in a stable manner with 600 MW of maximum output as shown in "3.3.1.1. Quantitative Effects (Operation and Effect Indicators)". The main equipment for electricity generation such as turbines, generators and boilers are maintained well. Although some equipment like the inner casing of the turbine, tubes, and chimneys were damaged during operation, NS1 has fixed them. NS1 has a database for managing spare parts and inspection records. Moreover, the related facilities such as the ash disposal pond, port facilities for loading coal and etc. are being operated as planned and no major problems have been observed.

[11] In the case of Tokyo Electric Power Company Holdings, the capital adequacy ratio and current ratio in 2018 were 21.1% and 47.8% respectively.

Regarding coal as fuel, NS1 uses domestic anthracite coal procured from Hong Gai mine and Cam Pha mine in Quang Ninh province. However, since the volume of domestic coal is decreasing, imported coal may be required in the future.

No major problems have been observed in the status of the operation and maintenance system.

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

4. Conclusion, Lessons Learned and Recommendations

4.1 Conclusion

The objective of the project was to construct a new coal-fired Thermal Power Plant with a capacity of 600 MW (300 MW×2 Units) in the Nghi Son Economic Zone, to meet the increasing power demand in the north part of Vietnam, thereby contributing to the promotion of economic growth and strengthening of the international competitiveness of the region. Vietnam's development plan places importance on the development of new power sources, including thermal power as base-load power, and, since power demand in the north part of Vietnam has been increasing since JICA's Phase I appraisal, development needs are high. Japan's ODA policy also includes the strengthening of power generation as one of its priority agendas in the power sector. The relevance of these objectives is high, as they are consistent with Vietnam's development plan and development needs, as well as with Japan's ODA policy. The project cost exceeded the plan, since the contract amount for constructing the power plant increased, due to the rise of equipment and labor costs, and because land acquisition for the Nghi Son 2 thermal power plant and its port facility was included into the scope of the Project from Phase II. The project period was significantly longer than planned, since the bid was rejected for the employment of the contractor and because various technical issues came up during the construction period. While the project cost exceeded the plan, the project period significantly exceeded the plan. Therefore, the efficiency of the project is low. The operation and effect indicators of the project facilities, such as the maximum output, the net electric energy production, and the plant load factor, have mostly achieved the targeted values. In addition, the stability of the power supply in the Northern and North Central regions of Vietnam is improving annually and the project has contributed to this improvement to some extent. This improvement in the stability of the power supply has contributed to the encouragement of private investment in the Northern and North Central regions of Vietnam and, furthermore, to strengthening the international competitiveness of Vietnam. No negative impact on the natural environment was observed, and land acquisition and resettlement due to the implementation of the project were properly conducted in accordance with the relevant laws and regulations of Vietnam. Therefore, effectiveness and impact are high. No major

problems have been observed in the institutional / organizational, technical, financial aspects or current status of the operation and maintenance system. Therefore, the sustainability of the project effects is high.

In light of the above, this project is evaluated to be 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) Employment of Procurement Consultant for Minimizing Risks for Delay and Cost Overrun

One reason of the delay in the project was the delay in the selection process. The selection of consultants was delayed by 4 months from the plan and the selection of contractors was delayed by 15 months from the plan. In case of contractor selection, the process was delayed by more than 1 year while EVN scrutinized the significant high bid price. Concerning the delays in the above-mentioned selection processes, EVN mentioned the importance of the preparation of bidding documents, especially instructions to bidders, and the evaluation of key experts during the selection process in the project completion report. The consultant was required to assist the bidding in the contract, but the procurement expert was not scheduled to be assigned according to the expert schedule attached in the Phase I appraisal documents. Although in fact the procurement expert was dispatched, support by the expert for EVN was limited during the contract negotiations with the contractor. In the case of a large-scale construction project requiring more than a 2 year construction period like this project, a prompt procurement process can reduce the risk of increasing cost and time.

Therefore, in the case where a contractor is selected by international competitive bidding in a large-scaled construction project, it is desirable that a procurement consultant is assigned as a member of the consultant team. Her/his experience of supporting the preparation of instructions to bidders should be based on JICA standard bidding documents and experience as key expert in contract negotiations.

(2) Unannounced Safety Inspections for Assuring Safety during Construction

An accident during construction has a huge impact not only on the victim but also on the project, possibly resulting in suspension and termination. Although a contractor has the responsibility for accidents in the case of a typical construction contract, an executing agency as the employer of

the contractor should monitor the contractor's safety management routinely. In order to check the actual situation of a contractor's safety management especially in the case of a large-scaled construction project, it is useful that the executing agency and/or the consultant carry out unannounced safety inspections in addition to routine inspections. For this purpose, the executing agency should include assistance in routine and unannounced safety inspections into the consultant's scope of work.[12]

(3) Accurate Cost Estimation based on the Latest Market Price

Another reason for the delay in the project was EVN's prolonged internal discussions when scrutinizing the high bid price. If JICA estimates costs relying on past data and the unit costs provided by the executing agency only at the time of appraisal, the estimated cost cannot reflect the latest demand and, as the result, it will be low. At the time of the Phase I appraisal, the project cost, especially the cost of main types of equipment such as boilers, steam turbines and generator, was estimated by adjusting the actual cost of the Ninh Binh II Thermal Power Plant Construction Project and the Pha Lai Thermal Power Plant Project by price escalation according to documents provided by JICA. Therefore, it is important that JICA refers to the cost of similar projects recently implemented in other countries and quotes from potential contractors at the time of cost estimation. It is desirable that JICA includes such tasks in the scope of work of the consultant implementing the preparatory survey of the project.

(4) Role of ODA Project for Encouraging of Private Investment

The scope of the project included common facilities with NS2 to encourage private investment in the construction of NS2. In fact, the Minister of Industry and Trade of Vietnam announced in 2008 that the operator of NS2 under the Build-Operate-Transfer scheme was to be selected by international competitive bidding, and a selected private company was constructing NS2 as of December 2019. Therefore, by including facilities which can be utilized by another private-fund project, a Japanese ODA loan project can encourage private investment from overseas as was the case in this project.

End

[12] In case where the contractor failed to carry out appropriate safety measures, the employer is entitled to issue the notice to correct to the contractor. JICA's standard contract allows the employer to issue the notice to correct.

Comparison of the Original and Actual Scope of the Project

Item	Plan at Phase I	Actual
(1) Project Output 1. Construction of Nghi Son Thermal power plant Unit 1 (300 MW) and Unit 2 (300 MW)		
Package 1: Dredging and Land Reclamation Works (EVN Portion)	• Dredging, Reclamation (Depth -9.0 m)	Same as planned scope
Package 2: Temporary Construction (EVN Portion)	• Temporary Roads for Construction • Power Facilities for Construction • Water Facilities for Construction • Workshop for Construction • Yard for Materials, Equipment • Site Office • Other Related Facilities, like Temporary Housing	Same as planned scope except Yard for Materials, Equipment which was omitted.
Package 3: Civil and Architecture (EVN Portion)	• Ash disposal pond (80 ha) • Estate Housing	• Ash disposal pond (49 ha)
Package 4: Power Plant EPC Works	• Boiler with associated equipment (300 MW x 2) • Steam turbine generator and condenser with associated equipment • Coal supply and processing system • Wet flue gas desulfurization (FGD) system (Included Gas Heater) • 220kV Switch yard • Electrical components including switchgear and motors • Instrument and control system • Water intake and cooling water system (incl. Discharge channel) • Water treatment system • Wastewater treatment system • Jetty (Coal, HO, Equipment) and associated equipment	Same as planned scope except: • Wet flue gas desulfurization (FGD) system: Excluded Gas Heater • Water intake and cooling water system (incl. Discharge channel): Separate package
Package 5: Cooling Water Intake and Intake Channel	-	• Intake Capacity: 80 m^3/s (NS1: 25 m^3/s; NS2: 55 m^3/s) • Length of Intake Channel: 785 m
Package 6: Discharge Channel and Output	-	• Discharge Capacity: 80 m^3/s (NS1: 25 m^3/s; NS2: 55 m^3/s) • Length of Pipeline: 2,700 m
Package 7: Fuels for Commissioning	-	Coal: 633,272 tons Heavy Fuel Oil: 36,814 tons Diesel Oil: 2,515 m^3 Limestone: 7,315 tons

Item	Plan at Phase I	Actual
2. Consulting Services	• Tender Assistance • Construction Supervision • Environmental Monitoring Assistance incl. planning (Work Volume) • International Consultant: 259 MM • Local Consultant (incl. Supporting staff): 506 MM	 (Work Volume) • International Consultant: 274 MM • Local Consultant (incl. Supporting staff): 531 MM
(2) Project Period	March 2007–April 2012 (62 months)	March 2007–May 2015 (99 months)
(3) Project Cost Amount Paid in Foreign Currency	56,832 million yen	78,904 million yen
Amount Paid in Local Currency	28,319 million yen (4,045,571 million VND)	37,028 million yen (7,203,891 million VND)
Total	85,150 million yen	115,931 million yen
ODA Loan Portion	72,378 million yen	88,573 million yen
Exchange Rate	1VND=0.007 yen (November 2006)	1VND=0.00514 yen (Average between 2007 – 2018)
(4) Final Disbursement	February 2019	