FY2020 Simplified Ex-Post Evaluation Report of Japanese ODA Loan Project

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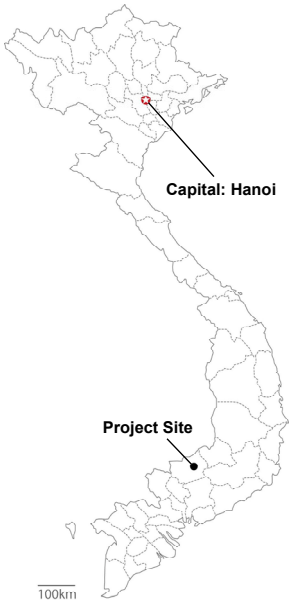
Duration of the Study: November 2020－January 2022

Duration of the Field Study: Not implemented

Country Name	(ODA Loan) Thac Mo Hydropower Station Extension Project
Socialist Republic of Viet Nam	



Location of the Project site

Exterior of the Thac Mo Hydropower Station

I. Project Outline

Background	Vietnam's demand for electrical power had soared due to its economic growth. From 1996 to 2002, national power consumption grew on average at 14.6% annually. Vietnam Electricity predicted that the power demand would grow at an average rate of 13.8% each year until 2010 in southern region. In particular, the demand for power in parts of the northeastern region of southern Vietnam and the Central Highlands, which were the sites of the project, was expected to grow by 16.0% each year. Specifically, power supply and demand in the region was expected to be tight in 2009 (shortage of 534 MW), even after taking into account the construction of new power stations other than the project (126 MW). Therefore, easing the gap between the demand and supply of power in the region was an urgent concern.			
Objectives of the Project	The objective of the project was to improve the power supply situation by extending a 75 MW hydropower station in the existing Thac Mo hydropower station in southeastern Vietnam where power supply and demand situation was tight, thereby contributing to the revitalization of economic activities and the improvement of living environment of residents.			
Contents of the Project	1. Project Site: Thac Mo Town, Binh Phuoc Province, Vietnam 2. Japanese side: 1) Civil works, procurement of equipment, etc. ・ Civil works: Inlet channel, intake facilities, surge tank, etc. ・ Water steel structure: Penstock, other water gate equipment ・ Power generation equipment: Turbine (francis × 1 unit), generator (75 MW × 1 unit), main transformer, etc. 2) Consulting services ・ Detailed design, bid document review ・ Assistance in tendering and contract ・ Construction supervision 3. Vietnamese side: ・ Land acquisition, etc.			
Implementation Schedule	E/N Date	March 31, 2004	Disbursement Date	January 31, 2019
	L/A Date	March 31, 2004	Completion Date	November 2018 (At the end of the warranty period)
Project Cost	Total Project Cost (Planned): 7,026 million yen Loan Approved Amounts: 5,972 million yen Disbursed Amounts: 4,533 million yen			
Executing Agency	Vietnam Electricity: EVN			
Conditions (Loan only)	Interest Rate: 0.75%, Repayment Period:40 year (of which, Grace Period: 10 years), General Untied			
Borrower (Loan only)	The Government of the Socialist Republic of Viet Nam			
Contracted Agencies	Main Contractors: National Research Institute of Mechanical Engineering Narime (Vietnam) / Lilama 45.4 Joint Stock Company (Lilama 45.4) (Vietnam) (JV), Alstom Hydro (France) / GE Power India Limited (India), Truong Son Construction Corporation (Vietnam) / Underground Works Construction Joint Stock Company			

	(Vinavico) (Vietnam) (JV) Main Consultants: Electric Power Development Co., Ltd. (Japan) / Nippon Koei Co., Ltd. (Japan) Agent: N.A.

II. Result of the Evaluation

Summary

This project extended a 75 MW hydropower station in the existing Thac Mo hydropower station with the aim of improving the power supply situation in southeastern Vietnam where power supply and demand situation was tight. The project, which aimed to alleviate the power supply and demand gap in the region, was consistent with Vietnam's development policy, development needs and Japan's assistance policy which put up economic infrastructure development as a priority area of assistance. Therefore, the relevance of the project is high. In terms of project implementation, although the project cost was within the plan, the project period exceeded the plan. Therefore, efficiency of the project is fair. As for project effects, indicators for forced outage hours and maximum output have achieved the targets. Net electric energy production was slightly less than 80% of the target, because the actual rainfall was less than expected. In order to secure water supply to the lower reaches of the Be River[1] during the dry season and to ensure the safety of the power system from a regional perspective, the National Load Dispatch Center adjusted the grid and supply/demand operations and restricted the operation of the power station. As a result, the target was not reached. The power station has responded to the peak power demand in response to fluctuating demand, contributing to a stable power supply. It can be considered that the project has been also contributing to the revitalization of economic activities in the southeastern region of Vietnam and to the improvement of the living environment of local residents. Therefore, the project has mostly achieved its objectives and thus, effectiveness and impacts of the project are high. No negative impacts on natural environment have been reported, and resettlement and land acquisition process has carried out appropriately in accordance with the relevant regulations of Vietnam, thus, no problem has been seen. No major problem has been observed in the institutional/organizational, technical and financial aspects of operation and maintenance as well as in the current status. In addition, the power station is operating smoothly and in good condition. Therefore, sustainability of the project effects is high.

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

Overall Rating[2]	**A**	**Relevance**	**③[3]**	**Effectiveness & Impact**	**③**	**Efficiency**	**②**	**Sustainability**	**③**

<Special Perspectives Considered in the Ex-Post Evaluation／Constraints of the Ex-post Evaluation>

In this study, due to the global spread of COVID-19, the external evaluator could not travel to Vietnam, and affected by domestic infection control measures in Vietnam, the local consultant could not conduct actual inspection, etc., of the project, either. Therefore, the survey was conducted completely remotely, including the local consultant. For this reason, the external evaluator could not directly visit the site to check the outputs or conduct interviews with stakeholders, etc., and thus conducted evaluation analysis and judgment by closely examining the information and data obtained through remote surveys utilizing the local consultant.

1 Relevance

<Consistency with the Development Policy of Vietnam at the Time of Ex-Ante Evaluation>

Regarding the power development plan of the Vietnamese government at the time of the appraisal, the *Fifth Master Plan for Vietnam Power Sector (2001-2010)* called for the construction of new power stations with a total installed capacity of 18,110 MW by 2010, balancing thermal power for base load and hydropower for middle/peak load. In addition, based on the "Power Sector Policy Statement" established by the Ministry of Industry, the power sector reform was being carried out in line with the policy of gradually opening the power market after securing stable power supply capacity. The project aimed to ensure stable power supply by extending a hydropower station to support peak loads, which was consistent with the development policy at the time of the appraisal.

<Consistency with the Development Needs of Vietnam at the Time of Ex-Ante Evaluation>

At the time of the appraisal, power supply and demand situation was expected to be tight as described in the Background, and thus the necessity to implement the project was high.

<Consistency with Japan's ODA Policy at the Time of Ex-Ante Evaluation>

At the time of the appraisal, in the Japanese government's *Country Assistance Program for Vietnam* (April 2004) and the *Overseas Economic Cooperation Operations* and the *Country Assistance Strategy* of JICA (then JBIC), the development of economic infrastructure including power was regarded as the priority area for assistance in order to achieve sustainable economic growth.

<Evaluation Result>

In light of the above, the relevance of the project is high.

2 Effectiveness/Impact

<Effectiveness>

(Quantitative Effects)

At the time of the ex-ante evaluation, "forced outage hours (hour/year)," "net electric energy production (GWh/year)," and "maximum output (MW)" were set as quantitative effects of the project. Table 1 summarizes baseline, target, and actual figures for each indicator. As

[1] The Be River flows through Thac Mo Town, Binh Phuoc Province, where the project is located, and the hydropower station is operated using the Be River water.
[2] A: Highly satisfactory, B: Satisfactory, C: Partially satisfactory, D: Unsatisfactory
[3] ③: High, ②: Fair, ①: Low

the project completion was in November 2018 (at the end of the warranty period), the target year to be compared is 2020, 2 years after completion.

- Forced outage hours: The actual figure in 2020 was 5.40 hours, which was lower than the target (12.39 hours) and achieved the target. The achievement rate is 229%.[4]
- Net electric energy production: The actual figure in 2020 was 39.2 GWh and the achievement rate of the target (52 GWh) is 75%. According to Thac Mo Joint Stock Company (hereinafter referred to as "Thac Mo JSC"), which is in charge of operation and maintenance of the project, the target achievement rate was slightly below 80% because of low rainfall in 2020. According to Thac Mo JSC, 46 GWh of net electric energy production was initially planned in accordance with the power generation plan for 2020 as shown in the document (No.3733/QD-BCT) of the Ministry of Industry and Trade of Vietnam. However, since the actual rainfall was lower than expected, the National Load Dispatch Center[5] restricted the operation of the power station to ensure water supply to the lower reaches of the Be River during the following dry season and the safety of the power system.[6] It was explained that Thac Mo JSC adjusted the daily power generation according to the instructions and as a result, net electric energy production in 2020 did not reach the target. According to the executing agency, the reason why the actual figure for 2019 was below 52 GWh was also due to low rainfall. Rainfall is an essential factor in achieving the project objectives. Since data or information to support the low rainfall have not been obtained from the executing agency, as a next best measure, rainfall data for the area around Thac Mo hydropower station was obtained from the "World Rainfall Distribution Statistics" website[7] of the Japan Aerospace Exploration Agency (JAXA) and is summarized in Figure 1. From this data, it appears that rainfall in 2019 has decreased from the previous year, but it cannot be said that the rainfall in 2020 has clearly decreased.
- Maximum output: The actual figure for 2020 was 75 MW, achieving the target (75 MW). The achievement rate is 100%.

Table 1: Quantitative Effects of the Project

Indicators	Target (2010) 2 Years after Start of Operation	Actual		
		2018	2019	2020
Forced Outage Hours (hour/year)	12.39	36.46 Note	10.57	5.40
Net Electric Energy Production (GWh/year)	52	133.7	47.8	39.2
Maximum Output (MW)	75	75	75	75

Source: Ex-ante evaluation report, project completion report and results from questionnaire survey of the executing agency

Note: The forced outage hours in 2018 were caused by the initial troubles with the turbine water seal systems and the filter of the water cooling system.

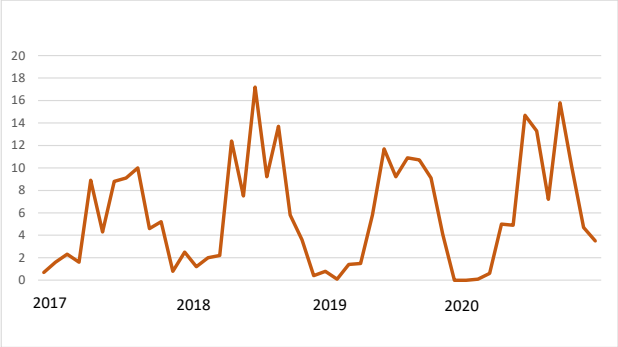


Figure 1: Average Monthly Rainfall near Thac Mo Hydropower Station (unit: mm)

Source: Prepared based on the data obtained from JAXA's "Global Rainfall Distribution Statistics" website.

(Qualitative Effects)

"Improvement of power generation capacity" and "stable power supply" were set as qualitative effects of the project. Thac Mo hydropower station is a peak-road power station, and the generated power is transmitted to the grid, covering the southeastern part of Vietnam including Ho Chi Minh City and a wide area. Among them, the main supply area is Binh Phuoc Province, where the hydropower station is located, thus Table 2 summarizes the maximum power demand and actual power consumption in the province. Both of these trends have been steadily increasing. According to the executing agency, the additional power supplied by the extended power station is contributing to stabilize the grid, but the maximum output of this power station is 75 MW, which is not a large amount of power generation from the perspective of the entire power system. In addition to this power station, Binh Phuoc Province has several other hydropower stations,[8] and also receives electricity from power stations in other regions via the grid. Therefore, it can be said that the stable power supply is largely due to the results of continuous improvement of power generation capacity by the executing agency including this project.

[4] The target achievement rate was calculated by defining it as the target figure / actual figure.
[5] In general, the power generated at power stations is sent to the grid (power transmission system network) in each region, and then the National Load Dispatch Center or the Regional Load Dispatch Center adjusts the system / supply and demand operations from a wide-area perspective, and then the power is transmitted to each region via the grid again.
[6] An official letter (Ref. 4136/DĐQG-TTD) has been issued by the National Load Dispatch Center instructing to restrict the operation of the power station.
[7] https://sharaku.eorc.jaxa.jp/GSMaP/index_j.htm
[8] There are several hydropower stations including Can Don hydropower station (77.5 MW) and Srok Phumieng hydropower station (51 MW).

Table 2: Trend of Maximum Power Demand and Power Consumption in Binh Phuoc Province

	2015	2016	2017	2018	2019	2020
Maximum Power Demand (MW) Note 1	1,562	1,615	1,670	1,726	1,784	1,845
Actual Power Consumption (MWh) Note 2	1,144	1,568	1,646	1,693	2,204	2,500

Source: Results from questionnaire survey of the executing agency
Note 1: Maximum power demand (MW) is the instantaneous maximum demand during peak hours.
Note 2: Actual power consumption (MWh) is the actual consumption converted to hourly average.

<Impacts>
(1) Intended Impacts

"Revitalization of economic activities" and "improvement of living environment of local residents" were regarded as expected impacts of the project.

- Revitalization of economic activities: It is difficult to verify direct correlation with the project since factors other than the project are also affecting. However, in order to confirm the assumptions made at the time of the ex-ante evaluation, the trends of industrial production and Gross Regional Domestic Product (hereinafter referred to as "GRDP") in Binh Phuoc Province and Ho Chi Minh City are shown in the table below from a comparative perspective. The table below shows the trend of industrial output and gross regional domestic product (GRDP) in Ho Chi Minh City in comparison with Binh Phuoc Province. Industrial production in 2017, when the expanded hydropower station began operating, grew at a much faster rate than the previous year and has outpaced the rate of increase in Ho Chi Minh City since 2017. The GRDP growth rate of Binh Phuoc Provinces in 2017 was also much higher than the previous year and has been steadily increasing since then. In addition, the growth rate in 2019 is much higher than in Ho Chi Minh City.

Table 3: Trend of Industrial Production

(Unit: indexed using 2010 figures as 100)

	2015	2016	2017	2018	2019 Note
Binh Phuoc Province	106.8	106.0	116.2	119.9	119.5
Ho Chi Minh City	107.2	107.3	115.7	115.8	115.0

Source: General Statistics Office of Vietnam
Note: Preliminary figures

Table 4: Trend of GRDP Growth Rates

(Unit: % (2010 Standard))

	2015	2016	2017	2018	2019
Binh Phuoc Province	6.37	5.03	6.58	8.27	9.11
Ho Chi Minh City	9.85	8.05	7.76	8.30	8.32

Source: Statistics Offices in Binh Phuoc Province and Ho Chi Minh City

In addition, Binh Phuoc Province has 13 large-scale industrial parks (total area of 4,686 ha) and is making efforts to attract foreign investment. In December 2020, CPV Food, a Vietnamese subsidiary of Thailand's major conglomerate Charoen Pokphand Group (CP), began operating the largest poultry processing plant in Southeast Asia (total investment of USD250 million and site area of over 10 hectares).[9] Stable power supply is a prerequisite for enabling investment environment, and it can be said that the project has contributed to the revitalization of economic activities to a certain extent.

- Improvement of living environment of local residents: According to the executing agency, "household electrification rate" was already 100% before the project. Existing studies have shown that nightlight intensity is strongly correlated with economic indicators, thus the analysis of nightlight intensity in Binh Phuoc Province from 2014 to 2020 was made as an alternative indicator for electrification rate, etc. Specifically, Google Earth Engine was used to extract the nightlight data from VIIRS Nighttime Day/Night Band Composites Version 1 using the administrative boundary data from Humanitarian Data Exchange v1.56.0 and the average annual nightlight intensity was calculated. (Figure 2) In 2017, when the power station expanded by the project started operation, the nightlight intensity increased significantly compared to the previous year, and it has steadily increased since 2017.

[9] Source: From JETRO information.
https://www.jetro.go.jp/biznews/2021/01/18df94ad59fcf767.html
https://binhphuoc.gov.vn/vi/binh-phuoc-portal/plan-projects/security-potilics-economy-and-society-45.html

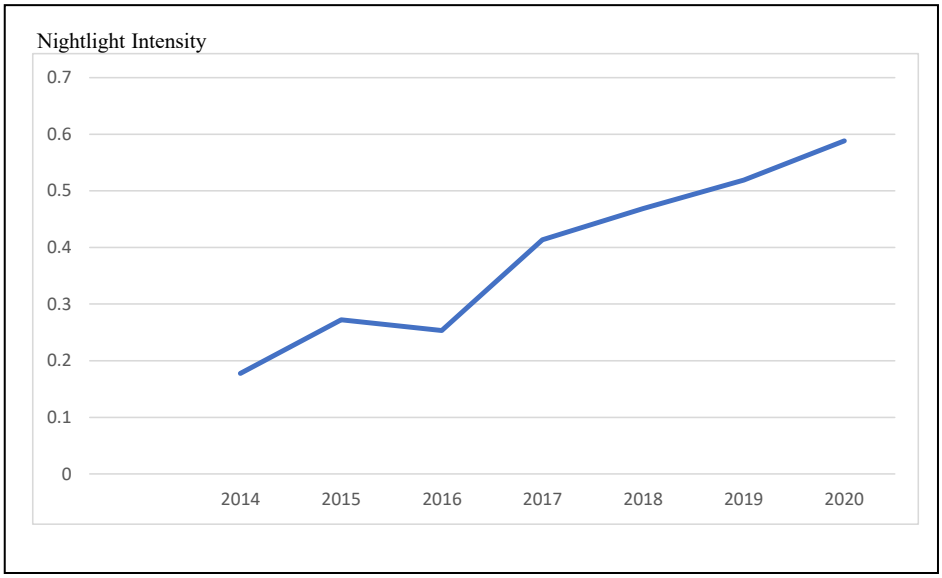
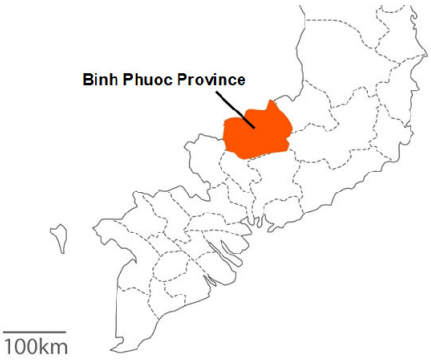
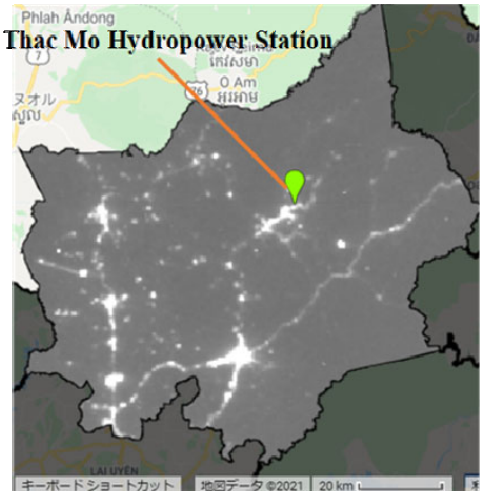


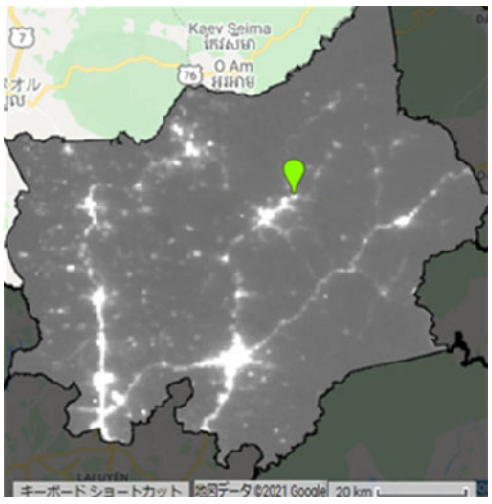
Figure 2: Trend of Nightlight Intensity (average) in Binh Phuoc Province
Source: Prepared based on VIIRS Nighttime Day/Night Band Composites Version 1, Humanitarian Data Exchange v1.56.0

The nightlight image in Binh Phuoc Province is also shown in Figure 3. Comparing the image in 2014, when construction of civil works of the project began, with that of 2020, the year of the ex-post evaluation, it can be seen that the nightlight intensity has become slightly stronger overall. Although the project is not the only one that has contributed to the rise in nightlight intensity in Binh Phuoc Province, the additional power supply from the expansion of the hydropower station is thought to have contributed to a certain extent. Therefore, it can be considered that the project is contributing to the revitalization of economic activities and the improvement of living environment of local residents.





2014 (Before the project (the year of the start of the civil works))



2020 (After operation of power station)

Figure 3: Image of Nightlight in Binh Phuoc Province
Note: There are other hydropower stations in Binh Phuoc Province in addition to this power station and power is also supplied from power stations in other regions via the grid.

(2) Other Positive and Negative Impacts
① Impacts on the Natural Environment
This project is classified as category B in the *JBIC Guidelines for Confirmation of Environmental and Social Considerations* (April 2002). The project did not require the approval of the Vietnamese government for the Environmental Impact Assessment (EIA) Report and therefore EIA was not prepared. According to the executing agency, environmental monitoring was conducted quarterly during the project for items of air, water quality, noise, vibration, and fish biodiversity. According to the environmental monitoring report of the executing agency, water quality and noise have temporarily exceeded the standards, but according to interviews with the executing agency and a Japanese consultant in charge of construction supervision, it did not develop into a big problem as a result of taking measures such as installing sedimentation basin for cement polluted water and reducing the amount of chemicals for blasting in places near a private houses. In addition, according to the monitoring report, residents pointed out that domestic water had high hardness, and when the executing agency investigated it, it was found that $CaCO_3$ (calcium carbonate) exceeded the standard. However, as a result of verification by the executing agency, it was confirmed that the project was not the direct cause, as the water source was in an area with high water hardness.

② Impacts on the Social Environment (Land Acquisition and Resettlement)

Involuntary resettlement occurred to 53 households (179 people) as a result of the project.[10] According to the executing agency, land acquisition and resettlement was carried out by the People's Committee of Phuoc Long Town in accordance with the Vietnamese national procedures and the resettlement action plan. A Compensation Committee was established by the People's Committee and procedures for land acquisition and resettlement have taken place. According to the executing agency, the members of the Compensation Committee consisted of the Department of Natural Resources and Environment, the Department of Economy and Infrastructure, the Duc Hanh Commune People's Committee, the Head of Thac Mo JSC and experts, and did not include representatives of the resettled residents.[11] However, opinions and requests of the resettled residents were heard by the Compensation Committee, and reasonable opinions were accepted.

The Compensation Committee met as needed, including when determining the calculated value of real estate and compensation for resettled households. After surveying the land area and confirming the owner, compensation was paid based on the unit price of compensation according to the land area and in accordance with the Vietnamese national law. Consultations with residents and negotiations on the amount of compensation have been carried out on a cumulative basis, and consensus was reached through these discussions. There were no complaints from the resettled residents and all 53 households agreed to resettle and accepted the amount of compensation, which was subsequently paid as agreed. In addition, there were no complaints or opposition movements from resettled residents or NGOs during the entire process of land acquisition and resettlement. According to the executing agency, the standard of living of the residents has at least recovered compared to the situation before the resettlement.

③ Other Impacts: Reducing Flood Damage by Utilizing the Water for Power Generation

As a positive impact, it would be possible to reduce flood damage in the lower reaches of the Be River by reducing the water flow in the spillway during the rainy season by operating the power station and using the amount of water for power generation.

<Evaluation Result of Effectiveness and Impacts>

As quantitative effects of the project, three indicators of "forced outage hours," "net electric energy production" and "maximum output" were set at the time of the ex-ante evaluation, and at the time of the ex-post evaluation, forced outage hours and maximum output have reached the targets. The actual figure of net electric energy production was slightly less than 80% of the target. This was because the amount of rainfall in 2020 was lower than expected and the National Load Dispatch Center restricted the operation of the power station to ensure water supply to the lower reaches of the Be River during the dry season of the following year and the safety of the power system. Although it is largely due to the results of continuous improvement of power generation capacity by the executing agency including the project, it is judged that the failure to achieve the target of net electric energy production would not be a factor to reduce the overall effectiveness since the additional power supply from the extended power station by the project contributes to the stabilization of the grid to a certain extent, the other two indicators have achieved the targets, and net electric energy production has achieved 75% of the target. Based on the results of large-scale investments in Binh Phuoc Province, which is a major power supply area, and the trend of nightlight intensity in the province, it is considered that the project has been contributing to the revitalization of economic activities and the improvement of the living environment of local residents. Therefore, the project has mostly achieved its objectives and the effectiveness/impact of the project is high.

3 Efficiency

<Outputs>

The contents of the project indicated in "I. Project Outline" were generally implemented as planned. The upstream section of the penstock was changed from an inclined shaft to a vertical shaft based on the actual geological conditions at the site, and this change has not affected the safety or project effectiveness. Thus it can be considered as a relevant change.

<Inputs>

The total project cost was initially planned to be 7,026 million yen (out of which 5,972 million yen was to be covered by Japanese ODA loan). In actuality, the total project cost was 5,710 million yen[12] (out of which 4,533 million yen was covered by Japanese ODA loan), which was lower than planned (81% of the planned amount). As described below, the project cost was significantly reduced because the selection method of contractors was changed from international competitive bidding in the original plan to local competitive bidding.

Project period (from signing of loan agreement to the end of the warranty period) was planned to be from March 2004 to December 2009 (70 months), but in actuality, it was from March 2004 to November 2018 (177 months) and significantly exceeded the plan (253% of the initial plan). As a result, loan period was extended twice, in July 2011 and November 2015. Table 5 summarizes the comparison of planned and actual project period for each item.

[10] At the time of the ex-ante evaluation, involuntary resettlement of 12 households (30 people) was anticipated. The increase in the number of resettlement was due to significant delay in the project, during which time natural and social growth of the population occurred.

[11] The reason for this was that the selection of resettled resident representatives was not mandatory by the Vietnamese national law.

[12] The exchange rate was calculated using 1VND = 0.005518 yen and 1USD = 103.52 yen. (From IMF International Financial Statistics (2004-2018 average rates))

Table 5: Comparison of Planned and Actual Project Period for Each Item

Item	Plan	Actual
Selection of consultants	January 2004–June 2004 (6 months)	September 2005 (start of bidding)–April 2006 (8 months)
Detail design, tender assistance (selection of contractors)	July 2004–November 2005 (17 months)	May 2006–June 2014 (98 months) *Of which, consulting services were suspended in June 2008 and resumed in January 2011. (Resumption was announced in July 2010.)
Civil works	December 2005–December 2008 (37 months)	July 2014–July 2017 (37 months)
Start of operation	December 2008	July 2017
End of the warranty period	December 2009	November 2018

Source: Information provided by JICA, results from questionnaire survey of the executing agency, and interview with the Japanese consultant in charge of construction supervision

The main reasons why the project period significantly exceeded the plan were due to (1) the delay in starting the consultant selection process and (2) the significant delay in the contractor selection process.

As regards (1), there is a gap of about one and a half years between the signing of loan agreement (March 2004) and the start of selection of consultants (September 2005). The reason for this was that the pre-construction work such as land acquisition and removal of power lines was delayed more than expected, and the schedule was changed to avoid the start of construction during the rainy season, which pushed back the overall process of the project. As such, the executing agency changed the consultant selection method because it no longer needed to conclude contract with consultant early after the start of the project that it was aiming for. Initially, the executing agency planned to conclude direct contract with the consultant who conducted the special assistance for project implementation of the project and start the project efficiently. However, due to the above reasons, even if the consulting work was started immediately, it turned out that the civil work could not start until after the rainy season. Therefore, the executing agency could no longer see the merit of starting the consulting services immediately after the start of the project under direct contract, and changed the selection method to competitive bidding.

As regards (2), consulting services were temporarily suspended from June 2008 and resumed in January 2011, a suspension of about 31 months. The reason for this was that the contractors' bid, initially held in 2007, was unsuccessful because the bid amount greatly exceeded the executing agency's planned amount, and it took time for the executing agency to reconsider the bidding method. The reason behind this was the significant rise of prices of construction materials, equipment, and labor costs. The executing agency finally divided the bidding lot for civil works into two, and changed the selection method from the originally planned international competitive bidding to local competitive bidding for both lots.

< Internal Rates of Return (Reference only)>

The Financial Internal Rate of Return (hereinafter referred to as "FIRR") at the time of the appraisal was 6.6%, calculated on the assumption that electricity sales[13] to be considered as benefit, construction cost, operation and maintenance cost, management cost and tax to be regarded as cost, and project life assumed to be 50 years. The FIRR recalculated at the time of the ex-post evaluation turned out to be 4.2%, which is lower than the figure at the time of the appraisal.

The Economic Internal Rate of Return (hereinafter referred to as "EIRR") at the time of the appraisal was 15.3%, calculated on the assumption that alternative thermal value to be considered as benefit, construction cost, operation and maintenance cost and management cost to be regarded as cost, and project life assumed to be 50 years. The EIRR recalculated at the time of the ex-post evaluation turned out to be 10.5% which is lower than the figure at the time of the appraisal.

The main reason why both FIRR and EIRR were lower than the figures at the time of the appraisal is considered to be because the actual amount of power generation was below the expectations at the time of the appraisal.

In light of the above, although the project cost was within the plan, the project period exceeded the plan. Therefore, the efficiency of the project is fair.

4 Sustainability

<Institutional/Organizational Aspect>

The operation and maintenance of the facilities and equipment of the power station extended by the project is carried out by Thac Mo JSC based on the operation service contract concluded between the EVN,[14] the executing agency, and Thac Mo JSC, a company in charge of operation and maintenance. The operation service contract is renewed annually, and Thac Mo JSC submits its work plan and budget estimations to the EVN at the beginning of each year, and carries out operation and maintenance work upon the EVN's approval. In addition, Thac Mo JSC reports its work performance to the EVN every month and is required to report to the EVN whenever a problem occurs.

The breakdown of the staff in charge of operation and maintenance of Thac Mo hydropower station is shown in Table 6 (total of 48 staff excluding outsourced security guards and cleaners).

[13] The figures for electricity sales are for convenience only, and the EVN does not calculate the official electricity sales revenue from the extended hydropower stations by the project. The reason for this is that all the electricity produced by the EVN-owned power stations is combined into the EVN's power network, so the revenue from the sale of electricity from individual power stations is not calculated.

[14] At the time of the ex-post evaluation, the EVN has the ownership of Thac Mo hydropower stations, including the existing power station.

Table 6: Breakdown of Staff in Charge of Operation and Maintenance of Thac Mo Hydropower Station

	Role/Position	Number of Staff	Note
1	Operation Chief (Central Control Room)	5	Concurrent work with existing power station work
2	Operation Leader (this power station)	5	Concurrent work with existing power station work
3	Operator (central control room)	5	Concurrent work with existing power station work
4	Operator (machine room)	5	Full-time work at the extended additional power station
5	Planning and power market engineer	1	Concurrent work with existing power station work
6	Technical engineer	1	Concurrent work with existing power station work
7	Firefighting equipment engineer	1	Concurrent work with existing power station work
8	Maintenance worker	25	Concurrent work with existing power station work
9	Security	6	Outsource
10	Cleaning staff	1	Outsource
	Total	55	

Source: Results from questionnaire survey of Thac Mo JSC

According to Thac Mo JSC, the current staffing is sufficient and smooth operation and maintenance work has been carried out and thus there are no particular problems. In addition, Thac Mo JSC is in constant communication with the EVN, and a close collaboration system is in place. The decision-making process, authority, etc., are clearly defined in the operation service contract, and the operation and maintenance work is carried out based on the contract.

From the above, no particular problem has been identified regarding the institutional/organizational aspect of operation and maintenance of the project.

<Technical Aspect>

The staff in charge of operation and maintenance of Thac Mo JSC is deployed with personnel who have accumulated sufficient skills, knowledge and experience. For example, almost all of the operators are university graduates with expertise in engineering (electricity and electrical systems) and have accumulated sufficient skills and experience in the operation and maintenance of the power station. The maintenance and inspection workers are also a team of engineers with a wealth of experience and skills, and even if a sudden on-site problem were to occur, repair work can be carried out quickly.

Thac Mo JSC has its own training system and training plan, and all operation and maintenance staff receive training according to the plan. Prior to the start of operation of the power station, Thac Mo JSC conducted training for all staff in charge of operation and maintenance. After the start of operation, experts are invited from the National Load Dispatch Center every year to provide training on power system operation for operation chiefs and operation leaders based on the training agreement between Thac Mo JSC and the National Load Dispatch Center. Thac Mo JSC also conducts monthly training for operators.[15] In both trainings, after attending the training and passing the certification exam, certificates are issued. In addition, senior staff in charge of operation and maintenance provide on-the-job training to other staff.

Seventeen manuals have been prepared for daily operation and maintenance work, and the staff in charge of operation and maintenance use these manuals on a daily basis to carry out their work. The manuals are revised and updated based on the ISO regulations and other standards. In addition to the manuals, operation and maintenance activities are carried out by referring to the manufacturers' instruction manuals and the EVN's major repair regulations.

From the above, no particular problem has been identified regarding the technical aspect of operation and maintenance.

<Financial Aspect>

Tables 7 shows the budget, actual allocation and actual expenditure of operation and maintenance costs of the hydropower station extended by the project. Operation and maintenance costs are allocated and disbursed based on the actual costs, and therefore do not match the budget estimates (planned amounts) that Thac Mo JSC submits to the EVN at the beginning of the year. In 2018, the actual cost of operation and maintenance was less than the planned amount, while in 2019 and 2020, it was more. The required amount has been fully allowed for and is allocated in a timely manner.

[15] The main content of the training includes operation monitoring, operating, and troubleshooting of power generation equipment, understanding single wire connection diagrams and control panels, power system operation, and equipment repair.

Table 7: Operation and Maintenance Costs of the Hydropower Station Expanded by the Project

(Unit: million VND)

	2018	2019	2020
Budget (planned amount)	5,117	5,117	5,117
Actual allocation	4,246	5,412	5,384
Actual expenditure	4,246	5,412	5,384

Source: Results from questionnaire survey of Thac Mo JSC

The EVN's financial data (consolidated financial statements) are shown in Table 8. Both net sales of goods and services, and gross profit from sales and service provision have shown steady transition.

Table 8: EVN's Consolidated Financial Statements

(Unit: billion VND)

	2018	2019	2020
Net sales of goods and services	10,048	44,167	40,367
Cost of goods sold and services provided	-8,810	-39,105	-35,606
Gross profit from sales and service provision	1,238	5,062	4,760
Financial revenue, corporate expense administrative expenses, etc.	-1,978	-3,796	-2,467
Net profit from operating activities	-740	1,266	2,294
Other losses	4	-27	-1
Total accounting profit before tax	-736	1,239	2,292
Current corporate income tax expense	-144	-87	-477
Deferred Income Tax expense	27	-26	-
Profit after corporate income tax	-853	1,125	1,815

Source: EVN Annual Reports (2018, 2019, 2020)

Note: Some figures do not match due to rounding.

Table 9 summarizes the trend of the EVN's major financial indicator data. In terms of solvency, both current and the quick ratio for 2015-2019 are higher than 1 time, and in 2019 they are 1.63 times and 1.38 times respectively, which show the positive sign in the management of cash flows while keeping the liquidity at a safe level. In terms of performance, both the number of days of receivable and the number of days of inventory is lower than the previous year in 2019, indicating an improvement in the indicator. Fixed asset turnover is on the rise, showing that the EVN is making effective use of its assets. In terms of profitability, although gross profit ratio, profit from operating activities on net revenue ratio, and profit before tax on equity ratio were all slightly lower than the previous year in 2019, the overall trend suggests that the EVN continues to maintain high profitability.

Table 9: Trend of EVN's Major Financial Indicator Data

Indicator	Data	2015	2016	2017	2018	2019
Solvency	Current ratio (Times)	1.32	1.77	1.46	1.63	1.63
	Quick ratio (Times)	1.06	1.47	1.21	1.37	1.38
	Cash ratio (Times)	0.1	0.19	0.38	0.22	0.25
Performance	Days of receivable (days)	46.97	59.98	75.47	78.43	74.04
	Days of inventory (days)	30.39	31.41	33.24	31.74	27.49
	Fixed asset turnover (Times)	0.71	0.56	0.64	0.71	0.77
Profitability	Gross profit ratio (%)	9.16	9.85	11.36	12.54	11.36
	Profit from operating activities on net revenue ratio (%) Note	2.78	2.49	4.20	5.39	4.96
	Profit before tax on equity ratio (%) Note	7.76	11.30	17.78	21.49	17.92

Source: EVN Annual Report (2019)

Note: Does not include foreign exchange losses

From the above, no particular problem has been identified regarding the financial aspect of operation and maintenance.

<Current Status of Operation and Maintenance>

According to Thac Mo JSC, the facilities and equipment of the hydropower station extended by the project are well maintained and operating smoothly, including the main equipment such as turbines, generators, gas breakers, and medium pressure switchgears. In addition, maintenance records are prepared for each activity, and the results of the activities are compiled and reported to the EVN every month. Whenever a problem occurs, it is to be reported to the EVN. Although there was an initial problem with the turbine water seal system and the filter of the water cooling system in 2018, necessary measures have taken place by Thac Mo JSC and there have been no sudden problems since.

Spare parts are procured by Thac Mo JSC based on the electrical equipment contract with the vendor and are stored in the equipment warehouse of Thac Mo JSC. In addition, database has been established and acceptance record has been maintained to manage spare parts. Although there is no need to procure them at this time, since some transformers, circuit breakers, etc. need to be imported, Thac Mo JSC is systematically managing them so that they can be procured in a timely manner when needed.

From the above, no particular problem has been identified regarding the operation and maintenance status.

<Evaluation Result>
Therefore, the sustainability of the project effect is high.

III. Recommendations & Lessons Learned

Recommendations to Executing Agency: None

Recommendations to JICA: None

Lessons Learned for Executing Agency and JICA: One of the main reasons for the delay of the project was due to the significant delay in the contractor selection process, while another reason was the delay in starting the selection of consultants. Pre-construction work such as land acquisition and removal of power lines, which was to be carried out by the Vietnamese side, was delayed more than expected, and the schedule was changed to avoid the start of construction in the rainy season, so the overall project process was delayed. As a result, the executing agency no longer needed to conclude contract with consultants early after the start of the project, which it aimed for. As a result, the executing agency changed the selection method of contractors from direct contract method to competitive bidding method, which resulted in delay in the start of consultant selection. Therefore, in order to start the project without delay after concluding the loan agreement, the executing agency should plan well in advance to prepare and coordinate with related parties regarding responsibilities which are the prerequisites to the project.

Control Room

Machine Room