PROJECT PERFORMANCE ASSESSMENT REPORT

VIETNAM

Transmission Efficiency Project

Report No. 182837
AUGUST 31, 2023

IEG
INDEPENDENT EVALUATION GROUP

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(IBRD-84170)

August 31, 2023

Finance, Private Sector, Infrastructure, and Sustainable Development

Independent Evaluation Group

Abbreviations

AMS	asset management system
EVN	Vietnam Electricity
NPT	National Power Transmission Corporation
PDP	Power Development Plan
PMB	Project Management Board
TEP	Transmission Efficiency Project
VRE	variable renewable energy

All dollar amounts are US dollars unless otherwise indicated.

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Note: IEG = Independent Evaluation Group; PPAR = Project Performance Assessment Report.

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Data

This is a Project Performance Assessment Report by the Independent Evaluation Group (IEG) of the World Bank Group on the Transmission Efficiency Project (P131558), implemented in Vietnam from 2015 to 2021. Following standard IEG procedure, copies of the draft Project Performance Assessment Report were shared with relevant government officials for their review, and no comments were received. The instrument and the methodology for this evaluation are discussed in appendix C.

This report presents findings based on a review of the World Bank's project documentation, relevant materials, and interviews with government officials, implementing agencies, World Bank staff, and selected development partners. An IEG mission visited Vietnam from February 20, 2023, to February 28, 2023, to hold meetings and to visit selected project sites in the northern, central, and southern regions (in or near Hanoi, Danang, Quy Nhon, and Ho Chi Minh City).

IEG gratefully acknowledges the courtesies and cooperation extended by officials of the government and implementing agencies, including engagement in informative and insightful discussions. We also thank the World Bank's Hanoi office staff for their insights and seamless logistical support.

Transmission Efficiency Project (P131558)

Basic Data

Country	Vietnam	World Bank financing commitment	US$500.00 million
Global Practice	Energy and Extractives	Actual project cost	US$517.53 million
Project name	Transmission Efficiency Project	Expected project total cost	US$731.25 million
Project ID	P131558	Actual amount disbursed	US$318.53 million
Financing instrument	Investment project financing	Environmental assessment category	B
Financing source	IBRD-84170		

Dates

Event	Original Date	Actual Date
Approval	August 7, 2014	August 7, 2014
Effectiveness	November 1, 2014	February 10, 2015
Mid-Term Review	August 20, 2017	August 20, 2017
Restructuring	December 31, 2019	December 31, 2019
Closing	December 31, 2019	December 31, 2021

Key Staff Responsible

Management	Appraisal	Completion
Project team leader	Peter Johansen	Hung Tan Tran
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Summary

This Project Performance Assessment Report assesses the implementation experience and outcomes of the Transmission Efficiency Project, implemented in Vietnam from 2015 to 2021, with a project cost of $517.53 million, including International Bank for Reconstruction and Development financing of $318.53 million.

Under this project, the World Bank supported the National Power Transmission Corporation (NPT) to improve the capacity, reliability, and efficiency of its electricity transmission services. This was to be achieved through the construction and rehabilitation of high-voltage transmission lines and substations and adoption of smart grid technology. Improved reliability of power supply would in turn support long-term socioeconomic development, and improved efficiency of electricity supply would lower greenhouse gas emissions.

Context

Vietnam has seen strong economic growth in the past decade accompanied by double-digit annual growth in the electricity sector. Vietnam's GDP per capita (current US$) has nearly doubled from $2,190 in 2011 to $4,110 in 2021. In recent years, installed capacity for electricity generation has increased rapidly from 55.9 gigawatts in 2019 to 78.8 gigawatts in 2022, driven by private sector investments in variable renewable energy (VRE; solar and wind)[1] incentivized by a favorable feed-in tariff. The share of VRE in total installed capacity is expected to grow from 8 percent in 2019 to 30 percent in 2030.

Vietnam's national transmission infrastructure is struggling to keep pace with the rapid increase in electricity demand and expansion of generation capacity. The main challenge to the integration of VRE is the limited power transfer capacity of the grid from production to consumption locations. As a result, despite a positive outlook for VRE supply, between 15 percent and 25 percent of existing projects' generation is being curtailed.

Investments in transmission are not keeping pace with the growing demand and expansion of power generation and especially with support of the transition to a stronger and smarter grid that is "VRE friendly." The Power Development Plan (PDP) 7 for 2011–20 (which has been extended until the adoption of PDP8) does not reflect the emerging investment needs for transmission infrastructure, which is projected at

[1] Variable renewable energy consists of generation technologies whose primary energy source varies over time and cannot easily be stored. Variable renewable energy sources include solar, wind, ocean, and some hydropower generation technologies.

$1.4 billion per year (about D33,000 billion) up to 2030, in contrast with the estimated investment for 2023 of D13,000 billion.

In the context of growing investment and technical assistance needs for Vietnam's rapidly expanding and evolving electricity sector, the relevance of the World Bank's support for the country's transmission infrastructure remains high.

Results

At project completion, the project met or significantly exceeded nearly all targets for outputs, intermediate outcomes, and outcomes that were set out in its results framework. Updated data provided by Vietnam Electricity (EVN) and NPT show that most of these indicators have been sustained since then.

Targets for construction and rehabilitation of transmission lines and upgrading substations were significantly exceeded. The project supported the construction of 981 kilometers of high-voltage transmission lines against a target of 920 kilometers and rehabilitated 261 kilometers against a target of 120 kilometers. It upgraded five 500-kilovolt substations and ten 220-kilovolt substations and equipped them with smart grid technology as planned. The project added 4,263 megawatts of transformer capacity against a target of 3,950 megawatts. An asset management system to support improved investment and maintenance-related decision-making was implemented and made fully operational.

Transmission capacity significantly exceeded targets. At project closing, transmission capacity in the project areas had increased by nearly 80 percent from the baseline at project effectiveness in 2014, achieving a total increase of 85.6 percent as of March 2023 after completion of some remaining works. This has contributed to an increase in the physical volume of electricity transmitted by NPT from 184.5 terawatt-hours in 2018 to 200.9 terawatt-hours at project closing and 211.5 terawatt-hours in 2022. This has clearly not kept pace with the total demand increase from 220 terawatt-hours in 2018 to 268.4 terawatt-hours in 2022.

Nearly all transmission efficiency–related parameters exceeded targets significantly. Average duration of faults, average electricity supply interruption duration and frequency, and unserved energy as a result of transmission system failures fell sharply, significantly exceeding targets. Transmission losses were reduced from 2.34 percent in 2015 to 2.15 percent in 2019 and increased to 2.29 percent in 2021, although still below the baseline value. Since then, losses have increased to 2.50 percent in 2022. This recent trend is driven by changes in system load flows because of a rapid increase of VRE, causing network congestion and increasing losses in the transmission grid. Another reason is a slowdown in investment in transmission infrastructure in recent years.

Most parameters for reliability of electricity transmission have improved steadily, often exceeding targets significantly and showing further improvement after project completion. Parameters exceeding targets included fewer forced outages, fewer unplanned faults in transmission substations, fewer transmission faults for 500-kilovolt lines, a lower voltage deviation index, and a lower frequency deviation index. The exception was the number of transmission faults for 220 kilovolts, which increased marginally.

What Worked

Early identification of subprojects and completion of feasibility studies for most project components before project effectiveness allowed for a steady pace of implementation. However, the adoption of smart grid technology in substations was delayed because of a lack of early action on choice of technology and necessary regulation, resulting in a time overrun for the project, which is discussed in the What Didn't Work section.

Decentralization of project activities was effective and built on past experiences with World Bank–supported projects. The NPT implemented this project through its three Project Management Boards (PMBs)—namely, Northern PMB, Central PMB, and Southern PMB—building on a strong track record of implementing electricity sector projects funded by the World Bank and other lending and donor agencies. The mission team's discussions with NPT and the three PMBs confirmed the strong human resource development in these units over the years, covering the capacity to effectively carry out overall coordination, quality assurance, procurement, financial management, monitoring and reporting, and establishment of environmental and social safeguards.

The PMBs worked collaboratively with local authorities in accordance with local laws and regulations to speed up the land acquisition process. This project significantly benefited from early consultations by the PMBs with local authorities, village heads, and representatives of civil service organizations to reach consensus before infrastructure development.

NPT and the PMBs are effectively using the World Bank's procurement guidelines for greater cost savings. NPT's use of the World Bank's procurement guidelines resulted in highly competitive bids, which are credited for significant cost savings under the project. NPT is building on its experience to use "turnkey" contracts to accelerate project implementation. It has achieved significant time savings by splitting contracts for transmission lines into two or more lots.

What Didn't Work

The time and effort required for preparatory work for deploying smart grid technology was underestimated, resulting in an avoidable two-year project closing extension. The approval process for smart grid technology lasted more than four years, including the time for reviewing technology options, passing necessary regulations, and dealing with concerns related to disconnecting substations to implement the upgrades. This was the first effort in the country to adopt smart grid technology, and the learning curve that this entailed added to the delay in preparation and implementation. Overall, monitoring and evaluation data could have been better leveraged to highlight the significant delay in the implementation of project activities and restructure the project earlier than was done.

Some portion of project costs was significantly overestimated, locking up resources that could have been applied to other activities or projects. At project closing, cost savings amounting to $160 million were canceled from the World Bank's loan. Although some of the savings were due to a steep decline in steel prices, a significant part of the cost savings can be attributed to a conservative approach to cost estimates on the part of EVN and NPT's planning and budgeting functions. These cost savings could not be readily applied elsewhere because of loan conditions and temporarily affected the government's sovereign guarantee capacity.

The project's efficiency was affected by some issues related to the implementation of the involuntary resettlement safeguard policy. The land acquisition activities were implemented in compliance with the requirements of the safeguard policy. In total, 2,500 households were affected by the project, resulting in the relocation of 80 households, and there was a severe impact on the productive lands of 290 households. Some issues that arose during implementation related to the rerouting of a part of the Nho Quan–Phu Ly–Thuong Tin transmission line, which affected an additional 100 households and one household affected by the Quang Ngai–Quy Nhon transmission line not accepting the proposed compensation package. Outstanding cases relating to relocation and compensation are being addressed in a Post-Closure Action Plan, which is being monitored by the World Bank's safeguard team.

Risk to Development Outcome

Financial sustainability of EVN NPT. NPT transmission tariff is now approximately 5 percent of the retail tariff for the end consumer (which is significantly lower than the broad global norm of approximately 10 percent). This has resulted in NPT being stretched thin in meeting its economic costs and constrained in mobilizing financing needed for its investment needs. NPT's present financial situation calls for adjusting transmission tariffs to return it to financial sustainability.

Investments in transmission are not keeping pace with the growing demand. The rapid increase in power generation calls for adequate and affordable investments in power transmission and distribution systems. Currently, about 70 percent of NPT's investment program is financed by debt, with maturity as short as 12 years with a 2-year grace period from commercial banks, in contrast to maturity of international financial institution loans, which is 20 years with a 5-year grace period. Recent regulatory and administrative changes through Decree 114/2021/ND-CP have laid down priorities that make it less likely to avail itself of official development assistance for investments in electricity transmission.

Conclusion

This assessment rates current project performance as highly satisfactory, based on evidence from the Independent Evaluation Group mission's findings for project relevance, efficacy, and efficiency, which are detailed in the main report. The project's achievements are considered replicable in potential follow-up projects, based on the capacity and experience that have been built in the implementing agencies. To sustain the project's outcomes, there needs to be a quantum increase in investments in transmission infrastructure to keep up with the projected growth in installed capacity and demand for electricity. This is even more crucial to deal with intermittency issues from the recent surge in VRE and the projected increase of its share in total installed capacity in the coming decade. The project's experience and achievements provide favorable conditions for potential private sector investments in transmission. However, although Vietnam's public-private partnership law provides for private investments in transmission lines and substations, such investments are not likely given the current levels of transmission tariffs, which do not cover economic costs, and the current low financial returns on investments in power transmission. Discussions with the Ministry of Industry and Trade and EVN officials indicate their clear recognition of the impact of tariffs on the financial viability and investment needs of the electricity transmission subsector.

Lessons

This assessment offers the following lessons:

- The readiness of subprojects for implementation before project effectiveness is critical for timely achievement of project objectives. It is even more so if an advanced technology is being introduced for the first time. In this project, 8 out of 12 transmission subprojects had their feasibility studies and bidding documents ready at the time of project appraisal and were completed on time. The remaining 4 subprojects that were finalized during implementation

remained unfinished at the original project closing date. However, the greatest delay arose from the delay in finalizing the selection of technology and adopting the regulation for selected smart grid technology, requiring a two-year extension of the closing date. In retrospect, although a road map was prepared at approval for the introduction of smart grid technology in transmission substations, the learning curve and due diligence on the part of the borrower in choosing the appropriate smart grid technology were underestimated.

- Overestimation of project costs at appraisal locks up funds and strains the government's sovereign guarantee capacity. The actual cost for this project was 30 percent lower than the appraised cost, partly due to a sharp decrease in steel prices and strong competition between bidders, but largely due to conservative estimates of EVN and NPT's planning functions.

- Planning for the expansion of the transmission network must keep pace with electricity demand and generation expansion plans, particularly the increasing share of renewable sources, to prevent loss of performance gains from past investments. PDP7 (2011–20) has been extended until the adoption of PDP8 and does not reflect the current and emerging investment needs for the power grid. This is adding to costs through increased transmission losses and network congestion resulting from a rapid increase in VRE in the past three years.

- Delayed planning has a direct impact on the financial situation of the utility and grid performance. In this case, the increasing costs (from cost of financing, transmission losses, and grid congestion) that could be mitigated by planning, coupled with unremunerative tariffs, affect the financial sustainability of NPT and result in underinvestment for current and future needs. If not addressed in a timely manner, such underinvestment would negatively affect grid performance. There is clear recognition among sector officials of the impact of the delay in adopting PDP8.

- A sustainable transmission tariff allows the power grid company to finance its capital expenditures more effectively while attracting private sector investments. Transmission tariff below the economic cost for NPT is the main reason for underinvestment and difficulties in mobilizing long-term financing. Although NPT has been able to turn around from negative return on equity in 2015 to 10.9 percent return on equity in 2019, keeping this key parameter of profitability at a sufficient level remains a challenge. The low return on equity is also the main reason for the lack of private investments in power transmission, which are allowed under the country's public-private partnership law.

- Land acquisition for transmission lines and substations can be a lengthy process and requires close collaboration between the utility and local authorities. Land acquisition is a major driver of the cost and timeliness of investments in transmission lines and substations. The key ingredients to timely and expeditious land acquisition, based on NPT's experience, would be (i) proactively collaborating with local authorities and affected communities and (ii) balancing the variations in the time spent for the land acquisition process across provinces or states.

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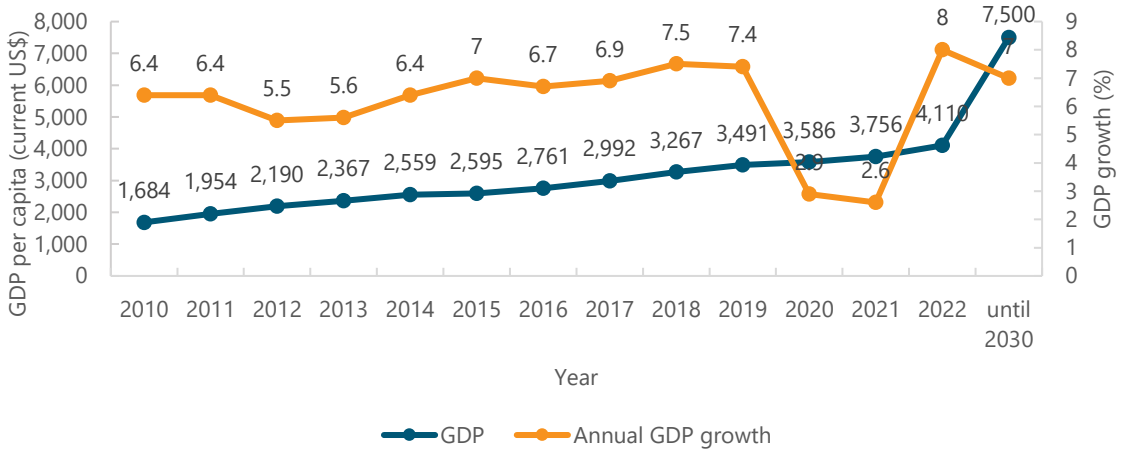
1. Background, Context, and Design

Background and Context

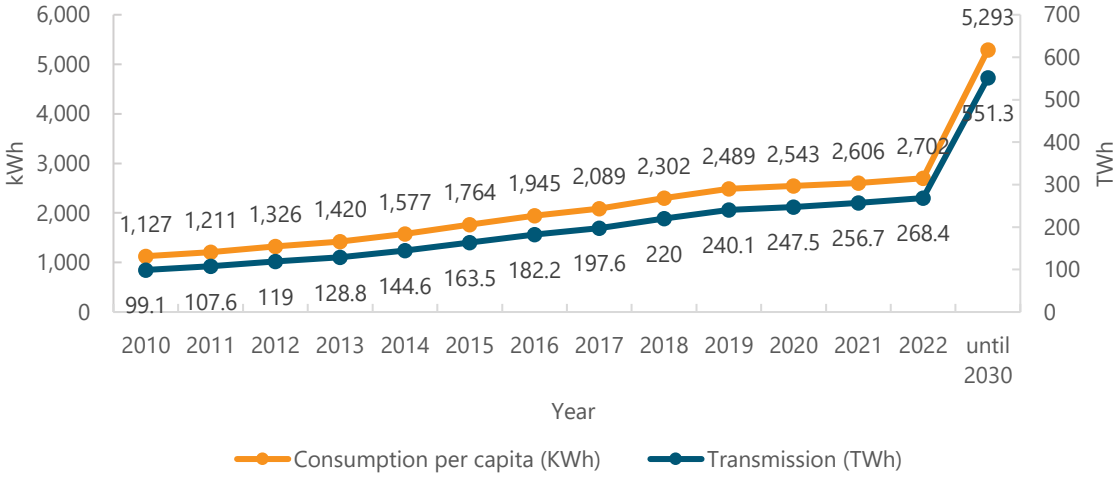
1.1 Vietnam has seen strong economic growth in the past decade together with rapid expansion of the electricity sector. The country's GDP (current US$) grew at an average rate of 7.1 percent from 2016 to 2019 and, after a dip during the COVID-19 period, reached 8.0 percent in 2022. GDP per capita (current US$) has nearly doubled from $2,190 in 2011 to $4,110 in 2021. Vietnam's electricity sector has seen double-digit growth powering industry and commerce and meeting the increasing energy needs of the growing middle-class population in urban centers (figure 1.1).

Figure 1.1. Vietnam: GDP and Electricity Transmission and Consumption, 2010–30

a. GDP per capita and GDP growth



b. Electricity transmission and consumption

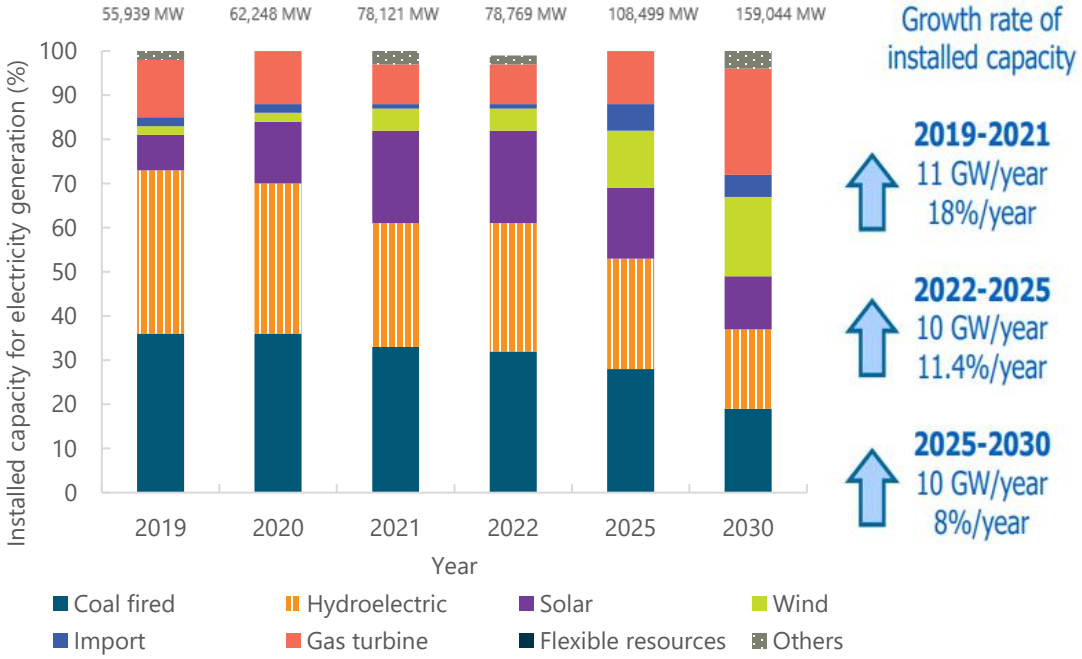


Source: Vietnam Electricity.
Note: GDP = gross domestic product; kWh = kilowatt-hour; TWh = terawatt-hour.

1.2 Institutional and administrative arrangements have performed well in managing energy sector growth. Electric power is under the jurisdiction of the Ministry of Industry and Trade, which oversees Vietnam Electricity (EVN)—the vertically integrated, state-owned utility. EVN owns large-scale hydropower and coal-fired power plants (which contribute up to 58 percent of the national power generation system); oversees three power generation corporations, the National Power Transmission Corporation (NPT), and five regional power distribution corporations (northern, central, southern, Hanoi, and Ho Chi Minh City corporations); and manages the operation of the national power system through the National Load Dispatch Center. The Electricity Regulatory Authority of Vietnam, which reports to the Ministry of Industry and Trade, is responsible for establishing and supervising the power market, power planning, tariff regulation, and licensing. NPT implemented this project through its three Project Management Boards (PMBs)—namely, Northern PMB, Central PMB, and Southern PMB, building on a strong track record of implementing electricity sector projects funded by the World Bank and other donor agencies.

1.3 Installed capacity for electricity generation is growing rapidly, driven by private sector investments in renewable energy (solar and wind). Installed capacity for electricity generation in Vietnam has increased from 55.9 gigawatts in 2019 to 78.8 gigawatts in 2022 and is projected to nearly double to 159.0 gigawatts by 2030. In recent years, a favorable feed-in tariff has provided a strong boost for private sector investments in variable renewable energy (VRE; solar and wind). Rooftop solar installations have reached approximately 8 gigawatts, and the grid-connected solar and wind are approximately 8 gigawatts and 4 gigawatts, respectively. The share of VRE in total installed capacity is expected to rise from 8 percent (practically all solar) in 2019 to 30 percent (12 percent solar and 18 percent wind) by 2030 (figure 1.2). After the current feed-in tariff expires, new offtake agreements will be based on a bidding process, which is expected to start in 2023. It is likely that this will slow down new investments in renewable energy in the short run, but the government and EVN expect that the growth of renewable energy (wind and solar) will continue and reach 48 gigawatts by 2030, including 29 gigawatts for wind and 19 gigawatts for solar.

Figure 1.2. Vietnam: Trend in Electricity Generation Installed Capacity by Source, 2019–30



Source: Vietnam Electricity.
Note: GW = gigawatt; MW = megawatt.

1.4 As Vietnam enters its next phase of growth, the electricity sector stands at an inflection point. The national transmission infrastructure is struggling to keep pace with the rapid increase in electricity demand and expansion of generation capacity. This is particularly challenging with the growing share of VRE, which can be built much faster than transmission system can be expanded.[2] The main challenges related to the integration of VRE include the limited power transfer capacity of the grid from production to consumption locations and ability of the grid operators to balance the intermittent generation of the VREs, ensure adequate voltage support in the network, and provide other ancillary services. As a result, despite a positive outlook for VRE supply being made available, between 15 percent and 25 percent of existing projects' generation is being curtailed. The highest levels of curtailment have particularly affected solar generation in southern Vietnam.

1.5 Development of the transmission and distribution network is critical for decarbonization of the power system in Vietnam. Given the government's commitment to decarbonization of energy sector and strong support for this agenda among development partners (for example, the Just Energy Transition Partnership between Vietnam and Group of Seven Plus countries, announced in 2022, pledged $15 billion of

[2] The average time for construction of new transmission lines and substations is four to five years, and the construction of large wind and solar plants takes less than two years.

support to the decarbonization agenda in Vietnam [European Commission 2022]), it is likely that renewable energy generation will see even faster growth in the coming years. In this context, adequate investments and development of power transmission and distribution grids will be key to the achievement of stated decarbonization objectives in the power sector, which currently accounts for approximately 62 percent of greenhouse gas emissions in Vietnam.

1.6 Investments in transmission are not keeping pace with the growing demand and expansion of power generation. The Power Development Plan (PDP) for 2011–20 (which has been extended until the adoption of PDP8) does not reflect the current investment needs of power sector. Draft PDP8 envisages significant increase in investments—approximately 30 percent across EVN. However, the investment needs in NPT may be even higher and up to 100 percent above the current level—that is, approximately $1.4 billion per year (about D33,000 billion) until 2030. In contrast, the projected investment for 2023 is about D13,000 billion (table 1.1).

Table 1.1. National Power Transmission Corporation: Actual and Projected Capital Expenditure, 2015–23

Expenditure	2015	2016	2017	2018	2019	2020	2021	2022	2023 (projected)
Capital expenditure (billions, dong)	14,674	14,277	11,665	9,893	12,893	14,910	10,752	11,898	13,035

Source: Vietnam Electricity.

Objective, Design, and Financing

1.7 **Project development objective.** The project development objective was to improve the capacity, efficiency, and reliability of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower. The project development objective did not change during project implementation.

1.8 **Dates.** The project was approved on August 7, 2014, became effective on February 10, 2015, and closed on December 31, 2019, after being extended by two years from its original closing date.

1.9 **Financing.** The estimated total project cost at appraisal was $731 million. The project closed with a significantly lower project cost of $518 million, mainly because of lower-than-projected steel prices and cancellation of some project activities (see paragraph 1.14). The International Bank for Reconstruction and Development loan disbursed was $319 million against the planned $500 million. The borrower's contribution at project closing stood at $199 million against the planned $231 million.

1.10 The Transmission Efficiency Project (TEP) consisted of three components.

1.11 **Component 1.** Enhancing transmission infrastructure (appraisal cost: $625 million; actual cost: $465 million) supported an upgrade and construction of transmission lines and substations at voltage levels of 220 kilovolts and 500 kilovolts in three areas key to the economic development of Vietnam—the greater Hanoi area, the greater Ho Chi Minh City area and the Mekong Delta, and the central region. The component financed 15 percent of Vietnam's transmission network expansion during 2015–20.

1.12 **Component 2.** Developing a smart grid network (appraisal cost: $80 million; actual cost: $46 million) supported the modernization of the substations' monitoring, control, and protection equipment to improve the reliability of the bulk supply points in the distribution network and of the overall system. It also financed upgrading of the information system for operation and equipment management and the establishment of a data and metering system.

1.13 **Component 3.** Capacity building (appraisal cost: $25 million; actual cost: $6 million) financed NPT's transition into an independent power transmission company, with revenues from the application of performance-based regulation. It also supported the overall power sector reform in creating independent players within the power sector through capacity building, specifically (i) improvement of NPT's asset management system (AMS), (ii) application of cost-reflective transmission tariffs, (iii) improvement of financial reporting capacity based on International Financial Reporting Standards, and (iv) upgrades of the electrical testing laboratory center.

1.14 **Revised components.** Under the third component, the International Bank for Reconstruction and Development loan financed only one technical assistance activity—the improvement of AMS—whereas NPT financed all other technical assistance activities, except the canceled upgrading of operation and management information systems activity. Under the second component, 1 transmission line out of 12 was canceled; the upgrading of the Ninh Binh substation was canceled due to a decision to dismount the substation. The subcomponent on technical assistance for studies relating to cost-reflective tariffs was dropped at restructuring and taken over by the government. The project supported the EVN corporate finance strategy advisory services through a report prepared by PricewaterhouseCoopers that included tariff analysis and recommendations, which the government may take on board to improve the financial viability of NPT.

1.15 **Project restructuring.** In December 2019, the project was restructured to extend the closing date by two years to account for the time taken by the Ministry of Industry and Trade to review the technical designs of 16 substations in respect of disconnection of substations for upgrading, choice of smart grid technology to be implemented systemwide, and preparation of relevant regulations. At the time of project

restructuring, there had been no progress in the implementation of project activities under the second component because of the long delay in assessing alternative smart grid technologies and developing related regulation. The additional time also allowed for completing the construction of two substations and four overhead transmission lines under the first component (whose contract processing had been delayed) and for resolving pending compensation to project-affected persons.

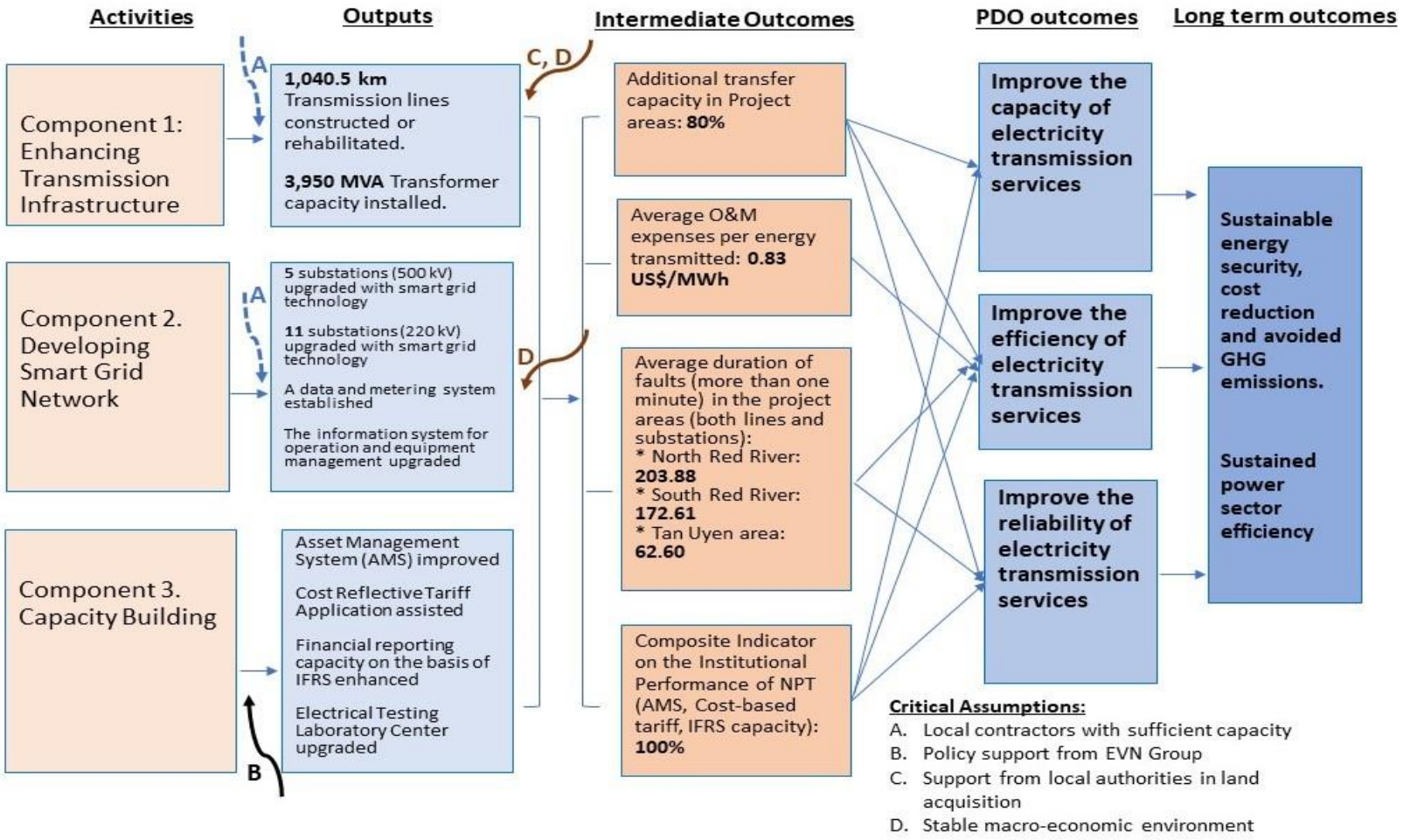
Theory of Change

1.16 The project's inputs—International Bank for Reconstruction and Development loan and technical assistance support—would result in an increase in transmission capacity that would ease the overload on transmission lines and substations and lead to outcomes of lower technical losses, increased reliability (fewer and shorter forced electricity outages), and improved efficiency (reduction in network congestion). Improved reliability of power supply (lower unserved electricity because of fewer or shorter interruptions of transmission services) and reduced cost of electricity supply are expected to support long-term socioeconomic development and lower greenhouse gas emissions.

1.17 It is noted that improvement of efficiency of the power transmission system is achieved mainly through reduction of transmission losses and operation and maintenance savings. Conversely, improved reliability of the power transmission system also increases efficiency of the power system through savings in generation cost (that is, by optimizing power dispatch) because of unconstrained access to the transmission grid measured in terms of available transmission capacity. In this project, only the first (direct) efficiency measures are considered; hence, the title refers to efficiency of transmission services.

1.18 Overall, the causal pathways from inputs to outcomes were valid and direct (figure 1.3), and the achievement of the outcomes and project objectives could be attributed to the project because there was no similar intervention in the project areas. The planned capacity-building activities would be expected to contribute to improved operational efficiency and technical capacity that would improve the sustainability of the electricity transmission services. These activities covered the adoption of an AMS, International Financial Reporting Standards, and a performance-based transmission tariff application, of which the World Bank ultimately financed only the AMS; the rest were financed by the borrower.

Figure 1.3. Theory of Change



Source: Independent Evaluation Group.

Note: AMS = asset management system; EVN = Vietnam Electricity; GHG = greenhouse gas; IFRS = International Financial Reporting Standards; km = kilometer; kV = kilovolt; MVA = megavolt-ampere; MWh = megawatt-hour; NPT = National Power Transmission Corporation; O&M = operation and maintenance; PDO = project development objective.

2. What Worked, What Didn't Work, and Why?

Results

2.1 This section covers the salient results from the project. More details and ratings of project relevance, efficacy, efficacy, overall project outcome, and risk to development outcome are presented in appendix A.

Objective 1

2.2 The objective is to improve the capacity of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

2.3 Under this objective, the project completed the planned investments for construction and rehabilitation of transmission lines and upgrading substations at project. Some remaining works in substations were completed as of March 2023. The resulting outcomes for efficiency and reliability of electricity services are captured by objectives 2 and 3.

2.4 Targets for construction and rehabilitation of transmission lines and upgrading substations were significantly exceeded. The project constructed 981 kilometers of high-voltage transmission lines and rehabilitated 261 kilometers, significantly exceeding the targets of 920 kilometers and 120 kilometers, respectively. The project upgraded five 500-kilovolt substations with smart grid technology, as targeted. It also upgraded 10 out of 11 planned 220-kilovolt substations with smart grid technology.

2.5 Transformer capacity targets were also significantly exceeded. At project closing, transformer capacity was increased by 4,263 megawatts against a target of 3,950 megawatts from the addition of new transformer capacity in eight of the upgraded substations. Transmission capacity in the project areas was increased by nearly 80 percent, as targeted by project closing, and has since reached 85.6 percent as of March 2023 after the completion of remaining works. This has contributed to an increase in the physical volume of electricity transmitted by NPT—increasing from 184.5 terawatt-hours to 200.86 terawatt-hours at project closing and 211.47 terawatt-hours in 2022 (table 2.1).

Table 2.1. Physical Volume of Electricity Transmitted by the National Power Transmission Corporation, 2018–22

National Power Transmission Corporation Transmission	2018	2019	2020	2021	2022
Volume of electricity transmitted (terawatt-hour)	184.5	199.78	203.85	200.86	211.47

Source: Vietnam Electricity.

2.6 In addition, one of the two transmission lines constructed in the country's central region—that is, the Quang Ngai–Quy Nhon 220-kilovolt line—connected the 220-kilovolt networks in the north and the south of the country, allowing the improved use of hydropower from the Thuong Kon Tum Hydropower Station. The upgrading of the substations with smart grid technologies will contribute to smoother integration of VRE—that is, wind and solar energy—to the grid.

2.7 It is noted that the performance parameters presented under this and the following objectives relate to the overall grid because it was not possible to separate out the contributions specific to the infrastructure improvements in the project areas.

Objective 2

2.8 The objective is to improve the efficiency of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

2.9 AMS became fully operational. At project closing, project-financed AMS was installed and fully operational. Improved investment and maintenance-related decision-making were supported based on an adequate balancing of cost, benefits, and risks under the AMS program.

2.10 The enhanced system standardization and automation were implemented. This was carried out under the developing smart grid network component (Component 2)[3] and involved integrating new monitoring, protection, and control technologies.

Outcomes

2.11 The utility's costs of providing transmission services while maintaining regulation-mandated performance levels were significantly reduced. The implementation of AMS led to average operation and maintenance expenses per megawatt-hour of energy transmitted being reduced from a baseline level of $0.87 per megawatt-hour to

[3] A smart grid is an electricity network that uses digital and other advanced technologies to monitor and manage the transport of electricity from all generation sources to meet the varying electricity demands of end users.

$0.67 per megawatt-hour at project completion and maintained at this level as of 2022, significantly improving on the target of $0.83 per megawatt-hour (table 2.2).

Table 2.2. Average Operation and Maintenance Expenses per Unit of Energy Transmitted

Operation and Maintenance Expenses	Baseline	Target	At Project Closing (December 2021)	2022
Average expense (US$ per megawatt-hour)	0.87	0.83	0.67	0.67

Source: Vietnam Electricity.

2.12 The project achieved fewer and shorter brownouts and blackouts and increased life expectancy of electrical equipment. These results are linked to enhanced system standardization and automation and were also reflected in substantial savings in labor costs and operation and maintenance expenses.

2.13 Unserved energy was reduced. Unserved energy (or shortfall with respect to demand)[4] as a result of transmission system failures was reduced from 4,875 megawatt-hours at the end of 2012 to 817 megawatt-hours at project closing.

2.14 Average interruption duration and average interruption frequency fell sharply. Average interruption duration and average interruption frequency fell from 724.28 minutes and 4.97 times per customer in 2018 to 356.12 minutes and 3.11 times per customer in 2021, respectively. Average duration of faults (minutes per year) dropped from 76.2 in 2013 to 15.38 in 2021.

2.15 Although transmission losses were reduced from the baseline value by project completion, they have increased since then mainly because of increased VRE coming online. NPT saw a decrease in transmission losses from 2.34 percent in 2015 to 2.15 percent in 2019 and an increase to 2.29 percent in 2021, although still below the baseline value. Since then, transmission losses have increased to 2.54 percent in 2022 (table 2.3). There are two main reasons for this trend. First, the increase in transmission losses is directly related to changes in system load flows due to rapid increase of VRE over the past three years, particularly in the central and southern regions of Vietnam. As a result, the power flows, which were mainly from north to south in the past, have reversed direction during periods of high generation from renewables, causing congestion and increasing losses in the transmission grid. The second reason is a

[4] Unserved energy is a measure of the amount of customer demand that cannot be supplied within a region because of a shortage of generation, demand-side participation, or interconnector capacity.

slowdown in investment in transmission infrastructure, as noted in the Background and Context section.

Table 2.3. Vietnam: Electricity Transmission Losses, 2012–22

Unit	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
kWh (millions)	2,487	3,097	3,176	3,348	3,782	4,168	4,618	4,388	4,643	4,703	5,510
Share of total transmission (%)	2.33	2.69	2.49	2.34	2.36	2.45	2.44	2.15	2.23	2.29	2.54

Source: Vietnam Electricity.
Note: kWh = kilowatt-hour.

Objective 3

2.16 The objective is to improve the reliability of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

Outcomes

2.17 Voltage and frequency deviation indexes have improved steadily. The voltage deviation index in 2018 (0.075)[5] has remained close to the voltage deviation index in 2012 (0.073) after having dipped to 0.024 in the intervening years. The frequency deviation index has steadily decreased from 0.066 to 0.014 from 2018 to 2021.[6] The number of times voltage was outside the threshold has decreased from 12,731 to 10,373 (figure 2.1).

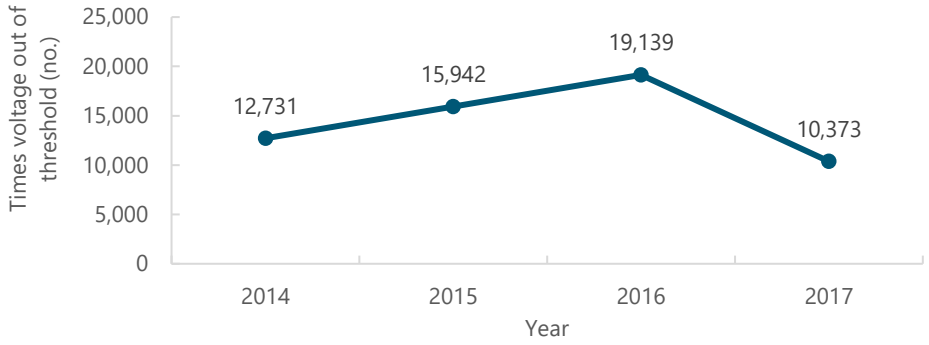
2.18 Transmission faults and forced outages have significantly decreased. The number of faults in the high-voltage transmission system has decreased for 500-kilovolt lines from 42 to 29 during 2018–22, but for 220-kilovolt lines, the number has increased marginally from 135 to 159 over the same period (figure 2.2). Over the same period, the number of forced outages (lasting more than one minute) per 100 kilometers of high-voltage transmission lines was reduced from the baseline value of 0.51 to 0.27, significantly better than the target of 0.39. The number of unplanned faults in transmission substations per year (lasting more than one minute) was reduced from the baseline value of 0.66 to 0.12, significantly better than the target of 0.51.

[5] The difference between the nominal voltage and the actual voltage.

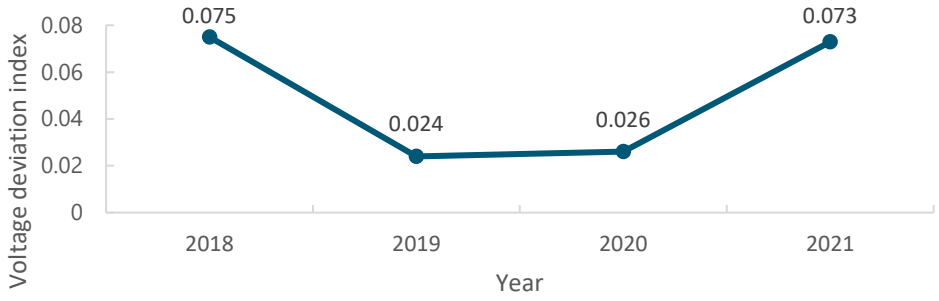
[6] The difference between the nominal and actual frequency (oscillations of alternating current) in a wide-area synchronous grid transmitted from a power station to the end user.

Figure 2.1. Vietnam: Transmission System Performance

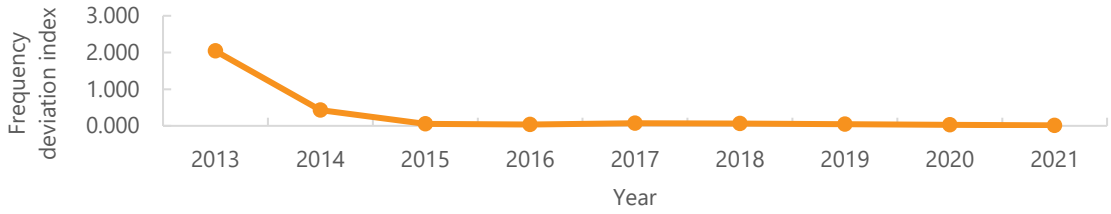
a. Times voltage out of threshold (500-kilovolt lines), 2014–17



b. Voltage deviation index, 2018–21

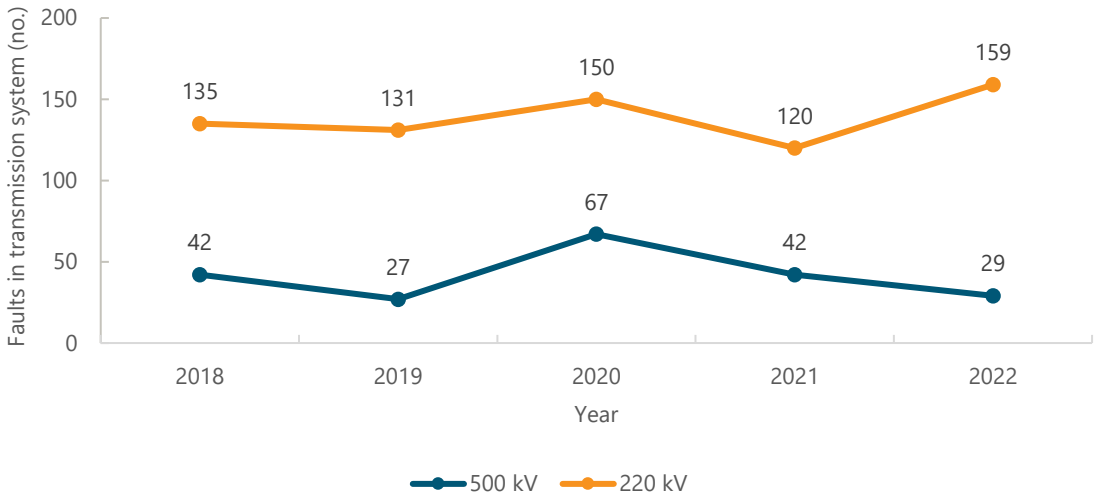


c. Frequency deviation index, 2013–21



Source: Vietnam Electricity.

Figure 2.2. Vietnam: Faults in Electricity Transmission System, 2018–22



Source: Vietnam Electricity.
Note: kV = kilovolt.

2.19 The reliability of power transmission has been uneven over the past few years. The initial decline of power curtailments in 2018 (0.52 gigawatt-hours of energy not served with load shedding of 821 megawatts in two incidents) was followed by significant increase of curtailment in 2019 (8.36 gigawatt-hours of energy not served with load shedding of 1,300 megawatts in five incidents) and in 2021 (14.71 gigawatt-hours of energy not served with load shedding of 1,500 megawatts in 15 incidents). However, in 2020, curtailments dropped to 0.59 gigawatt-hours of energy not served with load shedding of 852 megawatts in two incidents (table 2.4).

Table 2.4. Vietnam Energy Curtailment, 2012–21

Year	Maximum Curtailment (MW)	Energy Curtailment (MWh)	Curtailments (no.)
2012	170	729	14
2013	300	855	6
2014	600	855	5
2015	576	136	6
2016	1,982	1,691	6
2017	827	2,511	9
2018	821	517	2
2019	1,300	8,357	5
2020	852	593	2
2021	1,500	14,708	15
Maximum	1,982	14,708	15

Source: Vietnam Electricity.
Note: MW = megawatt; MWh = megawatt-hour.

What Worked and Why?

2.20 Early identification of subprojects and completion of feasibility studies for most project components before project effectiveness allowed for a steady pace of implementation. The project was designed to support the NPT's investment program, PDP7. Therefore, the first group of subprojects was already identified at appraisal with feasibility studies completed and ready for bidding. The project's readiness for the implementation of infrastructure investments was high. In contrast, the adoption of smart grid technology in substations was delayed due to lack of early preparation, resulting in a time overrun, as discussed in the What Didn't Work and Why? section. In retrospect, although a road map was prepared at approval for the introduction of smart grid technology in transmission substations, the learning curve and due diligence on the part of the borrower in choosing the appropriate smart grid technology were underestimated.

2.21 Decentralization of project activities was effective and built on past experiences with World Bank–supported projects. This project builds on past World Bank–supported projects in the sector (see appendix D). The Ministry of Industry and Trade delegated the responsibility for coordinating the project to EVN, which retained responsibility for technical assistance activities and in turn delegated all investment subprojects to the three PMBs under it—namely, Northern PMB, Central PMB, and Southern PMB. The PMBs have evolved as professional project management units that have been implementing World Bank and other donor-funded projects for several years. The mission team's discussions with NPT and the three PMBs confirmed the strong human resource development that has occurred in these units over the years, covering the capacity to effectively carry out overall coordination, quality assurance, procurement, financial management, monitoring and reporting, and conduct of environmental and social safeguards.

2.22 The results framework was well designed and useful for monitoring progress. The results framework and monitoring and evaluation indicators were designed to capture all relevant output and outcome indicators and to monitor progress in implementation. Data were collected regularly and used to inform project management and decision-making. The collected data were shared and discussed with relevant parties and used as inputs for decision-making and developing proposals to deal with issues that arose during implementation. The monitoring and evaluation framework was used to support the NPT and the World Bank in the project restructuring and making decisions on the project implementation, although lack of initial progress in smart grid implementation could have been signaled strongly and earlier.

2.23 The PMBs worked collaboratively with local authorities in accordance with local laws and regulations to speed up the land acquisition process. Land acquisition was one of the main drivers of cost and schedule for the implementation of NPT investments in transmission lines and substations. Vietnam has 63 regions, and many NPT investments (for example, transmission lines) cover more than one region. There are significant differences in the duration of land acquisition process from one region to the another. Land acquisition can take anywhere from six months to two years, with the longer duration typically associated with investments in peri-urban areas. NPT and the PMBs worked closely with the regional and local authorities that are responsible for determining the market price of land and carrying out the land acquisition. Regional authorities often hired an independent consultant to carry out assessment of the land market and prepare an estimate of land acquisition costs based on the location (right of way) proposed by NPT. The project significantly benefited from early consultations with local authorities, village heads, and representatives of civil service organizations, reaching consensus before project implementation. The implementation of social safeguards was strengthened by attention to vulnerable groups (including woman-headed households). NPT and representatives of affected communities participated in the committees that prepared land acquisition proposals before they were reviewed and adopted by the regional authority.

2.24 The use of World Bank's procurement guidelines by experienced NPT and PMB officials had several positive results. The use of these guidelines has helped reduce costs while ensuring quality and implementing works in a timely manner. These aspects are discussed as follows:

- NPT's positive experience with public procurement under the World Bank guidelines is leading to their use in self-financed projects to some extent. NPT has the sole responsibility for procurement under its investment program. Overall, NPT reported a good experience with using World Bank rules (guidelines) for competitive bidding, both international competitive bidding and national competitive bidding. Feedback from the heads of the PMBs suggests that World Bank procurement is somewhat easier for NPT to implement than the Vietnam public procurement rules. Approximately 70 percent of Vietnam public procurement rules are similar to or the same as the World Bank procurement guidelines.

- Procurement under the World Bank guidelines resulted in competitive bids, which are credited for significant cost savings under the TEP. Most contracts awarded under the World Bank procurement attracted significant competition and resulted in cost savings for NPT up to 30 percent of the cost estimate. World Bank procurement often resulted in contracts with reputable international

suppliers of transmission equipment (for example, for transformers and circuit breakers), although some winning bidders were trade companies from Vietnam representing foreign manufacturers. Almost all works contracts for installation of high-voltage equipment and construction of transmission lines were with local construction companies, except for large works contracts for cabling at 500-kilovolt substations.

- NPT's experience with procurement under NPT encouraged the company to consider the use of turnkey contracts to accelerate project implementation. Under TEP, NPT carried out procurement of main project components (subprojects) by using separate packages for goods and works. Turnkey (supply and installation) contracts were not used under TEP. However, NPT is considering combining more packages into larger procurements to shorten the implementation time. Currently, procurement takes about two years to complete, and the implementation for subprojects (substations and transmission lines) takes up to four years. NPT believes that a new packaging approach and use of turnkey contracts can significantly shorten this time. This is subject to the assessment of overall project cost and trade-offs.

- NPT has achieved significant time savings in the construction of transmission lines by splitting the contracts into two or more lots. The construction time was approximately two to four years, depending on the complexity of the specific subproject (size of substation and length of transmission line). To shorten the construction time for the 500-kilovolt transmission lines, NPT is splitting the works contracts and awarding sections of lines to different construction companies that can work in parallel. This approach has been established as a preferred option for the future use based on the significant time savings achieved.

2.25 The project contributed to the government's recognition of the potential for private investments in transmission. The project was expected to lead to the creation of favorable conditions for private sector financing in the future. During the project implementation period, the government passed a public-private partnership law, effective from January 1, 2021, that allows for private investments in transmission lines and substations. However, such investments are not likely to be attractive to the private sector in the near future given the current levels of transmission tariffs and, therefore, provide inadequate return on investment (it is estimated that the current return on investments in power transmission is approximately 3 percent). Therefore, this important source of support for development of power transmission system is likely to remain unused until the transmission tariff is adjusted to fully cover the economic cost of new investments.

2.26 NPT and the PMBs were able to adapt well to the constraints experienced during the COVID-19 pandemic. Two waves of COVID-19 in Vietnam, the first in March-May 2020 and the second in June-October 2021, resulted in widespread restrictions or shutdowns and had significant impacts on a wide range of activities including procurement, land acquisition, and construction of the later-phase subprojects. The PMBs and contractors had to double their efforts to make up the lost time when the restrictions or lockdowns were lifted.

What Didn't Work and Why?

2.27 The time and effort required for preparatory work for deploying smart grid technology was underestimated at project appraisal, resulting in an avoidable time overrun. The approval process for smart grid technology lasted more than four years, including the time for the Ministry of Industry and Trade to review the proposal, decide on the type of technology to be used, prepare regulations (which required an additional 12 months), and deal with concerns related to disconnecting substations to implement the upgrades. This led to a two-year project closing extension, and implementation could start only in April 2020.

2.28 Some portion of the project costs was significantly overestimated, locking up resources that could have been applied to other projects. At project closing, cost savings amounting to $160 million were canceled from the World Bank's loan. Some of the savings were due to a steep decline in steel prices (from $500 per ton in 2012 to $300 per ton in 2016), and others arose from the removal of some subprojects and activities costing $25 million. However, a significant part of the cost savings can be attributed to conservative cost estimates from EVN and NPT's planning and budgeting practices. These cost savings could not be applied elsewhere because the World Bank conditioned the financing of new subprojects on satisfactory progress of activities under the second and third components, and this too would have required a lengthy approval process. Further, the unused loan proceeds affected the government's sovereign guarantee capacity. Eventually, it was agreed to use the loan savings for a follow-up transmission investment (the Vietnam Renewable Energy Accelerating Change Project, P174460), which is yet to be approved.

2.29 The project's efficiency was affected by some issues related to the implementation of the involuntary resettlement safeguard policy, although these are being addressed after project completion. In total, 2,500 households were affected by the project, resulting in the relocation of 80 households, and there was a severe impact on the productive lands of 290 households. The social safeguard performance rating at project closing was moderately unsatisfactory, after the Operations Policy and Country Services' recommendation, because the project closed with outstanding safeguard issues

that required a Post-Closure Action Plan. The World Bank team has been monitoring the implementation of this plan to ensure compliance with the applicable OP/BP 4.12, OP/BP 4.01, and other safeguard policies. An update provided to the mission team shows that the remaining activities are being carried out as planned and monitored by the World Bank's safeguard team (see appendix B). The remaining construction work is estimated to be completed approximately one year after project closing through the NPT's own funds.

Risk to Development Outcome

2.30 **Financial sustainability of EVN NPT.** The transmission tariff of NPT is determined annually in accordance with the government regulations (Ministry of Industry and Trade Circular No. 02/2017/TT-BCT). In principle, the cost-based regulation methodology should ensure recovery of economic costs of NPT, including investment expenditures. The methodology uses a number of assumptions (such as transmission volume, technical losses, and so on), which are outside NPT's control (for example, electricity demand and losses mainly depend on power dispatch carried out by EVN's National Dispatch Center).

2.31 Investments in transmission are not keeping pace with the growing demand and evolution of power generation mix. The rapid increase in power generation and increasing share of renewable energy call for adequate investment in power transmission and distribution systems. This is needed to evacuate and deliver newly generated electricity, avoid grid congestions, and reduce losses to decrease load curtailment. Draft PDP8 envisages significant increase in investments (approximately 30 percent across EVN), but the investment needs in NPT may be even higher and up to 100 percent above the current level—that is, approximately $1.4 billion per year until 2030. Currently, approximately 70 percent of the NPT investment program is financed with debt with maturity as short as 12 years, with a 2-year grace period from commercial banks, in contrast to the maturity of international financial institution loans, which is 20 years with a 5-year grace period. However, recent regulatory and administrative changes through Decree 114/2021/ND-CP have increased the complexity and slowed down mobilization of international financial institutions and official development assistance support.[7]

[7] Official development assistance loan: To be given priority to use for programs and projects in health, education, vocational education, adaptation to climate change, environmental protection, and essential economic infrastructure with no direct return of capital.

2.32 Current transmission tariff levels have resulted in NPT being stretched thin for meeting its economic costs and mobilizing finance for investment. Global experience shows that the transmission tariff of high-voltage power grid companies, such as NPT, accounts for approximately 10 percent of the retail tariff for end consumers. In Vietnam, the NPT tariff is less than 5 percent of the retail tariff (specifically, 5.5 percent in 2019 and 4.3 percent in 2020, as estimated by Fitch Ratings). Furthermore, NPT's tariff has seen a reduction of 8.6 percent in 2019, 20.9 percent in 2020, and 2.3 percent in 2022, in accordance with the EVN financial plan. Despite a significant increase of transmission volume (approximately 7 percent compound annual growth rate over the past five years), the reduction of the transmission tariff and increasing costs (including the cost of borrowing) negatively affected financial sustainability of NPT and contributed to underinvestment in the past few years.

3. Lessons

3.1 The readiness of subprojects for implementation before project effectiveness is critical for timely achievement of project objectives. It is even more so if an advanced technology is being introduced for the first time. In this project, 8 out of 12 transmission subprojects had their feasibility studies and bidding documents ready at the time of project appraisal and were completed on time. The remaining 4 subprojects that were finalized during implementation remained unfinished at the original project closing date. However, the greatest delay arose from the delay in finalizing the selection of technology and adopting the regulation for selected smart grid technology, requiring a two-year extension of the closing date. In retrospect, although a road map was prepared at approval for the introduction of smart grid technology in transmission substations, the learning curve and due diligence on the part of the borrower in choosing the appropriate smart grid technology were underestimated.

3.2 Overestimation of project costs at appraisal locks up funds and strains the government's sovereign guarantee capacity. The actual cost for this project was 30 percent lower than the appraised cost, partly due to a sharp decrease in steel prices and strong competition among bidders, but largely due to conservative estimates of EVN and NPT's planning functions.

3.3 Planning for the expansion of the transmission network must keep pace with electricity demand and generation expansion plans, particularly the increasing share of renewable sources, to prevent the loss of performance gains from past investments. PDP7 (2011–20) has been extended until the adoption of PDP8 and does not reflect the current and emerging investment needs for the power grid. This is adding to costs

through increased transmission losses and network congestion resulting from a rapid increase in VRE over the past three years.

3.4 Delayed planning has a direct impact on the financial situation of the utility and grid performance. In this case, the increasing costs (from cost of financing, transmission losses, and grid congestion) that could be mitigated by planning, coupled with unremunerative tariffs, affect the financial sustainability of NPT and result in underinvestment for current and future needs. If not addressed in a timely manner, such underinvestment would negatively affect grid performance. There is clear recognition among sector officials of the impact of the delay in adopting PDP8.

3.5 A sustainable transmission tariff allows the power grid company to finance its capital expenditures more effectively while attracting private sector investments. A transmission tariff below the economic cost for NPT is the main reason for underinvestment and difficulties in mobilizing long-term financing. Although NPT has been able to turn around from negative return on equity in 2015 to 10.9 percent return on equity in 2019, keeping this key parameter of profitability at a sufficient level remains a challenge. The low return on equity is also the main reason for the lack of private investments in power transmission, which are allowed under the country's public-private partnership law.

3.6 Land acquisition for transmission lines and substations can be a lengthy process and requires close collaboration between the utility and local authorities. Land acquisition is a major driver of the cost and timeliness of investments in transmission lines and substations. The key ingredients to timely and expeditious land acquisition, based on NPT's experience, would be (i) proactively collaborating with local authorities and affected communities and (ii) balancing the variations in the time spent for the land acquisition process across provinces or states.

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Appendix A. Ratings

Vietnam Transmission Efficiency Project (IBRD-84170; P131558)

Table A.1. ICR, ICR Review, and PPAR Ratings

Indicator	ICR	ICR Review	PPAR
Outcome	Highly satisfactory	Highly satisfactory	Highly satisfactory
Bank performance	Satisfactory	Satisfactory	Satisfactory
Quality of monitoring and evaluation	Substantial	Substantial	Substantial

Note: The ICR is a self-evaluation by the responsible Global Practice. The ICR Review is an intermediate Independent Evaluation Group product that seeks to independently validate the findings of the ICR. ICR = Implementation Completion and Results Report; PPAR = Project Performance Assessment Report.

1. Relevance of the Objectives

Objectives

Project development objective. The project development objective was to improve the capacity, efficiency, and reliability of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower. The project development objective did not change during implementation.

Relevance of the Objectives

The project objectives were highly relevant to the country context. They were substantially aligned with the Country Partnership Strategy at project approval (fiscal years 2012–16) and the Country Partnership Framework (CPF) at project closing (fiscal years 2018–22). Both documents noted the issue of insufficient electricity transmission capacity in the economic growth areas of Vietnam and its potential impact on the long-term sustained economic development of the country. Having supported Vietnam in unbundling its electricity sector through sector reform, achieving universal access to electricity, and strengthening the electricity network, the focus of the CPF for fiscal years 2018–22 moved on to the decarbonization of the electricity sector through the promotion of low-carbon energy generation and reduction of greenhouse gas emissions. The development problem partly fits under the third focus area of the CPF (that is, ensuring environmental sustainability and resilience) and contributes to the achievement of Objective 9 to promote low-carbon energy generation, including renewables and energy efficiency, and to reduce greenhouse gas emissions.

The project development objective addressed the developmental problem through increasing electricity transmission capacity and upgrading grid technology. The expected outcomes were improved efficiency of electricity transmission—reduced unserved electricity and, therefore, lower greenhouse gas emissions—and integration of

new monitoring, protection, and control technologies that will improve grid reliability and make efficient use of infrastructure while facilitating future integration of scaled-up renewable energy sources. The project objectives were appropriately pitched to the development status and capacity of the country as described in the CPF. The project-financed activities were listed in the government's Power Development Plan 7 covering 2011–20, confirming government ownership of the project. There were few operational constraints because the National Power Transmission Corporation (NPT) and the project implementing Project Management Boards (PMBs) had experience in implementing World Bank–financed projects.

Overall, the relevance of objectives is rated **high.**

2. Efficacy

Objective 1

The objective is to improve the capacity of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

The project's inputs—International Bank for Reconstruction and Development loans and technical assistance support—were to be used to finance the construction and rehabilitation of high-voltage transmission lines and substations and upgrading of existing substations, all including smart grid technology. The immediate output of these activities would be an increase in the transmission capacity.

Increased transmission capacity would ease the overload on the transmission lines and the substations, which would lead to the project's expected outcomes of fewer electricity outages and load shedding because of fewer instances of tripping in substations and a decrease in the amount of unserved energy—that is, lower technical losses in the system, improving the reliability of electricity supply.

A lower unserved electricity amount corresponds to improved efficiency and availability of electricity to meet increasing electricity demand in the urban and industrial load centers.

Improved reliability of power supply supports long-term socioeconomic development, and improved efficiency of electricity supply lowers the amount of greenhouse gas emissions. Overall, the causal pathways from inputs to outcomes were valid and direct.

Targets for construction and rehabilitation of transmission lines and upgrading substations were significantly exceeded. The project constructed 981 kilometers of transmission lines and rehabilitated 261 kilometers, significantly exceeding the targets of 920 kilometers and 120 kilometers, respectively. The project upgraded five 500-kilovolt

substations with smart grid technology, as targeted. It also upgraded 10 out of 11 planned 220-kilovolt substations with smart grid technology.

Transformer capacity targets were also significantly exceeded. At project closing, transformer capacity was increased by 4,263 megawatts against a target of 3,950 megawatts from addition of new transformer capacity in eight of the upgraded substations. Transmission capacity in the project areas was increased by nearly 80 percent as targeted by project closing and has since increased by 85.6 percent as of March 2023 after completion of remaining works.

In addition, one of the two transmission lines constructed in the country's central region—that is, the Quang Ngai–Quy Nhon 220-kilovolt line—connected the 220-kilovolt networks in the north and the south of the country, allowing the improved use of hydropower from the Thuong Kon Tum Hydropower Station of 22-megawatt capacity systemwide. The upgrading of the substations with smart grid technologies will contribute to smoother integration of variable renewable energy—that is, wind and solar energy—to the grid.

It is noted that the performance parameters presented under this and the following objectives relate to the overall grid because it was not possible to separate out the contributions specific to the infrastructure improvements in the project areas.

Overall, the project's efficacy in achieving Objective 1 is rated **high.**

Objective 2

The objective is to improve the efficiency of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

The asset management system was made fully operational at project closing, as targeted. Improved investment and maintenance-related decision-making was supported based on an adequate balancing of cost, benefits, and risks under the asset management system program, which significantly reduced the utility's costs of providing transmission services while maintaining regulation-mandated performance levels. Average operation and maintenance (O&M) expenses for energy transmitted per megawatt-hour were reduced from $0.87 to $0.67 in 2022, significantly exceeding the target of $0.83.

Outcomes

Unserved energy was reduced from 4,875 megawatt-hours at the end of 2012 to 817 megawatt-hours at project closing. The enhanced system standardization and automation were implemented by integrating new monitoring, protection, and control technologies under the developing smart grid network (Component 2), with the outcome of fewer and shorter brownouts and blackouts, increased life expectancy of

electrical equipment, and saved labor cost (which led to substantial savings in O&M expenses).

Average interruption duration and average interruption frequency fell to 356.12 minutes and 3.11 times per customer in 2021, respectively, from 724.28 minutes and 4.97 times per customer in 2018, respectively. Average duration of faults (minutes per year) dropped from 76.2 in 2013 to 15.38 in 2021.

O&M costs constitute approximately 20 percent of the transmission tariff. Therefore, the decrease in O&M costs contributed to the gradual reduction of the transmission tariff, which decreased by 25 percent from 2015 to 2021, increasing the affordability of electricity.

However, NPT has seen an increase in transmission losses from 2.15 percent in 2019 to 2.5 percent in 2022. There are two main reasons for the increase of transmission losses. First, the increase in transmission losses is directly related to changes in system load flows due to the fast increase of renewable power generation over the past three years, particularly in the central and southern regions of Vietnam. As a result, the power flows, which were mainly from north to south in the past, have reversed direction during periods of high generation from renewables, causing congestions and increasing losses in the transmission grid. The second reason is a slowdown in investment, as noted in the Background and Context section.

The reduction in O&M expenses is directly linked to the increase in the amount of electricity transmitted or, similarly, the reduction in unserved energy. In addition, the increased decision-making capacity on investments and maintenance works based on the information provided by the asset management system contributed to the reduction in O&M expenses, along with fewer outages in the system achieved with the increase in the transmission capacity.

The capacity-building activity did not directly support the achievement of the project objectives. However, increased technical and operational capacity of the NPT (because of the implementation of an asset management system, financial reporting based on International Financial Reporting Standards, and application of performance-based transmission tariff application) can reasonably be expected to contribute to improved operational efficiency and technical capacity that would improve the sustainability of the electricity transmission services.

Overall, the project's efficacy in achieving the project objective to improve the efficiency of electricity transmission services in selected parts of the electricity transmission network is rated **high**.

Objective 3

The objective is to improve the reliability of electricity transmission services in selected parts of the electricity transmission network in the territory of the borrower.

Outcomes

Voltage and frequency deviation indexes. The voltage deviation index (0.073 in 2012) has remained at the 2018 level (0.075), after having dipped to 0.024 in the intervening years. The frequency deviation index steadily decreased from 0.066 to 0.014 from 2018 to 2021. The number of times voltage was outside of the threshold decreased from 12,731 to 10,373.

Transmission faults. The number of faults per transmission system decreased for 500-kilovolt lines from 42 to 29 during 2018–22, and for 200-kilovolt lines, the number increased marginally from 135 to 159 over the same period. Over the same period, the number of unplanned faults per 100 kilometers of transmission lines (more than one minute; 220-kilovolt lines and above) was reduced from the baseline value of 0.51 to 0.27, significantly better than the target of 0.39. This indicator measured the achievement at the total NPT level and cannot be fully attributed to the project.

The number of unplanned faults in substations per year (more than one minute; 220-kilovolt lines and above) was reduced from the baseline value of 0.66 to 0.12, significantly better than the target of 0.51. Like the previous indicator, this indicator measured the achievement at the total NPT level and cannot be fully attributed to the project.

The reliability of the power transmission system has been uneven in the past few years. The initial decline of power curtailments in 2018 (0.52 gigawatt-hours, with load shedding of 821 megawatts in two incidents) was followed by a significant increase of curtailment in 2019 (8.36 gigawatt-hours, with load shedding of 1,300 megawatts in five incidents) and in 2021 (14.71 gigawatt-hours, with load shedding of 1,500 megawatts in 15 incidents). However, in 2020, curtailments dropped to 0.59 gigawatt-hours, with load shedding of 852 megawatts in two incidents.

Overall Efficacy

The project successfully implemented the transmission lines and substations investments, resulting in an 85 percent transmission capacity increase with substations equipped with smart grid technology. This capacity increase led to a significant reduction in the amount of unserved electricity and duration of outages. As a result, the transmission system's reliability and efficiency improved. This capacity increase with smart grid technology should be expected to facilitate the integration of variable

renewable energy to the grid in the future. Overall, the project's efficacy in achieving the project's objectives is rated **high.**

3. Efficiency

At appraisal, a "with the project" and "without the project" economic analysis was conducted for the transmission line investments and the upgrading of substations (smart grid benefits). Quantifiable benefits were defined as follows: (i) expanded transmission capacity to meet the rising demand, which was quantified using the transmission tariff per kilowatt-hour as willingness to pay for transmission service; (ii) reduction in load loss under brownouts quantified using incremental cost of alternative power supply; (iii) reduction in transmission line losses; and (iv) improved reliability from reduction in load loss under blackouts, both of which were quantified using the weighted average cost of grid-based power supply. The benefits of the smart grid investments were defined as follows: (i) improved system reliability through reduced frequency and duration of system faults quantified using incremental cost of alternative power supply and (ii) reduced cost of O&M as a result of system standardization and automation. The costs were taken as up-front investment costs and O&M costs—2 percent of the investment cost per year. The benefits and costs were adequately identified for an investment project in electricity transmission and conformed to sector standards. The socioeconomic benefits of improved electricity supply reliability were not included in the calculations; hence, the assumptions were rather conservative. Using these costs and benefits, the economic analysis for transmission line investments and upgrading of substations resulted in an economic internal rate of return (EIRR) of 31.2 percent and an economic net present value of $1,168 million at a discount rate of 10 percent for a 20-year period.

A cost-benefit analysis was conducted using the same methodology at project completion and resulting in a postcompletion EIRR of 52.6 percent, which is significantly higher than the EIRR estimated at appraisal. Although the reestimated value of lost load and the energy demand were lower than those estimated at appraisal (which would be expected to lower the EIRR), the reduction in the investment cost was large enough to offset the downward impact of those decreases on the EIRR. The postcompletion economic net present value was calculated at $1,089 million, which was lower than the economic net present value estimated at appraisal because of the depreciation of Vietnamese dong against the US dollar.

Financial Analysis

At appraisal, the financial benefits of the transmission infrastructure investments were defined as increased revenues from additional power transmitted because of improved system capacity and reliability and avoided cost of generation resulted from loss

reduction in the transmission grid. The financial benefits of smart grid investments were defined as avoided load loss because of improved system reliability and lower O&M expenses. Costs were defined as capital costs, O&M costs estimated at 2 percent of investment costs, and an inflation rate of 5 percent. The calculations resulted in a financial internal rate of return of 10.9 percent and a financial net present value of $403 million at the weighted average cost of capital of 6 percent for a 20-year period. Using the same methodology, the postcompletion financial internal rate of return and the financial net present value were 14.2 percent and $446 million, respectively. Like the increase in the EIRR, the increase in the financial internal rate of return was mostly due to the significantly lower investment cost compared with the cost overestimated at appraisal.

Administrative and Operational Efficiency

The implementation of project activities for upgrading substations with smart grid technology was delayed because of the Ministry of Industry and Trade's lengthy review of the technical design used and the preparation of the regulation that would cover the whole transmission network (World Bank 2019). This delay led to a two-year project closing date extension, although 16 out of 20 project activities under the first component had already been completed. Some of the planned construction work was not completed at project closing and is being completed with NPT's own funds.

At project closing, cost savings amounting to $160 million were canceled from the World Bank's loan. Some of the savings were due to a steep decline in steel prices (from $500 per ton in 2012 to $300 per ton in 2016) and others arose from the removal of some subprojects and activities costing $25 million (approximately 5 percent of project cost.) However, a significant part of the savings can be attributed to conservative cost estimates from Vietnam Electricity (EVN) and NPT's planning and budgeting practices. These cost savings could not be applied elsewhere because the World Bank conditioned the financing of new subprojects on satisfactory progress of activities under the second and third components, and that too would require a lengthy approval process. Further, the unused loan impacted the government's sovereign guarantee capacity. Ultimately, it was agreed to use the loan savings for a follow-up transmission investment (the Vietnam Renewable Energy Accelerating Change Project, P174460), which is yet to be approved.

Travel restrictions because of the COVID-19 pandemic caused disruptions to project implementation starting from March 2020, but contractors were able to make up for the lost time by increasing their efforts when restrictions were eased.

Project efficiency was also adversely affected by the issues related to the implementation of the involuntary resettlement safeguard policy. An update provided to the mission

team shows that the activities that were yet to be completed at project closing are being carried out through a postproject action plan that is being monitored by the World Bank's safeguard team (see appendix B).

Overall, the project's efficiency in achieving the project objectives is rated **substantial,** with some minor shortcomings in administrative and operational efficiency.

4. Outcome

The alignment of the project objectives to the World Bank strategy and the country context was high. Therefore, the relevance of objectives is rated **high**. The project's efficacy in achieving the project objectives is rated **high**. The project successfully achieved the targeted transmission capacity increase that led to improved reliability and efficiency of electricity transmission services. Finally, although the project achieved significantly higher economic and financial rates of return, because of significantly lower project costs mostly due to overestimation at appraisal, the project's efficiency in achieving the project objectives is rated **substantial** because of shortcomings in administrative and operational efficiency that led to a two-year project closing date extension and nonuse of loan savings of approximately $150 million during project implementation. Overall, the project's outcome is rated **highly satisfactory.**

5. Risk to Development Outcome

Financial sustainability of EVN NPT. The transmission tariff of NPT is determined annually in accordance with the government regulations (Ministry of Industry and Trade Circular No. 02/2017/TT-BCT). In principle, the cost-based regulation methodology should ensure recovery of economic costs of NPT, including investment expenditures. The methodology uses a number of assumptions (such as transmission volume, technical losses, and so on), which are outside NPT's control (for example, electricity demand and losses mainly depend on power dispatch carried out by EVN's National Dispatch Center).

Investments in transmission are not keeping pace with the growing demand. The rapid increase in power generation calls for adequate investments in power transmission and distribution systems. This is needed to evacuate and deliver newly generated electricity, avoid grid congestions, and reduce losses to reduce load curtailment. The draft Power Development Plan 8 envisages significant increase in investments (approximately 30 percent across EVN), but the investment needs in NPT may be even higher and up to 100 percent above the current level—that is, approximately $1.4 billion per year until 2030. Currently, approximately 70 percent of the NPT investment program is financed with debt with maturity as short as 12 years with a 2-year grace period from commercial banks, in contrast to maturity of international financial institution loans, which is 20

years with a 5-year grace period. However, recent regulatory and administrative changes through Decree 114/2021/ND-CP have increased the complexity and slowed down mobilization of international financial institutions and official development assistance support.

Current transmission tariff levels have resulted in NPT being stretched thin for meeting its economic costs and mobilizing finance for investment. Global experience shows that the transmission tariff of high-voltage power grid companies, such as NPT, accounts for approximately 10 percent of the retail tariff for end consumers. In Vietnam, NPT tariff is less than 5 percent of the retail tariff (specifically, 5.5 percent in 2019 and 4.3 percent in 2020, as estimated by Fitch Ratings). Furthermore, NPT's tariff saw a reduction of 8.6 percent in 2019, 20.9 percent in 2020, and 2.3 percent in 2022, in accordance with the EVN financial plan. Despite a significant increase of transmission volume (approximately 7 percent compound annual growth rate over the past five years), the reduction of transmission tariff and increasing costs (including the cost of borrowing) negatively affected the financial sustainability of NPT and contributed to underinvestment in the past few years.

6. Bank Performance

Quality at Entry

The project benefited from lessons learned from similar World Bank projects (that is, transmission lines and upgrading substations with smart grid technology) in Vietnam and other countries. The project was designed to support the NPT's investment program—the Power Development Plan 7. Therefore, the first group of subprojects was already identified at appraisal, with feasibility studies completed and ready for bidding. However, the preparatory work for upgrading of substations with smart grid technology was not in place at project effectiveness. Environmental and social safeguard aspects of the project were adequate to ensure compliance with relevant policies, including those related to Indigenous peoples, involuntary resettlement, forests, natural habitats, and physical cultural assets. Economic and financial analyses were conducted based on sector-specific assumptions with a robust methodology. The NPT and its three PMBs (Northern PMB, Central PMB, and Southern PMB) were assessed as having sufficient capacity to implement the project based on their experience with implementing World Bank and other donor-funded projects. The monitoring and evaluation (M&E) system was adequate to capture the outcomes of the physical investments and substation upgrading activities. Major risks were sufficiently identified, and mitigation measures were in place, but the risks related to time required for technical review of smart grid technologies and completion of approval procedures that delayed the implementation of project activities under the second component by four

years had not been identified. The materialization of these risks resulted in a project closing date extension by two years.

Overall, the quality at entry is rated **satisfactory.**

Quality of Supervision

Supervision missions were held every six months until the onset of COVID-19 in March 2020, after which virtual missions were held. There was continuity in the project team; one of the task team leaders stationed in Hanoi was with the project from appraisal through to project closing. All other members of the project team were stationed in Hanoi, which facilitated frequent contact with the Vietnamese counterparts. The project team was efficient in reviewing and clearing 80 goods and works procurement packages, which enabled the quick start of activities and processing of loan disbursements as planned. The project team's focus on the development impact of the transmission infrastructure investments was sufficient. The technical review of smart technology options and passing necessary regulation took almost four years after the loan became effective, which led to a project closing date extension by two years. This was mostly due to the shortcomings at entry (see the Quality at Entry section in this appendix). The project team's focus on fiduciary aspects was adequate; the project closed without any known misuse of funds or fraud; however, this was identified as a risk at appraisal. The project team's focus on the implementation of safeguard policies was adequate. The project team carried out ad hoc missions to help local authorities to address land acquisition issues, including those that emerged toward the end of project implementation because of the rerouting of a transmission line. The project team's supervision of the safeguard policies continues after project completion, and the status as of March 2023 is discussed in the main portion of the report, with details provided in appendix B. Despite the delay in the implementation of project activities under the second component and the restrictions imposed as a result of the onset of the COVID-19 pandemic, the project team supported the project implementing agencies in contract management and safeguard implementation to complete most of the project activities before the revised project closing date.

The quality of supervision is rated **satisfactory.**

Overall, this Project Performance Assessment Report concurs with the Implementation Completion and Results Report and the Implementation Completion and Results Report Review (World Bank 2022a, 2022b) on its assessment of the Bank performance as being **satisfactory.**

7. Quality of Monitoring and Evaluation

Design

The results expected from the project were well captured in the theory of change. The M&E framework built on the theory of change and included appropriate indicators for the project outputs of transmission lines constructed or rehabilitated and substations upgraded with smart grid technology, and the intermediate outcomes of reliability and efficiency of electricity transmission services. The indicators were sector specific, measurable, achievable, relevant, and time-bound. Baselines were defined for relevant indicators. All indicators had target values. Sampling methods, data collection methods, and analysis were electricity sector specific and as commonly implemented in the sector. The M&E design and arrangements were well embedded within NPT and PMBs, which were assessed as having sufficient capacity to implement M&E. However, the M&E design did not sufficiently capture the outputs and outcomes expected from the implementation of technical assistance activities, although, except for the implementation of the asset management system, most of the other technical assistance was financed by EVN and NPT by their own funds.

Implementation

NPT and the PMBs regularly measured and reported on the indicators in the results framework. The data were generated from EVN's internal data system supplemented by project implementation progress reports.

Use

M&E findings were used to track achievement of the project's results in improving electricity transmission capacity, efficiency, and reliability, rather than solely focusing on the achievement of the physical transmission infrastructure built, rehabilitated, or upgraded under the project. The M&E data could have been better leveraged to highlight the significant delay in the implementation of project activities under the second component and to restructure the project earlier than was done. This could have provided an opportunity to use loan savings from lower infrastructure investment costs to finance an additional subproject under the first component. However, the M&E data were useful in designing a follow-up project (the Vietnam Renewable Energy Accelerating Change Project) to continue supporting the transmission network in Vietnam and to facilitate the integration of renewable energy (which is awaiting a response from the government for next steps).

References

World Bank. 2019. "Proposed Project Restructuring of the Transmission Efficiency Project." Restructuring Paper RES39002, World Bank, Washington, DC.

World Bank. 2022a. "Vietnam—Transmission Efficiency Project (TEP)." Implementation Completion and Results Report ICR00005828, World Bank, Washington, DC.

World Bank. 2022b. "Vietnam—Transmission Efficiency Project (TEP)." Implementation Completion and Results Report Review ICRR0023052, Independent Evaluation Group, World Bank, Washington, DC.

Appendix B. Environmental and Social Aspects

Environmental and Social Safeguards

At appraisal, the project was classified as category B under the World Bank's environmental and social safeguard policies, indicating that environmental impacts were site specific, with most, if not all, amenable to mitigatory measures. The policies triggered were Natural Habitats (OP/BP 4.04), Forests (OP/BP 4.36), Physical Cultural Resources (OP/BP 4.11), Indigenous Peoples (OP/BP 4.10), and Involuntary Resettlement (OP/BP 4.12).

Environmental safeguards. An environmental and social management framework was prepared, establishing the requirements for subproject safeguard screening, impact assessment, and development of mitigation measures. Environmental impact assessments and environmental management plans for subprojects that had been already identified for financing under project were prepared and incorporated feedback from consultations with the project-affected people and communities before being publicly disclosed. During project implementation, dedicated staff were appointed responsible for environmental safeguard management. Bidding documents included environmental provisions. The safeguard compliance reports were submitted periodically with occasional delays. The project closed without any accident or major environmental issue.

The Natural Habitats (OP/BP 4.04) and the Physical Cultural Resources (OP/BP 4.11) policies were triggered as a precautionary approach, but no significant need arose in this regard.

The project did not affect any conservation areas, national forests, or natural forests that would have invoked the Forests (OP/BP 4.36) policy, although the project team reported that three subprojects had affected some commercial forests. Afforestation plans were prepared, and compensations were used for afforestation of an area equal to the size of the affected forests.

Social safeguards. The Resettlement Policy Framework was prepared in respect of the Involuntary Resettlement (OP/BP 4.12.), along with individual Resettlement Action Plans for subprojects, and was publicly disclosed. In total, 2,500 households were affected by the project, resulting in the relocation of 80 households, and there was a severe impact on the productive lands of 290 households. The land acquisition activities were implemented in compliance with the requirements of the safeguard policy, but the project closed with one household affected by the Quang Ngai–Quy Nhon transmission line not accepting the proposed compensation package. Furthermore, the rerouting of a

part of the Nho Quan–Phu Ly–Thuong Tin transmission line changed the project-affected area. According to the Addendum Resettlement Action Plan prepared in November 2021, it was estimated that 100 households would be affected by this transmission line rerouting. Since the construction of the transmission would continue beyond project closing, an Environmental and Social Action Plan was prepared after project closing for this section. The World Bank project team has continued monitoring the implementation of this safeguard policy.

Under the Indigenous Peoples (OP/BP 4.10) policy, an Ethnic Minority Planning Framework and an Ethnic Minority Development Plan for the Hoa Binh–Tay Ha Noi transmission line subproject were prepared. In the Hoa Binh–West Ha Noi subproject, 115 ethnic minority households were affected by land acquisition for the construction of tower foundations. The ethnic minority people in these houses were consulted and provided full project information and had access to a grievance redress mechanism in their native language. Trainings were provided to ethnic minority people, including children, on inclusive safety.

At project completion, a Post-Closing Action Plan was prepared to monitor pending actions for environmental and social safeguards, including land acquisition, compensation, and resettlement. An update provided to the mission team showed that one pending case related to the 220-kilovolt Quang Ngai–Quy Nhon transmission line subproject had been resolved. Other material measures and actions to complete the outstanding environmental and social issues after project closing are expected to be completed by December 2023 and are being monitored by an independent consultant.

Appendix C. Methods and Evidence

This report is a Project Performance Assessment Report. This instrument and its methodology are described at https://ieg.worldbankgroup.org/methodology/PPAR.

Overview

This Project Performance Assessment Report followed a mixed method and is based on evidence gathered through review of (i) key project documents and data from the World Bank, the Vietnam government, and academic literature; (ii) semistructured interviews with World Bank staff, government counterparts, representatives of the implementing agencies, key development partners active in the energy sector (GIZ [Deutsche Gesellschaft für Internationale Zusammenarbeit] and KfW [Kreditanstalt für Wiederaufbau]), and beneficiaries; and (iii) field mission, including observations during site visits.

Field Mission

The project covered three regions, through the Project Management Boards (PMBs)—namely, Northern PMB, Central PMB, and Southern PMB—of the National Power Transmission Corporation.

A purposive sampling method was followed to select substations that were either constructed as greenfield projects or rehabilitated under the Transmission Efficiency Project.

During the field mission to the districts, key informant interviews were conducted using semistructured questionnaires with substation managers and staff. The field interviews qualitatively assessed the project interventions and implementation results in line with the theory of change.

Questionnaire Used for Government and Various Agencies

I. Background and key issues in the power sector.
a. Transmission investment needs in the Power Development Master Plan 7 (PDMP7) and PDMP8. (How successful was the implementation of PDMP7 in the transmission sector and how PDMP8 defines the next stage of power grid development?)
b. Did the transmission system enable reliable and efficient evacuation of fast-expanding power generation? Any delays in commercial start of new generation (of any type) related to readiness or capacity of transmission grid?
c. What is the current level of electricity shortages, if any (estimated at 1.5–2 terawatt-hours in 2013)? What part of the country (north, central, south) was most affected by electricity shortages?
d. Any large-scale blackouts in the power grid in the last five years (comparable to the blackout in 2013)?

I. Background and key issues in the power sector.

e. How did the recent expansion of renewable power generation affect the operation of power transmission system and plans for its future development? Did the World Bank project anticipate such needs? Any curtailment of renewable power generation due to availability of transmission capacity?

f. Technical and nontechnical (commercial) losses in power transmission system.

g. Financial performance of the National Power Transmission Corporation (NPT).

h. Corporate governance of NPT and the role of state and Vietnam Electricity (EVN).

1. Policy and regulatory framework governing power sector.

a. Progress in power market opening (2015–22) and other market reforms (for example, divestment of EVN's power generation assets and private sector investments).

b. Cost recovery of transmission tariffs and debts of NPT. (What is the share of debts in NPT's investment program?)

c. Private sector participation in the power sector and open access to transmission and distribution grids.

2. Rationale for the World Bank support to power transmission sector and the demand (of government, EVN, and NPT) for the World Bank support.

a. Role of transmission system investments and power sector reforms within the Vietnam's Socioeconomic Development Strategy and the World Bank Country Partnership Strategy. (How aligned are these strategies in the power sector?)

b. How significant was the impact of Transmission Efficiency Project on the achievement of the World Bank Country Partnership Strategy 2012–16 and the following Country Partnership Strategy in Vietnam?

c. Did the Transmission Efficiency Project facilitate or enable the policy dialogue with the government and EVN on policy and regulatory issues in the power sector?

d. What would happen if the World Bank financial support was not available for specific investments in NPT?

e. What are the main reasons for underuse of the World Bank loan (overall about 64 percent), particularly given the project extension by two years? (Note that extension was requested and approved in December 2019 just before the original closing date.)

3. Relevance of the project objectives and design in improving NPT and power sector performance.

a. Did the World Bank continue to support NPT after the completion of the Transmission Efficiency Project? If yes, did the World Bank continue to use the same objectives and project design?

b. If the World Bank discontinued support to NPT or significantly changed objectives and project design of further operations in the power sector, what were the main reasons?

4. Monitoring and evaluation of progress in project implementation.

a. Procurement performance of NPT. (Any significant delays?)

b. Implementation of safeguards. (Any delays because of permitting and so on?)

5. Sustainability of project outputs (results and key performance indicators) and development outcomes (objectives). What are the main risks for sustaining project achievements?

6. Bank and borrower performance and satisfaction.

7. Lessons learned and applied to other projects in the sector.

Appendix D. Additional Data

Table D.1. Vietnam Electricity and National Power Transmission Corporation: Select Financial Indicators, 2020–22

Indicator	2020	2021	2022
Accounts receivable (number of days revenue)	135.65	112.86	80.89
Accounts payable (number of days operating expenses)	366.62	345.99	338.50
Return on equity (%)	3.55	3.35	00.17
Debt-to-equity ratio	2.38	2.30	2.30
Self-financing ratio	0.30	0.30	0.30

Source: Vietnam Electricity.

Table D.2. World Bank Electricity Sector Projects in Vietnam, Approved 2002–Present

Project ID	Project Name	Net Commitment (US$, millions)	Status	Approval FY	Closing FY
P066396	System Efficiency Improvement, Equitization, and Renewables Project	252	Closed	2002	2012
P074688	Second Rural Energy Project	420	Closed	2005	2014
P084871	Second Transmission and Distribution Project	380	Closed	2006	2014
P099211	Rural Distribution Project	150	Closed	2008	2013
P115874	Vietnam Power Sector Reform Development Policy Operation	311.8	Closed	2010	2011
P125996	Distribution Efficiency Project	448.9	Closed	2013	2018
P131558	Transmission Efficiency Project	500	Closed	2015	2021

Source: World Bank.
Note: FY = fiscal year.