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Report Number: ICRR0021771

1. Project Data

Project ID	Project Name
P125996	VN-Distribution Efficiency Project
Country	**Practice Area(Lead)**
Vietnam	Energy & Extractives

L/C/TF Number(s)	Closing Date (Original)	Total Project Cost (USD)
IDA-51560,TF-13456,TF-13468	31-Dec-2018	439,004,299.90
Bank Approval Date	**Closing Date (Actual)**	
11-Sep-2012	31-Dec-2018	

	IBRD/IDA (USD)	Grants (USD)
Original Commitment	478,900,000.00	37,975,402.18
Revised Commitment	473,874,989.34	27,320,691.52
Actual	439,004,299.90	25,119,022.87

Prepared by	Reviewed by	ICR Review Coordinator	Group
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2. Project Objectives and Components

a. Objectives

The project development objective (PDO) is “to improve the performance of the Recipient’s Power Corporations in providing quality and reliable electricity services, and to reduce greenhouse gas emissions through demand side response and efficiency gains.” (Financing Agreement dated November 8, Schedule 1, page 6)

For the purposes of this ICR Review, the following three sub-objectives within the PDO will be assessed separately. The three sub-objectives are relevant in the context of an integrated, interconnected infrastructure investment, thus making it technically inaccurate to create a full separate theory of change for each sub-objective:

Sub-objective 1 (referred to as Objective 1 in Section 4): "To improve the performance of the recipient's power corporations in providing quality electricity services". Providing quality electricity services meant reducing voltage fluctuations.

Sub-objective 2 (referred to as Objective 2 in Section 4): "To improve the performance of the recipient's power corporations in providing reliable electricity services". Providing reliable electricity services meant reducing the duration and frequency of planned and unplanned outages.

Sub-objective 3 (referred to as Objective 3 in Section 4): "To reduce greenhouse gas emissions through demand side response and efficiency gains".

b. Were the project objectives/key associated outcome targets revised during implementation?

No

c. Will a split evaluation be undertaken?

No

d. Components

The project had three main components:

Component A: System Expansion and Reinforcement

(Appraisal estimate, US$694.4 million; actual cost, US$561.17 million)

This component was to support the construction and reinforcement of 110 kilovolt (kV), medium voltage (MV) and low voltage (LV) electricity distribution networks, including substations, of the Power Corporations (PCs), in order to meet load growth, address load supply constraints, reduce losses and improve reliability and quality of supply.

Component B: Introduction of Smart Grid Technologies in Distribution

(Appraisal estimate, US$95.5 million; actual cost, US$53.07 million)

This component was to support energy efficiency improvements, which translate into lower carbon emissions from energy generation, through: (i) automation of the PCs' electricity distribution network operations and data collection, through the introduction of supervisory control and data acquisition (SCADA) systems; and (ii) introduction of Advanced Metering Infrastructure (AMI) systems, including two-way communications systems, as smart grid technologies for key substations and consumers of selected PCs.

Component C: Technical Assistance and Capacity-Building

(Appraisal estimate, US$10.5 million; actual cost, US$5.56 million)

This component was intended to support two main activities: (i) technical assistance and capacity-building for Electricity Regulatory Authority of Vietnam (ERAV) to improve its efficiency in tariff-setting, incorporation of smart grid technologies and renewable energy in the grid, preparation of distribution codes, development of demand response and smart grid programs, and project management and monitoring and evaluation (M&E); and (ii) technical assistance and capacity-building to assist the PCs in project implementation, financial modeling and planning, customer surveys and improving customer satisfaction, implementation of AMI systems, programs to promote efficient electricity use, and project M&E.

e. Comments on Project Cost, Financing, Borrower Contribution, and Dates

Project Cost. The original amount approved was US$800.4 million. The actual cost at completion was US$ 619.3 million.

Financing. At appraisal, the financing commitments were US$448.9 million equivalent from IDA, US$30 million from the Clean Technology Fund (CTF), and US$8 million from the AusAID Trust Fund. At project closing, the project was financed by IDA (US$413.86 million), the Clean Technology Fund (US$19.88 million), and AusAID (US$4.75 million).

Borrower Contribution. At appraisal, the Borrower committed US$313.5 million. At project closing, the Borrower had provided US$180.81 million in counterpart financing.

Dates. The project was approved on September 11,2012 and declared effective about five months later on February 7, 2013. A mid-term review was conducted on October 19, 2015. The project underwent a Level 2 restructuring that was approved on June 23, 2016, in response to the request from the State Bank of Vietnam (SBV) to remove the project's performance indicators from the Legal Agreements and placed them in the relevant project manuals. The original closing date was December 31, 2018 and the project closed on that date, without any extensions.

3. Relevance of Objectives

Rationale

Country Context

According to the Implementation Completion and Results Report (ICR, paras 1 to 3), Vietnam emerged from its status as a lower-middle-income, primarily rural agricultural economy in 2009, by which time it had transformed itself by the project's appraisal in 2012 into a mixed economy with rapid growth in commercial

and industrial activities. In 2011, the country's GDP growth was 5.1 percent, per capita income had reached US$1,515, and the poverty rate had fallen to 14.2 percent. By 2012, however, Vietnam was finding it harder to maintain high levels of growth because of periods of macroeconomic instability with high inflation levels, currency volatility and depreciation, and signs of significant internal capital flight. To address the structural drivers of macroeconomic instability and enhance the economy's efficiency, the Government of Vietnam (GOV) defined its 2011-2020 vision through its Socio-Economic Development Strategy (SEDS). The overall goal of the SEDS was to "lay the foundation for a modern, industrialized society by 2020." (para 3) This provided the national policy context for the project.

Sector Context

According to the Project Appraisal Document (PAD, paras 5 and 9), at the time of project appraisal in 2012, Vietnam was experiencing challenges in achieving energy security and sustainable growth in its electricity sector because of rapid urbanization, large increases in energy consumption in part due to the success of its own electricity access program, improvements in living standards, and growing industrialization. In the 15-year period between 1995 and 2010, household electricity access increased from 50 percent to over 96 percent, while annual per capital electricity consumption grew more than six times from 156 kilowatt-hour (KWh) to about 983 kWh. Industrial energy consumption was also growing at a faster rate than the national average. Meanwhile, power sector investments were insufficient to meet demand growth, resulting in load shedding particularly during periods of peak demand and dry hydrology. At the same time, greenhouse gas (GHG) emissions had more than doubled, with the industry, power and transport sectors expected to account for most of the future increases.

To support economic growth and poverty reduction, the main challenge in the power sector is to increase the quantity, quality and reliability of electricity supplies at competitive costs(PAD, para 10). Vietnam Electricity (EVN), the state-owned utility, is a holding company established in 2010 that has five subsidiary power corporations (PCs) responsible for 110-Volt electricity distribution and retail supply services in their franchise areas:

- Hanoi Power Corporation (HNPC)
- Northern Power Corporation (NPC)
- Central Power Corporation (CPC)
- Southern Power Corporation (SPC)
- Ho Chi Minh Power Corporation (HCMPC)

In 2011, the PCs faced major hurdles in providing high quality and reliable electricity services. As explained in the ICR (para 9), the PCs inherited the low-voltage networks previously owned by local distribution units, which had low supply quality and high technical losses, and needed rehabilitation. The PCs also lacked modern tools to capture and analyze system reliability and were manually recording outage data. They had no call centers to attend to customer queries or complaints. At project appraisal, manual calculations—which were being used to estimate the System Average Interruption Duration Index (SAIDI) and System Average Interruption Frequency Index (SAIFI) levels in each PC—found that distribution losses (technical) were high and increasing steadily. These challenging sector conditions led the Government of Vietnam (GOV) to recognize the need for modernizing the country's power system if its goals of energy security and power sector efficiency were to be achieved.

Government Strategy

At appraisal, the project's objectives were highly relevant to the Government's electricity sector strategy. GOV's Power Development Master Plan identified the power sector investments needed to achieve reliable supply for the next 5 to 10 years. The Plan also called for the development of a smart grid road map for transmission and distribution (T&D). To achieve secure electricity supplies at the lowest possible costs, the expansion and upgrading of the distribution system, combined with modernization and enhancement of planning and operation of the PCs' systems, were critically needed. Consequently, the GOV requested financial and technical support for the five PCs to improve distribution system efficiency and business operations and support ERAV's regulatory activities.

The project's objectives remain highly relevant to the GOV's current strategy. With the goal of laying the foundation for modern, industrialized society by 2020, SEDS identified three 'breakthrough areas', one of which was infrastructure development. SEDS calls for quick development of electricity sources and completion of the electricity network system together with the use of energy saving technologies to guarantee sufficient provision of electricity to meet demand. Concurrently, the Socio-Economic Development Plan (SEDP) 2011–2015 elaborated SEDS' objectives by identifying measures and resources for implementation. One of SEDP's major targets is that "The energy consumption based on GDP will be cut 2.5–3 percent annually"; and one of its tasks is "…assuring energy security, while effectively controlling energy consumption demands." (ICR, para 12) More specifically, this SEDP target refers to energy consumption per unit of GDP, or the energy intensity of the Vietnamese economy over time. The SEDP included this target, which was adopted by the Vietnamese National Assembly in November 2011, based on technical analysis of past trends and future projections of energy demand, taking into account the Government's policies and plans. Actual energy consumption per unit of GDP has been decreasing from 0.8 kWh in 2010 to 0.71 kWh in 2015, as reported in the latest SEDP for 2016-2020. Finally, the Vietnam's Prime Minister's decision approving the National Economic Development Strategy (NEDS) through to 2020 called for, among other things, adequate supply of high-quality energy and the efficient use of domestic energy resources. The decisions in the NEDS included reducing investment needs in the power sector, strengthening energy security, controlling and mitigating environmental pollution in energy activities, and fostering socioeconomic sustainable development.

Bank Strategy

At the time of appraisal, the project's objectives were highly relevant to the World Bank Country Partnership Strategy (CPS) 2012–2016. CPS Pillar 1 on competitiveness would address the low quality of key infrastructure services due to inefficiencies in power distribution and transmission, among others, while Pillar 2 on sustainability would address pollution control.

The project's objectives are also highly relevant to the current World Bank's Country Partnership Framework (CPF) for Vietnam (2018–2022), which sets as its Objective No. 9 (Focus area 3) the promotion of low carbon energy generation and the reduction of greenhouse gas (GHG) emissions by improving the efficiency and reliability of electricity supply in Vietnam. The reduction in losses from the project's system expansion and reinforcement, the energy improvements from the roll-out of smart grid technologies, and the capacity-building of ERAV and the PCs in the areas of smart grid programs, renewable energy and energy efficiency – are all highly consistent with improving distribution efficiency, thus requiring less generation fuel inputs, and leading to the goals of low carbon energy generation and reduction in GHG emissions.

Rating

High

4. Achievement of Objectives (Efficacy)

OBJECTIVE 1

Objective

To improve the performance of the recipient's power corporations in providing quality electricity services

Rationale

Theory of Change

As indicated earlier in Section 2(a), the project development objective (PDO) is "to improve the performance of the Recipient's Power Corporations in providing quality and reliable electricity services, and to reduce greenhouse gas emissions through demand side response and efficiency gains." For the purposes of this ICR Review, the efficacy of the three sub-objectives (referred to in this Section as Objectives) of quality, reliability, and reduction in greenhouse gas emissions will be assessed separately. Nevertheless, since the three sub-objectives operate together in the context of an integrated, interconnected infrastructure investment, it is technically inaccurate and inappropriate to create a separate theory of change for each of them.

Improving the quality of electricity services (meaning reducing voltage fluctuations) in Vietnam required the new construction or rehabilitation of 110-V, MV and LV substations and electricity distribution networks managed by the five PCs. The theory of change was that these investments would help the PCs to efficiently meet the anticipated growth in electricity demand with less fluctuations in voltage, reduced supply constraints due to system congestion, greater reliability, less electricity system losses, and a positive demand response in terms of more efficient electricity use, thus contributing to the reduction in greenhouse gas emissions (GHGs).

The project's components and corresponding activities were comprehensive for achieving the project's objectives. The resulting outputs from each component are logically and causally connected to the achievement of the intermediate and final outcomes. The technical indicators were all appropriate and adequate for measuring the extent to which each objective was achieved.

The energy system technologies are well known, hence the project's system expansion and reinforcement, as well as its smart grid technologies for electricity distribution, can be expected to directly deliver the physical targets under the project. Figure 1 of the ICR is well designed and articulated (although some lines were garbled in the third box under the second column, specifically the last three lines of the description of the 25 legal documents). The critical assumptions on the need for a stable macroeconomic environment, efficient implementation, and adequate tariff structure, were all relevant; however, institutional capacity factors appear to be missing, which would be important to indicate given the institutional strengthening needs of ERAV and the PCs that were to be supported by the project's Component 3.

Overall, the project's theory of change was robust and measurable, and readily translatable into a monitoring and evaluation (M&E) framework.

Outputs

- 8,587 km of 110-kilovolt (kV), medium voltage (MV) and low voltage (LV) lines were newly constructed or reinforced.
- 4,742 MVA of 110-kV, MV and LV substations were newly constructed or reinforced.

Outcomes

The ICR (paragraph 35, pages 15 to 16) define "quality" as "a steady supply voltage that stays within a prescribed range. Hence, the project's outcomes were to be measured by the following indicators: (a) number per year of voltage excursions outside +/−5% at the outlet of 110 kV substations in the project area, (b) percentage of total losses in the project areas per year, and (c) annual reduction in GWh of electricity consumption by PC customers with the Advanced Metering Infrastructure (AMI) compared to the Business As Usual (BAU) scenario without the project.

The quantitative evidence shows that the targets for measuring PDO 1's outcomes were nearly all exceeded. The detailed Table 3 of the ICR (pages 14 to 15) provides the data for the five PCs. The highlights are:

- The reduction in the percentage of distribution losses exceeded the targeted reductions by 1.6 to a high of 7.5 percentage points, across the five PCs. EVN's 2017 Annual Report also indicated that total losses were reduced during the project period: "The power losses of the entire power system fell to 7.57 percent from 7.94 percent in 2015." (ICR, para 37) According to the ICR, most of this reduction came from the distribution system, hence supporting the assumed attribution of the reduced losses recorded to the project's new construction and reinforcement of substations. In 2016, EVN's distribution loss rate decreased further to 5.21 percent.
- The reduction in the number of +/- 5% voltage fluctuations (per customer per year, when the voltage is outside the prescribed range) met the target for the PCs, except for SPC, which exceeded the target (4.00 targeted and 0.0005 achieved, in terms of number of fluctuations in a year as defined). SPC installed Automatic Voltage Regulators in addition, hence voltage excursions were almost nil at project completion.
- The reduction in GWh of electricity consumption with advanced metering infrastructure (AMI) exceeded targets for all the five PCs. The combined annual reduction for NPC, HCMPC, HNPC and CPC is 448.5 GWh, thus exceeding the target of 414.5 GWh. The baseline is zero GWh without AMI under the BAU scenario. SPC is not in this list as it did not procure smart meters; SPC only procured the Metering Data Management System (MDMS) under the project to synchronize with the other PCs.
- Regular customer service surveys have also shown consistent improvement of EVN's services and steadily increasing customer satisfaction indices in the project areas over the project's lifetime. The surveys included all classes of customers (residential, commercial, industrial) and questions related to power supply quality, billing, communication, customer service, tariff awareness and customer consensus. The data collection methods included face-to-face in-depth interviews, focus groups, and questionnaires.
- The call centers (see Outcomes under Objective 3 below) provide a channel for PCs to directly interact with consumers, promptly deal with incidents and inefficiency of the system. The benefits were

manifested in terms of reduced outage times, as the PCs can quickly react to consumer complaints. This also had a material impact on GHG emission reductions.

There is a high degree of attribution of project outcomes to its inputs, activities and outputs. According to the ICR team (October 22, 2019 email to IEG), the baseline values were determined taking into account the infrastructure that was already in place, hence existing infrastructure at the time of appraisal were not a factor in the eventual results. The incremental targets were determined based on the expected results from the planned additional technical interventions, while also benchmarking with comparable countries in the ASEAN region. Moreover, the ICR team also certified that there were no other similar projects that were being implemented in the project areas covered by the Distribution Efficiency Project that might have influenced the final results. The ICR team clarified that the project showed higher results that expected due to several reasons:

- More subprojects were implemented than planned due to prudent procurement practices, thus achieving higher results than estimated initially;
- Consumer behavior improved due to (i) real time receipt of information on their electricity use and (ii) the use of demand response pilots to encourage reductions in consumption (ICR, para 38);
- Behavior of operators also improved due to the real time receipt of network information on SAIDI and SAIFI figures (discussed in more detail under Objective 2 below);
- The provision of an adequate legal framework incentivized the PCs to improve their overall performance; and
- Training and study tours improved the behavior of PC operators with respect to planned maintenance, thus avoiding unnecessary outages.

Rating
High

OBJECTIVE 2
Objective

To improve the performance of the recipient's power corporations in providing reliable electricity services

Rationale
The theory of change presented under Objective 1 above also applies to Objective 2, for which the results are assessed below.

Outputs

- 2 automated SCADA systems were installed and upgraded. The project funded SCADA only for HCMPC and SPC. HNPC already had a SCADA system, while both NPC and CPC had mini-SCADA systems in several provinces, which they upgraded using their own funds. [Note that SAIFI and SAIDI indices (as discussed immediate below under Outcomes) are measures of the frequency and duration of outages in the electricity network, as experienced by the consumer, whereas SCADA systems

provide data used toward the calculation of these indices. SCADA systems also provide the PCs with a real-time view of the MV systems, thus helping the grid operators to identify instantly the location of faults within the MV system and enable them to react quickly in order to reduce the SAIDI figures. In sum, a well-operating SCADA assists the PCs with network visibility and maintenance that in turn contribute to the reduction of SAIDI and SAIFI figures.]

- 125,450 smart meters were installed. Smart meters and the MDMS (discussed immediately below) comprise the Advanced Metering Infrastructure (AMI). These were installed for all targeted PC consumers, including commercial customers and household consumers with consumption between 500 to 2,000 kWh per month. The baseline was the actual 2011 sales by the PCs to the customers where AMI (i.e., a combination of smart meters and MDMS) would be implemented. The business-as-usual (BAU) scenario was determined from the baseline plus forecasted demand growth. Once the AMI was installed, the reduction in consumption would be seen from the total of the consumer's bills compared to the BAU scenario.
- 5 Meter Data Management Systems (MDMS) were installed in each of the 5 PCs. The MDMS stores and processes the interval load data from multiple Head-End Systems (HESs) to perform further processing such as billing, validation, editing and estimation (VEE). The consumption data are aggregated in different forms according to the requirements of the upper-layer applications, including multi-point data aggregation, metering data, and aggregation of consumption based on tariff structure, critical peak pricing (CPP). The MDMS enables bidirectional communication with HES, including outage data, disconnection/reconnection and load control. The MDMS provided a platform for the PCs to quickly aggregate data on consumers consumption to provide reports on consumption reduction; moreover, load analytics and control provided the PCs with information to improve their supply service. In addition, timely and accurate provision of consumption and billing information to the consumer motivates them to adjust their consumption behavior.

Outcomes

The quantitative evidence shows that achievement of reliability in the PC distribution system by reducing the duration and frequency of planned and unplanned outages as measured by SAIDI and SAIFI exceeded the targets. The details of the project's performance were:

- The improvements in the System Average Interruption Duration Index (SAIDI) exceeded targets by significant amounts as summarized in Table 3 of the ICR. For example, the duration of interruptions (per year for all customers) for SPC decreased from the December 2011 baseline of 6,958 minutes and target of 5,525 minutes -- to the 599 minutes achieved by December 2018, representing a major reduction of 4,927 minutes compared to the target. Based on the same timeframes: for NPC, the baseline, target and actual figures were 5,145, 4,656 and 989 minutes, respectively, which also shows a large reduction of 3,667 minutes compared to the target. For CPC, the baseline, target and actual figures were 3,631, 3,234 and 1,027 minutes, respectively, indicating a large reduction of 2,207 minutes compared to the target. Lower numbers were achieved for HCMPC and HNPC, while still marginally exceeding their respective targets.
- The improvements in the System Average Interruption Frequency Index (SAIFI) were also significant and exceeded targets in reducing the number of power interruptions, e.g., from the 20.95 targeted in December 2011 to 9.11 achieved in December 2018 for CPC, and the 21.60 targeted and 3.23 achieved for SPC in the same timeframe. Lower numbers were achieved for the three other PCs, while still exceeding their respective targets. [Note that for the foregoing SAIDI and SAIFI results, the

targets were determined based on the expected results of the planned investments and activities under the project, while benchmarking with regional peers within ASEAN.

- EVN's 2017 Annual Report indicated that the SAIDI and SAIFI for Vietnam were reduced during the project period: "A noteworthy improvement in the power supply quality was seen in 2016. The System Average Interruption Duration Index (SAIDI) remarkably declined to 1,651 minutes per customer in 2016 from 2,281 minutes in 2015. The System Average Interruption Frequency Index (SAIFI) dropped to only 10.6 times per customer (in 2016), equivalent to a 21% decrease as compared to 2015. The Momentary Average Interruption Frequency Index (MAIFI) (comparing 2016 to 2015 figures) experienced a considerable decrease of 28.7% to 1.51 times per customer."
- Beyond the PDO outcome indicators, a broader outcome of accurately measuring SAIDI and SAIFI is the increased awareness of network operators of the benefits resulting from management, technical and behavioral changes, which can lead to improved efficiency of network operations.
- In terms of sustainability, given the success of the SAIDI and SAIFI interventions, the EVN incorporated institution-wide the collection of outage data and reliability indices into their daily routine at an institutional level. During 2014, the EVN formally announced that the SAIDI and SAIFI indices will be used going forward to assess the performance of the PCs, which provides further incentive for the PCs to ensure efficient use of the tools and information to improve network performance.
- The call centers (see Outcomes under Objective 3 below) provide a channel for PCs to directly interact with consumers, promptly deal with incidents and inefficiency of the system. The benefits were manifested in terms of reduced outage times, as the PCs can quickly react to consumer complaints. This also had a material impact on GHG emission reductions.

The conclusion from these measures is that the reliability of electricity services to customers in the five project PCs has improved considerably during the project's implementation. Attribution to the project is high based on the same discussion provided at the end of Objective 1 above. Briefly stated, the baseline values were determined taking into account the infrastructure already in place, hence the incremental outputs and outcomes resulted directly from the incremental investments and activities supported by the project.

Rating
High

OBJECTIVE 3
Objective

To reduce greenhouse gas emissions through demand side response and efficiency gains

Rationale
The theory of change presented under Objective 1 above also applies to Objective 2, for which the results are assessed below.

Outputs

- 25 legal documents were drafted and/or issued, including improved efficiency in electricity tariffs, incorporation of smart grid technologies in the grid and distribution codes, regulations for smart grids,

grid-integrated renewable energy, efficient pricing, and demand response programs. Several examples of the contributions of these legal documents to the achievement of the project's objectives are provided under Outcomes below.

- 5 call centers were installed at the power corporations to respond to calls from electricity customers.
- 25 training courses and study tours were provided.
- 12 studies and surveys were conducted.

Outcomes

- The avoided GHG emissions (in tons CO2/year) exceeded the targeted levels for all the five PCs, ranging from 10,907 tons CO2/year higher than targeted for CPC to 53,219 tons CO2/year for NPC. The combined avoided GHG emissions for NPC, HCMPC, HNPC and CPC amount to 365,707 tons CO2/year, compared to a target of 269,148 tons CO2/year and a zero baseline.
- The 25 legal documents also had beneficial outcomes, of which the significant ones include the following, according to the ICR Team (October 22, 2019 email):

(a) Demand Response (DR) Program. One of the 25 legal documents resulted in the issuance of Circular 23/2017/TT-BCT dated November 16, 2017 on Incentive Mechanism for Demand Response (DR) Program. This decision was prompted by a TA subproject intended to support ERAV in: (i) the implementation of pilot demand response programs for PCs; and (ii) the testing of incentive mechanisms, implementation procedures of DR programs, and cooperation among PCs, consumers and stakeholders when operating a DR program. The DR programs would assist the PCs to register reduced consumption and hence contribute to Objective 1 of the project.

The pilot DR program was implemented in the management territory of HCMPC. ERAV cooperated with the consultant and HCMPC organized technical and marketing workshops to introduce benefits as well as all contents of the pilot DR programs to consumers. In addition, ERAV, the consultants and HCMPC organized face-to-face meetings with consumers to understand their thoughts and comments and explain to them contents related to the pilot DR programs. Those workshops and meetings were effective in convincing consumers to participate the pilot DR programs.

The pilot DR programs were implemented successfully. With the active participation of consumers, consumption behavior during peak hours adjusted downwards and consumption reductions were realized. Thus, this activity had a direct impact on achievement of reduced consumption by consumers, which contributed to reducing GHG emission emissions.

(b) The legal documents also contributed to developing improved regulations, by revising Technical Codes, Standards and Procedures on incorporating smart grids and integrating renewable energy generation. This created a favorable environment for using clean energy to replace fossil fuel energy. This had material impact on GHG emission reduction.

(c) The legal activities also contributed to supporting ERAV in finalization of BST mechanisms in the transition to wholesale competitive market. This was implemented under the TA sub-project "BST Transition and Loss Reduction Incentive". The objective of this TA was to provide a transition path for the BST to support more efficient pricing and loss reduction by PCs in the context of the wholesale competitive market and develop a mechanism to provide an incentive for distribution networks to reduce network losses.

(d) ERAV developed and submitted to MOIT for issuance, the official document No. 11933/BCT-DTDL dated December 19, 2017, which provided guidance for EVN in developing 2018 BST framework for PCs. The legal document outlined a mechanism that provides incentives for distribution networks to reduce network losses for PCs. This contributed to incentivizing PCs to focus on reducing losses (thus directly supporting Objective 1 of the project), which also had a material impact on GHG emission reduction.

- The call centers provide a channel for PCs to directly interact with consumers, promptly deal with incidents and inefficiency of the system. The benefits were manifested in terms of reduced outage times (thus directly supporting Objective 2 of the project), as the PCs can quickly react to consumer complaints. This also had a material impact on GHG emission reductions.
- The training courses and study tours were also focused on enhancing performance and efficiency of PCs, load research, DR, smart grid, electricity tariff for DR programs, integration of renewable energy into national grid, enhancing technical code efficiency, etc. The training courses and study tours have been evaluated and the results demonstrated improved staff capacity.

Attribution to the project is high. As explained in greater detail at the end of Objective 1 above, the baseline values were determined taking into account the infrastructure already in place, hence the incremental outputs and outcomes resulted directly from the incremental investments and activities supported by the project,

Rating
High

OVERALL EFFICACY
Rationale

The project's efficacy in achieving each of the three objectives is **high**. Targets were mostly exceeded, with only a few being fully met. No target was partially achieved or not achieved.

Overall Efficacy Rating

High

5. Efficiency

Economic and Financial Efficiency

Out of 99 subprojects planned at appraisal for the two-phased implementation, a total of 177 were actually implemented, thus significantly exceeding by 180 percent the number that the PCs originally proposed. At the project completion stage, economic and financial analyses were conducted for 174 out of 177 sub-projects

under Components A and B, accounting for 76.2 percent (US$609.8 million) of the total project cost at the appraisal stage (US$800.4 million) and 98.3 percent of the total project cost at the completion stage (US$619.8 million).

The economic and financial analyses showed that the project was expected to achieve higher rates of return than estimated at appraisal. The detailed assumptions made for the economic analysis at appraisal are presented in Annex 4, pages 57 to 63 of the ICR. The estimated economic internal rate of return (EIRR) and the Net Present Value (NPV) for the whole project at completion were 38.3 percent and US$2,496.7 million, respectively. The Economic Internal Rate of Return (EIRR) at completion was higher than the 29.2 percent calculated for the Phase 1 subprojects at appraisal.

The Financial Internal Rate of Return (FIRR) and the NPV for the whole project at completion were 19.7 percent, and US$1,720.3 million, respectively. At the time of project appraisal, the FIRR was estimated at 16.7 percent and the NPV at US$565.6 million. However, the financial returns at completion stage were significantly improved because (a) the actual investment costs were lower than appraisal estimates, (b) the system efficiency was better than expected, and (c) compared to appraisal levels, the margins between the Bulk Supply Tariff (BST) and the average retail tariff increased a little during project implementation. (See the more detailed explanation immediately below.) These favorable conditions produced healthy revenues that shortened the payback period for the PCs. (ICR, paragraph 22, pages 61 to 62) On the other hand, the ICR did not discuss the situation for household consumers as a result of the increases in retail electricity tariffs since the project was approved.

The ICR Team clarified that the conclusion regarding the margins between BST and the average retail tariff having increased a little since appraisal was based on calculating the difference between the buying and selling price applicable for each PC as provided by EVN. Based on this data, the increase in the margins left for PCs is considered small after reducing the figures by 20 percent, which is the total percentage of tariff increase during the period. (The figures are provided in Tables 4.4 and 4.5 of the ICR.) Retail electricity prices did not keep pace with the rate of inflation. According to Section 3.4.1 of a forthcoming report ("Learning from Power Sector Reform Experiences: The Case of Vietnam" by Ian David Lee and Franz Gerner): "In the period from 2005 to 2019, the nationally-determined average retail tariff was revised 13 times, at varying intervals of between 6 to 18 months, and between 0.8 and 17.4 percent in nominal terms compared to the previous rate. Tariff increases have barely kept up with inflation. Nominal average electricity tariffs increased by 53 percent from January 2019 to January 2015, whereas cumulative inflation for the same period was around 56 percent."

Administrative and Operational Efficiency

The ICR reported some delays during implementation but the project was completed as scheduled and no closing date extensions were required. Those implementation delays included slow approval processes and difficulties in land acquisition in big cities and provinces that also delayed the AMI start-up. The ICR did not report any procurement-related delays, which was rated Satisfactory when the project closed

Efficiency Rating

High

a. If available, enter the Economic Rate of Return (ERR) and/or Financial Rate of Return (FRR) at appraisal and the re-estimated value at evaluation:

	Rate Available?	Point value (%)	*Coverage/Scope (%)
Appraisal	✓	29.20	76.20 ☐ Not Applicable
ICR Estimate	✓	38.30	98.30 ☐ Not Applicable

* Refers to percent of total project cost for which ERR/FRR was calculated.

6. Outcome

The relevance of the project's objectives to the Bank's country strategy, and to the Government's strategies for the Vietnamese economy and for the country's energy sector, is **high**.

The overall efficacy of achieving the project's objectives is **high**. Achievement of each of the three objectives met or exceeded its original targets. Much better results than targeted were achieved due to the combined effects of installing AMI and MDMS for large customers, which resulted in behavioral changes that favored shifting to more energy-efficient equipment and lower energy consumption. Moreover, more efficient procurement practices led to project savings that enabled more subprojects to be carried out. Out of 99 subprojects planned originally, 177 projects were implemented that resulted in improved network capability to meet load growth, reduce losses, and improve power supply reliability and quality.

Efficiency is **high**, given the average economic and financial rates of return at project completion—38.3 percent and 19.7 percent, respectively, for the power companies—that significantly exceeded the appraisal estimates. Although there were delays related to land acquisition and slow approvals during the implementation period, the project was completed by the original closing date, without any extensions.

Based on the above criteria, the overall project outcome is rated **highly satisfactory**

a. Outcome Rating
Highly Satisfactory

7. Risk to Development Outcome

According to the ICR (para 92), the sustainability of this project's outcomes faces risks related to growth in energy consumption, rate of investments in the sector, and environmental impacts. These risks are assessed below.

Growth in energy consumption. Over time, given the average annual GDP growth rate projection of 8 percent to 2030 in Vietnam, there is a risk that the corresponding growth in energy use would lead to decreased quality and reliability of electricity supply. This would result from an overly burdened distribution system, both in the network sections upgraded by the project and portions that were not upgraded. However, given the training provided to PCs in monitoring the network, identifying improvement needs, and conducting some of the works, it is expected that they will actively plan for continuous network upgrades and

reinforcement. As stated in to the ICR (para 93): “EVN has also included performance, reliability, and quality indicators in their annual performance evaluation of the PCs, which are added incentives to ensure continued improvement of their networks.” In view of the expected growth in energy demand, the project supported capacity-building for load research, tariff efficiency, and grid integration of renewable energy, among other key areas.

Inadequate investments to match load growth. The Government is aiming to reduce its dependence on foreign public borrowing, yet the distribution network will require continuous upgrades and large funding amounts. Consequently, EVN will need to decrease its use of concessional loans for financing its capital expenditures. According to the ICR (paragraph 94, page 31): “In 2018, EVN achieved its first, positive rating (BB with ‘stable outlook’ for long-term foreign currency) from the Fitch ratings”, which would position EVN with an ability to access international capital markets on a non-sovereign basis. Moreover, the World Bank’s recent report on Maximizing Finance for Development also indicated that EVN can now access commercial financing or blended financing. This would enable EVN to continue maintaining its networks.

Increases in greenhouse gas (GHG) emissions from new electricity generation. The Government’s estimated increases in required generation capacity—i.e., from the current 42 GW to 60 GW by 2020 and to 100 GW by 2030 (ICR, para 95)—means that 5 GW would need to be installed each year between 2018 and 2030. In view of the risk that generation sources that increase GHG emissions would be harnessed, the Government has approved the Renewable Energy Development Strategy and set up specific renewable energy (RE) targets in the Power Development Master Plan (PMDP). RE targets are assessed and updated when the that Plan is updated every five years.

8. Assessment of Bank Performance

a. Quality-at-Entry

This project follows a previous series of Bank-financed energy projects in Vietnam. More specifically, according to the PAD (para 35), “the Bank has been providing support to the PCs and ERAV for the development of smart grid roadmaps, financed through the Rural Distribution Project and the System Efficiency Improvement, Equitization and Renewables Project. Based on information in the ICR, the Bank project team’s technical, economic and financial analyses, and the preparation of investment subprojects at appraisal, were sound. The project’s design components were specifically geared towards achieving improvements in reliability, efficiency, and quality of electricity supply. Moreover, certain design features were also selected to help commercialize the PCs so they could operate in a wholesale market under a new regulatory framework, while achieving independence from EVN. As such, the project’s objectives and design were closely aligned with the Government’s prevailing energy sector priorities and strategies, namely, the NEDS, SEDP and PDMP7, which aimed to achieve security of energy supply after 2016, develop a smart grid, upgrade and expand the distribution system, and modernize planning in the PCs and their operations.

The Bank team mobilized two trust funds (TF) to augment project funds aimed at providing technical assistance. First, the Australian TF helped to implement a series of activities to assist the Electricity Authority of Vietnam (ERAV) in reforming the power sector, preparing for a competitive market, and

improving the capacity of PCs. The Clean Technology Fund helped PCs introduce smart metering, improve their services to large customers, and help to reduce GHGs.

The design of the implementation arrangements appropriately combined Vietnam's centralized and decentralized institutional and governance structures. The arrangements also built upon the accumulated experience from past World Bank projects and followed the Government's regulations on projects with official development financing. During preparation, the Bank team assisted the PCs in following the practice of centralizing goods supply at the PC level to take advantage of economies of scale, while decentralizing procurement and supervision of works at the PC level to facilitate the implementation of projects covering a large area and many provinces. The latter arrangement also involved local authorities more closely for easier management of land acquisition/compensation and environmental management issues. In sum, the project had a flexible and decentralized design that readied the project or quick implementation start up.

Quality-at-Entry Rating

Highly Satisfactory

b. Quality of supervision

Regarding staffing, the ICR (paragraph 86, page 28) indicates that project supervision "had a competent and experienced task team leader" supported by a task team with the required skills mix, including fiduciary management, procurement, and safeguards. The whole team was based locally and provided "hands-on and quick support to the IAs when required."

Based on the ICR (para 86), the Bank's supervision missions monitored and documented project progress and implementation challenges through regular Implementation Status and Results reports (ISRs)—of which 12 were prepared during the project's lifetime—as well as Aide Memoires. At each month-long supervision mission, the team conducted site visits nationwide, focusing more closely on the most challenging subprojects that required support on resettlement, environment, and technical issues.

The Implementation Status and Results Reports (ISRs) and their ratings were shared with the PCs as signals regarding their performance. The ICR (paragraph 87, page 29) indicates that: "The task team provided valuable support to these implementing agencies throughout the project lifetime, contributing to the project success." The support covered a range of issues as they arose, including (a) procurement and progress vis-à-vis the implementation plan, (b) compliance with social and environmental safeguards, (c) compliance with the legal covenants of the project, (d) financial management guidance, and (e) technical guidance. The Bank team also transferred knowledge to the IAs through workshops, e.g., on all aspects of project management when the project was launched, and specifically tailored training during implementation, such as smart systems for utilities, and sector reform experiences of other utilities. This training proved valuable to the Hanoi Power Corporation (HNPC), which was implementing a Bank-financed project for the first time

Quality of Supervision Rating

Satisfactory

Overall Bank Performance Rating
Highly Satisfactory

9. M&E Design, Implementation, & Utilization

a. M&E Design
The design and operation of the M&E framework was adequately prepared in the PAD. The Bank team took into account the lack of familiarity of some PCs with M&E. For this reason, ERAV contracted a consultant during project preparation to design the M&E framework. Moreover, support for capacity-building was also given to the PCs to implement M&E functions. As a longer-term result, EVN has incorporated the M&E framework in its other projects and operations.

b. M&E Implementation
The ICR (para 72) states that “The M&E function was managed satisfactorily by ERAV for the purposes of reporting.” The ICR indicated that the Bank task team agreed a common template with the PCs, which collected and reported monthly on the M&E indicators to the Bank task team. The PCs collected data using their Integrated Business Management System modules, including the Customer Management System, Distribution Management System, and the Metering Data Management System which was installed under the project. The data on PDO Indicators were calculated by the PCs (consistent with the guidelines of the revised distribution code), aggregated, and submitted to EVN, MOIT, and the Bank. The Bank task team also developed a special project monitoring template for the IAs to use to report monthly on performance against intermediate indicators of implementation progress (e.g., procurement, construction, and payment status). The ICR also stated that “if any issues emerged, the team gave adequate support such as advice or site visits to help the IAs solve any problem early in the subproject lifetime.”

c. M&E Utilization
The M&E performance data proved effective in assessing implementation progress and making decisions on remedial actions when there were delays. The data were submitted to ERAV and were used for load forecasts and planning of network maintenance and improvements. According to the ICR (para 71), “Some of the project indicators (SAIDI, SAIFI, and MAIDI) are now used by the EVN for annual performance evaluation of the PCs.” EVN utilizes the M&E framework and draws from it for the monitoring of all their projects.

M&E Quality Rating
High

10. Other Issues

a. Safeguards

The project triggered two social safeguard policies: Involuntary Resettlement (OP/BP 4.12) and Indigenous Peoples (OP/BP 4.10). A Resettlement Policy Framework, Ethnic Minority Policy Framework, and where relevant Resettlement Action Plans, and Ethnic Minority Development Plans were prepared, reviewed, cleared and disclosed following requirements of the Bank and the Government.

The project also triggered the safeguard policy OP 4.01 on Environmental Assessment and was classified a Category B given the potentially negative impacts during implementation of civil works for the sub-projects under Component A. EVN prepared and adopted an Environmental Management Framework (EMF) that was applied to all sub-projects, and for which Environmental Management Plans (EMPs) were prepared in accordance with the EMF. The EMF and EMPs were disclosed in the Vietnamese language at the Vietnam Development Information Center (VDIC), EVN, the PMUs, and the sub-project area provinces; they were also disclosed in English at the Bank's Infoshop.

The ICR (para 75) states that "Overall, the social and environmental safeguard issues were addressed adequately in the project design to minimize social and environmental impacts and ensure compliance with the relevant World Bank safeguard policies." The PMUs allocated staff specifically dedicated for managing environmental safeguards. Environmental requirements were included in all bidding documents and achieved compliance, based on monitoring of the environmental performance of contractors. Reports on safeguards compliance were periodically submitted to the Bank. Issues identified during implementation supervision missions were always addressed and there were no outstanding environmental issues. The ICR (para 76) indicates that "The safeguards rating at project close was 'Satisfactory' for both environmental and social safeguards. Throughout the project cycle, the project complied with all safeguard policies triggered."

The ICR further states (para 78) that "A major success of the project is the integration of the World Bank's safeguards policies into the EVN's day-to-day project activities, owing to the success registered by following the World Bank's policies and procedures related to social and environmental safeguards management. The EVN is now using the World Bank template for their own and other financier-funded projects."

b. Fiduciary Compliance

The ICR (para 80) indicates that "Financial management complied with the Bank's policies and procedures throughout the project's life and was rated Satisfactory at project closing." The ICR goes on to state that the financial management (FM) function was managed by the Accounting and Finance division and project management teams at all IAs. The FM arrangements were designed to be decentralized – with each PC responsible for budget preparation, financial reporting and auditing, contract and expenditures management, expenditures verification, and accounting records maintenance. The PCs also managed project-designated accounts at commercial banks for each of IDA and CTF sources. The PCs submitted quarterly Interim Financial Reports (IFRs) to the Bank. Independent firms conducted annual financial audit; audit reports of acceptable quality were submitted to the Bank before end of June of the following year as required by the Financing Agreement. EVN and the PCs also submitted to the Bank their entity audited financial statements in line with International Financial Reporting Standards. The ICR (paragraph 80, page

27) indicates that "Financial Management complied with the Bank's policies and procedures throughout the project's life and was rated Satisfactory at project closing."

Procurement. According to the ICR (para 79), "Procurement performance was rated 'Satisfactory' at project closing" as a result of clear procurement regulations, training from the PCs and the World Bank, and intensive guidance and monitoring from the procurement expert in actual preparation of the bidding documents and the bid evaluation. During the project period, no cases of fraud and corruption were detected.

c. Unintended impacts (Positive or Negative)

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d. Other

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11. Ratings

Ratings	ICR	IEG	Reason for Disagreements/Comment
Outcome	Highly Satisfactory	Highly Satisfactory	
Bank Performance	Highly Satisfactory	Highly Satisfactory	
Quality of M&E	High	High	
Quality of ICR	---	Substantial	

12. Lessons

The ICR presented five useful lessons from the project. They are summarized below with some changes in presentation by IEG:

To increase the likelihood of achieving PDOs, projects need to be designed in close alignment with government strategies and objectives; have high technical relevance and solid preparatory work; maintain strong government ownership during preparation and implementation; and receive support from strong governance structures. Power system planning in Vietnam's energy sector is centrally managed but decision-making is collective. This process requires that all sub-projects for implementation should be aligned with the National Energy Development Strategy (NEDS). The lesson from implementing this project was that the collective decision-making process ensured that there was sufficient buy-in from the management and staff of the power companies, which increased incentives for successful project delivery.

The achievement of outcomes depends on technically sound analysis of sub-projects and maintenance of technical expertise within the sector. The PCs carried out a series of technical studies during project preparation to facilitate the detailed design of specific project activities. All five

PCs conducted surveys during project preparation to assess the potential for smart grid technologies in each PC, identify implementation challenges, and propose technologies for future development. This laid the groundwork for defining the longer-term road map for introducing new technologies such as smart meters, SCADA, unmanned substations, and improvement in the business services such as call centers, customers' satisfaction, and so on. Technical resources also typically remained within the energy sector, thus achieving technical stability within the sector institutions (MOIT, ERAV, EVN, and PCs), and thereby ensuring continuity and sustenance of the project outcomes.

The successful implementation of a large, complex project requires close and effective supervision--both by the Implementing Agencies (IAs) and the Bank team—and capable staff in the IAs. Project management was complex given the large number of sub-projects under three different components that were implemented by five different IAs. The lesson was that the structure of project implementation encouraged decision making at the lowest practicable level, to facilitate quick decision-making during implementation. The field-based Bank task team consisted of experienced team members, which facilitated close monitoring of project implementation. The project management board established in each IA also had strong and capable teams, with cross-cutting technical and project management skills.

Flexibility in project management—including aspects of physical scope and approvals—is essential for the sustained success of large complex projects. The lesson from this project was that it was essential that the PCs (the implementing agencies) be able to quickly adjust to unexpected conditions as they arose. The project benefited from the flexibility of the phased approach to project implementation as decisions on sub-project selections were made based on those which had the flexibility to be implemented more quickly. Continuously introducing further flexibility during project implementation also helped to shorten time for critical decisions.

Involving all relevant stakeholders including local authorities early in the project preparation process is critical to successful safeguard activities. Land acquisition and resettlement activities required for investments are becoming increasingly difficult in Vietnam. The project suffered delays due to delayed approvals for land acquisition, and in some cases, the works portion of five sub-projects could not be completed within the project lifetime; hence the project financed only the relevant material supply. The lesson from this project's experience was that there are benefits from early consultations with the relevant local authorities outlining the benefits and potential impacts of the project and receiving their consensus before project implementation. For further strengthening the implementation of social safeguards, the areas where more emphasis was needed included the following: (a) information disclosure and consultation at project preparation, in a more targeted/tailored manner; (b) implementation of developmental activities (for example, training) provided to ethnic minority communities; and (c) close collaboration with the local authorities to match the proposed developmental support and local needs.

13. Assessment Recommended?

No

14. Comments on Quality of ICR

The ICR was well prepared and thorough. The country, sector and strategic contexts were well articulated and provided solid justification for the project. The results chain was causally logical and included the critical assumptions, although the box on outputs for Component C was unclear. The ICR was evaluative and placed a large emphasis on accountability by providing concrete evidence behind the intermediate and final outcomes. Albeit long with 33 pages for the main text, the ICR put a lot of effort in delineating the project's implementation record and how specific issues evolved and were resolved. The ICR's format and internal substance within each section complied generally with the Bank's guidelines on ICR preparation. The lessons were closely based on the project's implementation experience and could have valuable and broad replicability for other similar Bank energy projects. The main messages, however, could have been more succinctly and clearly articulated. Some of the data, such as in Table 3 and paragraphs 35, 36 and 37, could have been more elaborated by providing more information

a. Quality of ICR Rating
Substantial