

INVESTING IN RENEWABLE ENERGY GENERATION AND POWER TRANSMISSION IN EASTERN INDONESIA

Lessons Learned from ADB's Renewable Energy
Development Sector Project and Power Transmission
Improvement Sector Project

Bagus Mudiantoro, Joy Galvez

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6 ADB Avenue, Mandaluyong City, 1550 Metro Manila, Philippines
Tel +63 2 632 4444; Fax +63 2 636 2444
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EXECUTIVE SUMMARY

This paper documents lessons learned during the implementation of two loans: (i) the Renewable Energy Development Sector Project¹, and (ii) the Power Transmission Improvement Sector Project². These loans were implemented by the Asian Development Bank (ADB) starting in 2002 to develop stronger and more sustainable power supplies in Indonesia, with a particular focus on outer islands in eastern Indonesia, and to encourage greater incorporation of renewable energy into Indonesia's national power supply.

These loans were designed and implemented to address challenges facing electrification efforts in Indonesia. Electrification in Indonesia is disproportionately oriented towards industrial centers on the islands of Java and Bali, leaving thousands of outer islands – particularly in Eastern Indonesia – with low electricity access and an enduring reliance on fossil fuels.

To reach more customers and facilitate rural electrification in the early 2000s, the Indonesian government began promoting renewable energy generation and power transmission improvements, with a greater role for the private sector. Electricity Law No. 20/2002 supported Indonesia's Power Sector Restructuring Policy of 1998 and provided the necessary legal framework to establish a competitive market for renewable energy-based power generation.

ADB designed and implemented two projects – the Renewable Energy Development Sector Project and the Power Transmission Improvement Sector Project – to align with the government's strategy of making more energy available in a least-cost and environment-friendly manner. In the present day (2015), electricity access remains low in remote areas of Indonesia, and the country continues to rely heavily on fossil fuels. In light of the government's recent efforts to achieve 100% electrification by 2020 and significantly increase its use of renewable energy, the lessons learned in implementing these two projects remain highly relevant today. This paper will present the lessons learned in implementing these two projects for the further consideration of PLN, development partners, the private sector, and other stakeholders in the energy sector.

Lessons Learned

Both projects were designed with a two-year implementation period but eventually took 10 years to complete. Both projects faced delays during implementation due to contractor performance, safeguards requirements and compliance issues, and a number of other pressing factors. During the implementation of both projects, ADB, PLN, and the project implementation consultant (PIC) learned which implementation modalities worked and which did not work. Lessons learned center particularly on the time and documentation required to comply with both ADB's safeguards requirements and the government's permitting and land acquisition requirements, and the importance of information management and communication.

¹ Loan 1982-INO: Renewable Energy Development Sector Project. 2002.

² Loan 1983-INO: Power Transmission Improvement Sector Project. 2002.

Engineering, Procurement, and Construction

The Renewable Energy Development Sector Project used the engineering, procurement, and construction (EPC) modality, which placed the entire responsibility for the design, procurement, and construction of each of the power plants on the contractor at a fixed price and completion date. After assessment, it was determined that the EPC modality was effective for the geothermal power projects, but less effective for the hydropower projects, which could have been better implemented by separating engineering services, civil and electromechanical works, and equipment procurement. The contractors lacked practical experience in implementing EPC, while project delays due to safeguards issues also impacted project costs and contractor performance.

Cost of Renewable Energy Development

The average cost of the power plants was US\$2.8 million per megawatt of electricity. The average cost of engineering, procurement and construction was US\$2.0 million per megawatt, while the remaining US\$0.8 million was spent on development costs including safeguards compliance, environmental management, site supervision, and project management. By comparison, the cost of diesel-based power generation in remote regions is only about US\$1 million per megawatt. This poses a challenge to the cost efficiency of renewable energy-based power generation in remote regions.

Social Safeguards and other Compliance Issues

Both projects experienced difficulties in complying with ADB's safeguards requirements and securing land and forestry permits, and rights of way from the government. Project acceptance from affected people also presented some degree of difficulty, which contributed to project delays. Differences in ADB's and PLN's requirements and approaches to social safeguards likewise contributed to confusion in project implementation.

To compensate for land acquisition and address community acceptance, the projects implemented livelihood restoration programs such as training in automotive repair, welding, cocoa farming, and the provision of chickens to affected households. Other benefits were also provided to communities, including the installation of water supply systems, the construction of access roads, and the restoration of monuments.

Communication

Clear and timely communication among project stakeholders is critical to effective project implementation. Differences in policy and practice between ADB and PLN could be mitigated by clarifying these at the outset, although ADB's social safeguards policy was relatively new and being applied for the first time in Indonesia while the project was being approved and implemented. PLN also had its own corporate social responsibility mandate, which had to accommodate this new safeguards policy, in relation to project implementation. Clear and timely communication would also help to resolve confusion about different terminologies and document requirements.

Capacity Building and Information Management

Technical and financial management capacities were affected by human resources shortfalls, high staff turnover, and organizational changes. There was a lack of continuity and ownership of the projects, and the frequent changes in project personnel gave rise to variations in the way the projects were supervised, especially on the application of ADB's social safeguards requirements, as well as the correct interpretation and application of EPC contracts. Therefore, it is important for other such projects to ensure that information management is built into the design and that implementation procedures require proper and timely documentation. Record-keeping of project progress needs to be built into standard operating procedures and/or manuals of operations. Periodic information and documentation-sharing among stakeholders can ensure continuity and proper turnover among ADB and PLN, project personnel, consultants, and contractors.



Mongango Mini-Hydro Power Plant in Gorontalo, island of Sulawesi (*Bagus Mudiantoro*)

I. INTRODUCTION

This paper documents lessons learned during the implementation of two loans: (i) the Renewable Energy Development Sector Project³, and (ii) the Power Transmission Improvement Sector Project⁴. These loans were implemented by the Asian Development Bank (ADB) starting in 2002 to develop stronger and more sustainable power supplies in Indonesia, with a particular focus on outer islands in eastern Indonesia.

Delays during the implementation of both projects resulted in extensions from their designed two-year implementation period, eventually needing 10 years to be completed. This paper will

³ ADB. 2002. *Loan 1982-INO: Renewable Energy Development Sector Project*. Manila; ADB. 2015. *Project Completion Report: Renewable Energy Development Sector Project*. Manila.

⁴ ADB. 2002. *Loan 1983-INO: Power Transmission Improvement Sector Project*. Manila; ADB. 2015. *Project Completion Report: Power Transmission Improvement Sector Project*. Manila.

present the lessons learned in implementing these two projects, since many lessons continue to be relevant to PLN, development partners, and the private sector.

Power Sector Overview

Indonesia presents a challenging context for electrification. The archipelago is comprised of over 17,000 islands, of which more than 6,000 are inhabited. In 2000, when the projects were being designed, the power supply of the State Electricity Company (PLN) reached only 53 percent of the estimated 52 million households in Indonesia. Electrification is disproportionately oriented towards power centers on the islands of Java and Bali, leaving widespread areas of the country with low energy access – especially in Eastern Indonesia. The largest islands in Eastern Indonesia are Papua and Sulawesi, which are energized by small-to medium-sized power grids. The rest of the smaller islands spread across Eastern Indonesia depend largely on expensive fossil fuel-based electricity generation.

In 2000, Indonesia's power generation was dominated by the State Electricity Enterprise (PLN) with a capacity of 21,000 megawatts (MW), 74 percent of which came from the Java-Bali power grid and 26 percent of which came from over 1,100 power grids in Sumatra, Kalimantan, and Sulawesi. Commercial power plants under PLN subsidiaries Indonesia Power and PT Pembangunan Jawa Bali added an aggregate capacity of 12,000 MW, and independent power producers (IPPs) generated an additional 3,000 MW. PLN's power supply served about 30 million customers, but PLN's supply only extended only to 84 percent of the country's villages, and reached only 53 percent of an estimated 52 million households.

Moment of Reform

In the early 2000s, to reach more customers and provide more electricity to remote regions of Indonesia, the Indonesian government promoted power generation from both renewable energy generation and power transmission improvements with a greater role for the private sector. Electricity Law No. 20/2002 supported Indonesia's Power Sector Restructuring Policy of 1998, and provided the necessary legal framework to establish a competitive market for renewable energy-based power generation. Law No. 20/2002 also required the creation of an independent regulatory body for the electricity market, and the unbundling of power generation, transmission, distribution, and supply.

At the time, ADB was promoting a power sector strategy of making more energy available in a least-cost and environment-friendly manner, and improving energy access, especially for the poor. Key components of this approach included least-cost means and establishing greater transparency in mobilizing and utilizing resources, having a competitive environment that promotes private sector investment, and increasing supply- and demand-side efficiencies. ADB sector strategy also sought to consider the regional and global environmental impacts of power generation and to encourage, to the greatest extent possible, greater use of renewable energy sources.

In support of the government's policy and consistent with its power sector strategy to make more energy available in a least-cost and environment-friendly manner, the ADB designed and

implemented the Renewable Energy Development Project and the Power Transmission Improvement Sector Project.

A Changing Context

Electricity Law No. 20/2002, the legal basis for the creation of a competitive electricity market, was annulled in 2004. The Renewable Energy Development and Power Transmission Improvement Sector Projects had to be restructured accordingly.

Components were canceled in both projects for creating a formula-based automatic tariff adjustment scheme and changing PLN's strategic business units into power companies. Two additional special features were canceled in the Power Transmission Improvement Sector Project: the power sector restructuring program and the establishment of an internal corporate governance framework. The information and communication technology (ICT) component of the transmission project was then replaced with the construction of a supervisory control and data acquisition (SCADA) master station in Kalimantan to improve power dispatching between the island's east and south power grids.

In addition, during the implementation of the two projects, PLN went through several phases of organizational restructuring that affected the project's implementation schedule. The Director for Construction was replaced by the Strategic Planning Director, which shifted the focus from actual project construction to PLN's medium- and long-term planning. Project construction was then delegated to the Operations Directors of the respective regions under which the project and its subprojects fell. PLN's project implementation units were also realigned and their geographic coverage changed. These organizational changes resulted in coordination and contract administration issues, as well as implementation delays.

II. RENEWABLE ENERGY DEVELOPMENT PROJECT

The Renewable Energy Development Project was envisioned to expand renewable energy use by about 82 MW, displace energy generated by fossil fuels of about 480 gigawatt hours (GWh) annually, and reduce greenhouse gas emissions. Although the power plants were of relatively small capacity, each equal to or less than 20 MW, they would have accounted for 5 to 10 percent of power generation in their respective power grids, mostly in remote regions of eastern Indonesia.

Design and Implementation History

The project was designed with three special features:

- (i) use of renewable energy resources, which was envisioned to establish benchmarks for base and total costs for similar projects by the government and the private sector;
- (ii) formula-based automatic tariff adjustments from 2006 onwards to make tariffs more transparent and to enable PLN to recover costs and generate sufficient cash flows for new investments; and
- (iii) conversion of PLN's strategic business units into power companies in the outer islands, where the provincial and local governments would participate in project design and implementation, help prepare provincial power development plans, and raise provincial electricity tariffs to generate resources to fund development plans.

Special features (ii) and (iii) were the basis for classifying the project as a sector loan, as they were designed to improve Indonesia's power sector by helping PLN recover costs and generate sufficient cash flows for new investments as well as establishing a competitive electricity market with increased private sector participation in generation and distribution.

Due to the annulment of the Electricity Law 20/2002 in 2004, two of the three special features of the project (establishing a formula-based automatic tariff adjustment mechanism and converting PLN's strategic business units into power companies) were canceled. As a result, the project was converted from a sector loan to a project loan because the special features that were canceled were part of Indonesia's power sector improvement program. Although the strategic business units were not converted into independent power companies, the new Electricity Law of 2008 opened electricity generation and distribution to private sector participation.

Over the course of implementation, social safeguards issues and poor contractor performance affected the subprojects' completion. Three subprojects were eventually cancelled, in large part due to issues of social and environmental safeguards.⁵ To reach or get close to the project's targeted additional generating capacity, an additional subproject at Lahendong IV GPP (20 MW) was added in 2008.

⁵ The subprojects canceled were: (i) the Amai mini-hydro power plant (MHPP) (1.10 MW) and (ii) the Tatui MHPP (1.20 MW) in 2007 due to opposition from indigenous people on the sites and high demand for land compensation, and (iii) the Poigar 2 hydro power plant (HPP) (30 MW) in 2009 due to failure to acquire a forestry permit for the site.

Outputs

Ten subprojects were implemented through the engineering, procurement and construction (EPC) modality, with the contractor responsible for the design, procurement, and construction of each of the power plants at a fixed price and completion date. Six mini-hydro, one hydro, and three geothermal power plants were built under the project and connected to PLN's existing transmission and distribution networks in Eastern Indonesia.

The project cost US\$266.28 million and was implemented over 10 years. The ADB provided a loan of US\$152.51 million and the Indonesian government provided a financing counterpart of US\$83.77 million. The project added a total of 74.80 megawatts (MW) of installed capacity to Indonesia's eastern islands, with an estimated total annual energy output of 524 gigawatt hours. By using renewable sources, the project strengthened PLN's power grids and will provide fuel savings to PLN's operations.

The environmental impact of the project is also significant in terms of avoided pollution from fossil fuel-based energy generation, such as diesel, as well as avoided carbon dioxide emissions. Table 1 presents a summary of technical specifications for each of the power plants.

Table 1. Renewable Energy Development Sector Project Subprojects

| Power System | | Installed Capacity (MW) | Annual Energy Output (GWh) | Estimated GHG Emissions Avoided (tco ₂ e) ^a |
|--------------------------------|------------|-------------------------|----------------------------|---|
| Mini-Hydro Power Plants | | | | |
| Lobong | Sulutenggo | 2 x 0.80 | 11.90 | 3,950.80 |
| Merasap | Bengkayang | 2 x 0.75 | 7.44 | 5,453.52 |
| Mongango | Sulutenggo | 2 x 0.60 | 8.20 | 2,722.40 |
| Ndungga | Flores | 2 x 1.00 | 12.40 | 9,920.00 |
| Prafi | Manokwari | 2 x 1.25 | 8.90 | 7,120.00 |
| Santong | Lombok | 1 x 1.00 | 6.10 | 4,880.00 |
| Hydro Power Plants | | | | |
| Genyem | Jayapura | 2 x 10.00 | 115.00 | 92,000.00 |
| Geothermal Power Plants | | | | |
| Lahendong II | Sulutenggo | 1 x 20.00 | 158.00 | 52,456.00 |
| Lahendong IV ^b | Sulutenggo | 1 x 20.00 | 164.00 | 54,448.00 |
| Ulumbu | Flores | 2 x 2.50 | 32.00 | 25,600.00 |

GHG = greenhouse gas, GWh = gigawatt hour, MW = megawatt

^a Based on emissions factors determined by the Division of Carbon Trading Mechanisms of the National Council on Climate Change.

^b Lahendong IV was added in 2008 to replace Poigar 2.

Benefits

All the mini-hydro power plants (MHPPs) are now in full commercial operation and have strengthened their respective small and medium power systems in eastern Indonesia.

Aside from providing much-needed electricity in the outer islands, the project also provided additional benefits to the communities surrounding the power plants. These included installation of water supply systems in Genyem and Ndungga; provision of livelihood training in automotive repair, welding, and cocoa farming in Genyem; upgrading of the Marian Grotto in Merasap, construction of a water monument in Ndungga, and rehabilitation of churches in Prafi; provision of water stations and public houses in Prafi; and construction of sealed access roads in Merasap and Santong.

The project provided a baseline overview of the cost of renewable energy-based power generation in remote regions of Indonesia, and will help future sector planning and project design in power generation. Estimated and actual costs from the project are provided in Table 2.

Table 2. Estimated and Actual Project Costs⁶
(\$ million)

| Component | Appraisal Estimate | Actual |
|--|---------------------------|---------------|
| Renewable energy | 185.20 | 215.69 |
| Consulting services | 2.50 | 9.88 |
| Earthquake and tsunami emergency rehabilitation ^a | | 2.59 |
| Technical assistance cost recovery | | 0.57 |
| Total base cost | 187.70 | 228.73 |
| Physical contingency | 18.70 | |
| Price contingency | 9.40 | |
| Total contingencies | 28.10 | 0.00 |
| Interest during construction | 19.90 | 13.74 |
| Tax | 18.70 | 22.20 |
| Front-end fee | 1.60 | 1.61 |
| Total | 256.0 | 266.28 |

Source: Asian Development Bank and State Electricity Company (PLN).

^a The tsunami emergency fund was not part of the original project scope. The government requested assistance following the 2004 tsunami, and \$2.59 million was set aside from the project's contingency funds.

Power Welfare Scheme

To help facilitate access to electricity among community beneficiaries in the project sites, technical assistance (TA) was designed and implemented to assist low-income rural households to access and utilize electricity. The power welfare scheme (PWS) was designed to establish a revolving loan fund to provide initial capital expenses for electricity use, such as subsidizing connection fees and buying and installing electric fixtures.

⁶ ADB. 2015. *Project Completion Report: Renewable Energy Development Sector Project*. Manila.

Three community beneficiaries were selected for the pilot phase of the PWS with four main PWS interventions: household electricity connections, household-level livelihood activities, community-level livelihood activities, and public facility support.

At TA completion, 511 households were connected to the mini-hydro power plants in the communities of Buata, Lobong, and Poyuyan, and livelihood equipment for pineapple processing and cold storage and cacao processing were delivered to the communities. The TA also upgraded public health centers, provided information technology equipment to junior high and elementary schools, improved preschool and community centers, provided public street lighting and household livelihood equipment. Livelihood training was also conducted on computer literacy, mechanical engineering, bread processing, livelihood marketing, and sewing machine use.

Lessons Learned

Engineering, Procurement, and Construction

The use of the EPC modality was proven effective for the geothermal power subprojects, but less effective for the hydropower subprojects. Only Lahendong II was contracted and implemented immediately after loan effectiveness, while the other nine subprojects experienced delays in bid processing, compliance with land acquisition and resettlement requirements, and engineering or geological issues. Three subprojects were eventually cancelled due to unresolved land acquisition or contracting issues. These were the Poigar hydropower project and the Amai and Tatui mini-hydro power projects. Lahendong IV was later added, and the other completed subprojects were the Lobong, Merasap, Mongango, Ndungga, Prafi, and Santong MHPPs, the Genyem HPP, and the Ulumbu GPP.

While the geothermal power subprojects benefited from the EPC modality, the hydropower projects could have been better implemented by separating engineering services, civil and electromechanical works, and equipment procurement. One of the major issues of applying the EPC modality in this project was the lack of experience of contractors, while project delays due to land acquisition and community acceptance also impacted project costs and contractor performance.

In the case of Ulumbu GPP, very poor performance by the original contractor resulted in the contract being terminated. The project was subsequently completed by two new contractors under ADB's direct selection methodology.

BOX 1. EPC Modality: the case of the Lahendong II Geothermal Power Project

Lahendong II is a good example of the effective use of the engineering, procurement and construction (EPC) modality. A single contractor was given the task of implementing the subproject in its entirety—from procuring equipment and materials to designing and construction the power plant.

The power plant suffered no delays in implementation because its proximity to Lahendong I meant that the site was already ready. The contractor for Lahendong II also had extensive experience in implementing the EPC modality in its other projects. Finally, for Lahendong II, a steam purchase agreement between PLN and Pertamina was already in place before construction began.

Lahendong II Geothermal Power Project

| | |
|----------------------|------------------------------|
| Generating capacity: | 20 MW |
| Location: | Tomohon, North Sulawesi |
| Contractor: | Sumitomo Corporation (Japan) |
| Contract signed: | October 11, 2005 |

| | |
|-------------------------------|-------------------|
| Total project cost: | US\$31.89 million |
| Original construction period: | 20 months |
| Actual construction period: | 20 months |

Construction, commissioning and plant performance testing of this project were completed on schedule in June 2007 and the power plant has been in full commercial operation since January 2008.

Project preparation, bidding, and contract commencement were completed from June 2004 to October 2005. PLN approved the design information and drawings, and held monthly progress meetings with the contractor. Civil works, site construction, and materials delivery were completed the following year, in 2006. Equipment installation and commissioning were completed shortly thereafter. The unit was first synchronized with the PLN network on April 24, 2007 and full load operation was achieved three days later. PLN issued the Taking-Over Certificate (TOC) to the contractor on June 19, 2007, after a 30-day reliability test run.

Full load commercial operation was achieved on January 29, 2008 after Pertamina completed the steam line for Lahendong II.

Cost of Renewable Energy Development

One of the objectives of the project was to attract more private sector involvement in energy generation, especially in the use of renewable sources. The project aimed to establish a baseline cost for developing renewable energy projects in order to contribute to better energy services policy planning.

After loan closing and project completion, the average cost of building the 10 power plants was found to be US\$2.8 million per megawatt of electricity. The bulk of this average cost was for construction (US\$2.0 million per megawatt), and the remainder (US\$0.8 million) was for development costs, which included safeguards compliance, environmental management, site supervision and project management.

The three different types of power plants built by the project had varying ranges of costs, mainly attributable to their technologies, required site preparation and construction, energy resource used, and social and environmental impacts. The mini-hydro power plants had the lowest cost, but also had low energy outputs with generating capacities ranging from 1 MW to 2.5 MW. The average cost of each of the mini-hydro power plants—Lobong, Merasap, Mongango, Ndungga, Prafi, and Santong—was US\$6.51 million, with construction cost at an average of US\$2.58 million, plus an average development cost of US\$3.93 million. The average cost of mini-hydro power per megawatt is US\$1.76 million.

Although located on the same site, the cost of Lahendong IV was almost double the cost of Lahendong II. The cost of Lahendong II was lower because it did not require major preparatory work; this was mostly completed through prior donor collaborations, and the location had already been cleared of its low safeguard requirements. On the other hand, Lahendong IV required major preparations to connect to the adjacent Lahendong III (a distance of 2-3 kilometers) and to obtain an extra turbine blade. Safeguard issues for Lahendong IV involved lengthy land acquisition processes, at significantly greater cost to PLN than Lahendong II, since PLN also had to resolve remedial actions involving livelihoods for Lahendong III.

As a result, the cost of Lahendong IV totaled US\$61.18 compared to Lahendong II at US\$31.89. The average cost per megawatt of energy produced was US\$1.59 million for Lahendong II and US\$3.06 million for Lahendong IV. The Ulumbu GPP, at project closing but before completion, was estimated at US\$17.3 million for 2 x 2.5 MW. The average cost of geothermal power per megawatt is US\$2.29 million.

The lone small hydropower plant built by the project, the Genyem HPP, was estimated to have cost US\$51.64 million when it was completed in the third quarter of 2015. This brings the average cost of small hydropower per megawatt to US\$2.58 million.

The cost efficiency of renewable energy-based power generation in remote regions poses a challenge to both the government and independent power producers, when the installation cost of diesel-based power generation is only US\$1 million per megawatt.

The financial and economic rates of return (FIRR and EIRR) need to improve for such projects to be implemented on a wider scale. The project had an average FIRR of 4.0 percent and an average EIRR of 33.9 percent. While the FIRR is low given the high development cost involved in each of the subprojects, the economic benefits of the project are high because of increased productivity, and positive health and environmental impacts.

BOX 2. Cost vs. benefits: the case of the Lahendong IV Geothermal Power Project

Construction cost for Lahendong IV's 20-MW power plant was US\$3.06 million per megawatt of electricity. Construction cost reached US\$43.50 million and development costs reached US\$17.68 million.

The high cost of Lahendong IV was attributed to the higher costs of materials and labor, as well as the short turnaround time required from the contractor. The subproject was implemented in less than 2 years, completed in 2011 after it replaced the 30-MW Poigar 2 HPP in 2009, which was canceled due to an unsecured construction permit from the Ministry of Forestry. Lahendong IV has been in full commercial operation since January 2012.

| | |
|-------------------------------|------------------------------|
| Generating capacity: | 20 MW |
| Location: | Tomohon, North Sulawesi |
| Contractor: | Sumitomo Corporation (Japan) |
| Contract signed: | November 20, 2009 |
| Total project cost: | US\$61.18 million |
| Original construction period: | 21.5 months |
| Actual construction period: | 21.5 months |

Similar to Lahendong II, steam supply for Lahendong IV was temporarily provided by Pertamina from the adjacent Lahendong III. The permanent steam supply was finally made available on October 17, 2011.

Social Safeguards and other Compliance Issues

Compliance with safeguards requirements was one of the challenges faced by the project. The project experienced difficulties in acquiring land, securing forestry permits, and soliciting project acceptance from affected people. Social safeguards were implemented for the Lobong, Merasap, Mongango, Ndungga, Prafi and Santong MHPPs and the Genyem HPP. While no social impacts were initially identified in the case of the Ulumbu GPP, it was found through due diligence that the compensation provided by PLN for affected crops cultivated by local people on PLN-owned land was satisfactory. The compensation included access to electricity and livelihood programs provided through PLN corporate social responsibility funding. None of the land acquisition and resettlement plans (LARPs) involved relocating affected households.

At the time the project was approved and during its implementation, ADB and the Indonesian government had legal frameworks to address land acquisition and the resettlement of affected people. Table 2 details the regulations and policies that were applied to the project.

Table 3: Policy Environment on Land Acquisition, Resettlement, and Social Safeguards

| Before loan effectiveness | After loan effectiveness |
|---|---|
| Government of Indonesia | Government of Indonesia |
| <ul style="list-style-type: none"> i) Presidential Decree No. 55/1993 on Land Acquisition for the Development of the Public Interest ii) Regulation No. 1/1994 of the State Minister of Agrarian Affairs and National Land Agency on the Operational Directive of Presidential Decree No. 55/93 | <ul style="list-style-type: none"> i) Republic Law No. 2/2012 on Acquisition of Land for Development in the Public Interest ii) Presidential Regulation No. 71/2012: Implementing regulation for Law No. 2/2012; and Presidential Regulation No. 40/2014: Amendment to Presidential Regulation No. 71/2012 iii) National Land Agency Guideline No. 5/2012 on Land Acquisition for Development in the Public Interest iv) Ministry of Finance Regulation No. 13/PKM.02/2013 on Operational and Supporting Cost for Implementation of Land Acquisition in the Public Interest from the National Budget v) Ministry of Home Affairs Regulation No. 72/2012 on the Operational and Supporting Cost for Implementation of Land Acquisition in the Public Interest from Regional Budgets |
| Asian Development Bank | Asian Development Bank |
| <ul style="list-style-type: none"> i) Involuntary Resettlement Policy (1995) ii) Handbook on Resettlement (1998) | <ul style="list-style-type: none"> Social Safeguards Policy Statement (2009) |

BOX 3. Indigenous People and Traditional Culture: the case of the Genyem Hydropower Project

Genyem HPP encountered a number of difficulties before and during its construction. In particular, the subproject was severely delayed due to the contractor's lack of experience in implementing EPC projects, social safeguards compliance, and securing permits.

| | |
|-------------------------------|---|
| Generating capacity: | 10 MW |
| Location: | Papua |
| Contractor: | Waskita-GXED/TKL Consortium (Indonesia and China) |
| Contract signed: | November 24, 2008 |
| Total project cost: | US\$51.64 million (estimated) |
| Original construction period: | 32 months |
| Actual construction period: | 80 months |

Around 150 hectares of tribal land—*tanah suku*—was required for the power plant and a local nongovernment organization was contracted to conduct *adat*-sensitive (traditional culture) participatory mapping of the project area to determine clan ownership, clan-member occupation and user rights, and communal rights. This was followed by internal clan meetings, further consultations and clarification, and negotiations between PLN and clan representatives. A Community Development Action Plan and a joint land acquisition and resettlement plan/indigenous people's development plan with a compensation package were developed. These documents became the basis for an agreement between the local government and the clan. The whole process, from mapping to forging an agreement took more than a year and a half to complete.

While the affected clan claimed all the land – including the forest, rivers, and underground wealth – as belonging to them, all forests are considered state land under national law. The Ministry of Forestry insisted on separately mapping the extent of forest area that was required by the power plant and taking an inventory of the number of trees to be affected. This resulted in increased costs for PLN as they had to provide compensation for the land belonging to the clan and secure a permit from and compensate the Ministry of Forestry for the use of state-owned forest. These processes further delayed project implementation by another 3.5 years.

In October 2015, the Papua and West Papua Region of PLN started the trial run of its machinery for the Genyem hydro power plant. Following a successful trial run, the electricity supply from Genyem will be permanently entered into the Jayapura power system.

Box 4. Securing land and permits: the case of the Poigar 2 Hydropower Project

The 30-MW Poigar 2 hydropower project (HPP) was envisaged to add 30 MW to the Minahasa power system in North Sulawesi. While all land crop compensation was paid to affected households as part of social safeguards compliance, the project was eventually cancelled after three years of unsuccessfully attempting to secure a permit from the Ministry of Forestry.

Poigar 2 Hydropower Project

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|----------------------|--|
| Generating capacity: | 30 MW |
| Location: | North Sulawesi |
| Contractor: | BCARE Consortium (Indonesia and China) |
| Contract signed: | February 11, 2008 |
| Total project cost: | US\$13.03 million |
| Contract cancelled: | July 3, 2009 |

Between 2002 and 2004, PLN conducted an inventory of losses (e.g., crops, land, etc.), negotiated and paid all compensation to affected households, and submitted a land acquisition and resettlement plan to ADB. Meanwhile, PLN had to apply for a permit from the Ministry of Forestry in 2005 to acquire land within a nature reserve for the power plant's proposed reservoir. This entailed a reclassification of the proposed area from a nature reserve to a protected forest. The Ministry of Forestry did not start the process of assessing the project area's reclassification until 2008.

Although the provincial government was keen on the project, after three years of unsuccessfully attempting to secure a forestry permit, and despite extensive and vigorous lobbying by PLN and the provincial governor, ADB proposed to PLN to consider dropping the Poigar 2 HPP from the loan and replacing it with the Lahendong IV GPP. The proposal was accepted and agreed in principle by the State Ministry of National Development Planning (Bappenas), PLN, and ADB. PLN made a formal request to the Directorate General of Electricity and Energy Utilization, which approved the cancellation of the project.

III. POWER TRANSMISSION IMPROVEMENT PROJECT

The Power Transmission Improvement Project was designed to remove power supply bottlenecks in selected power substations and high-voltage transmission lines in Java-Bali, interconnect the East and South Kalimantan power grids, and provide information and communication technology (ICT) for a competitive electricity market.

At project completion, the Java-Bali and Kalimantan subprojects were implemented, while the ICT component was dropped from the project after Electricity Law No. 20/2002 was cancelled in 2004. The project was implemented through nine contract packages: five in Java-Bali and four in Kalimantan.

The project cost totaled US\$173.75 million, with ADB providing a loan of US\$101.94 million from its ordinary capital resources. The project took 10 years to complete owing to delays and difficulty in acquiring land, securing permits and rights of way.

Design and Implementation History

The project was designed to align with the government's overall strategy to (i) expand the country's electricity supply based on a least-cost manner, (ii) improve supply efficiency and reliability, and (iii) make power generation and distribution more financially viable through the Power Sector Restructuring Strategy of 1998. In particular, the project was designed to address projected increases in electricity demand in the Java-Bali and Kalimantan grids.

The project outcomes were to include strengthening the Java-Bali power systems and interconnecting the outer island power grids, particularly the Kalimantan power systems. The project was also envisaged to support Electricity Law 20/2002 that was to create a competitive electricity market in Java-Bali. The annulment of Electricity Law 20/2002 in 2004 impacted special features of the project, particularly the unbundling of PLN's assets. Thereafter, the government requested to waive the automatic tariff adjustment mechanism from the special features of the project. However, despite the law's annulment, the project remained relevant to the government's priority to ensure reliable and efficient supply of electricity.

The ICT component in the project's original design included the supply and installation of information technology systems needed to operate the competitive electricity market, which was envisioned to deregulate the power sector and allow private sector participation. However, due to the annulment of Electricity Law 20/2002 in 2004, the ICT component was dropped from the loan. A supervisory control and data acquisition (SCADA) master station was later added to the project for the dispatching of 150 kV throughout Kalimantan to replace the ICT component.

Outputs

During the design stage of the project, the outputs included construction of new and upgrading of 150 kilovolt (kV) transmission lines, expansion of existing and building new 150 kV substations, and the creation of market facilities required for electricity trading. The transmission lines and substation components were either fully or partially completed. The market facilities

were not completed due to the cancellation of the ICT component, but the SCADA component in Kalimantan was later added instead.

The project constructed 251 kilometers (km) of 150 kV transmission lines in Java-Bali (49 km) and Kalimantan (202 km), upgraded and expanded 150-kV and 500-kV substations, expanded 11 x 150 kV and 5 x 500 kV substations in Java-Bali and 2 x 150 kV substations in Kalimantan, added 3 new 150 kV substations in Java-Bali and 2 x 150 kV substations in Kalimantan, and built a SCADA master station that strengthened power dispatching throughout the entire Kalimantan system.

Benefits

The project expanded and upgraded existing power substations and transmissions lines in Java-Bali, thus removing supply bottlenecks and improving electricity supply. The East and South Kalimantan power grids were connected, increasing the efficiency and reliability of the power supply.

The most significant impact of the project is the improved efficiency of electricity delivery to PLN's customers in Java-Bali and Kalimantan. Apart from the direct benefits to consumers of a more reliable power supply that can better support economic activities, benefits will also accrue to PLN and the government through fuel savings and efficient power dispatching.

Lessons Learned

Social Safeguards: land acquisitions and rights of way

The project suffered significant implementation delays mainly brought about by problems in land acquisition and obtaining rights of way (ROW) for the transmission lines.

Apart from difficulties in acquiring land and obtaining rights of way, ADB and PLN also had differences on how to address these issues. Whereas ADB required ROWs to be obtained before transmission towers were erected, PLN did so after the towers were constructed and before conductor stringing. This resulted in fragmented conductor stringing due to disputes over rights of way with affected people.

The Barikin-Tanjung transmission line in Kalimantan experienced construction delays for one year due to social safeguards compliance. The other subprojects' implementation delays were attributed to failures in reaching agreement on land compensation.

A total of 18 land acquisition and resettlement plans (LARPs) were drafted, with the time taken for LARPs to be prepared and approved by ADB ranging from 2.5 months to 28 months. This resulted in delays in construction mobilization, the worst of which was for the Barikin-Tanjung transmission line, at 15 months.

Box 5. Java-Bali: The case of the Sunyaragi–Rancaekek transmission line

Most of the transmission lines projects in Java-Bali and Kalimantan faced difficulties in securing permits and rights of way, as well as complying with social safeguards. In particular, for Java-Bali, the Sunyaragi-Rancaekek section of Package B3 had to be rerouted and reconfigured through a new dispatching arrangement. Therefore, the scope of works for the Sunyaragi-Rancaekek section was reduced to material supply only.

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|----------------------------------|------------------------------------|
| Transmission line specification: | 150 kV |
| Section: | Sunyaragi-Rancaekek |
| Distance: | 86 km |
| Contractor: | HGPT Consortium |
| Contract date: | November 2010 |
| Total project cost: | US\$17.82 million (entire package) |

Box 6. Kalimantan: Responding to priorities

The subprojects in Kalimantan experienced reconfiguration and rerouting in order to respond to PLN's priority to meet the growing demand from its customers. New 150 kV substations in Tanjung and Kuaro were built and the substations in Barikin and Karang Joang were extended. The Barikin-Tanjung and Kuaro-Tanjung 150 kV transmission lines were also built, while the Karang Joang-Kuaro transmission line had to be rerouted to pass through the new Petung substation and Teluk Balikpapan power plant. The project completed 77.8 km of conductor stringing between the Kuaro and Tanjung substations.

Communication

Clear and timely communication among project stakeholders was found to be critical to effective project implementation. Differences in policy and practice between ADB and PLN, especially on social safeguards compliance, could have been mitigated by clarifying these at the outset, although ADB's social safeguards policy were relatively new and being applied for the first time in Indonesia while the project was being approved and implemented. PLN also had its own corporate social responsibility mandate, which had to accommodate this new safeguards policy, in relation to project implementation.

Use of terminology and confusion about document requirements were also sources of delay for project implementation. For example, with regard to safeguards compliance, *resettlement* appeared in most ADB-required documents, as in *Land Acquisition and Resettlement Plans*, even when no resettlement was conducted or required. Instead, in most cases, compensation plans were required for land acquisition.

Capacity Building and Information Management

PLN's capacity to technically and financially manage the project was also brought into question at various points of project implementation. Staff turnover and organizational changes impacted project management overall, as there was a lack of continuity and ownership. The frequent changes in project personnel gave rise to variations in the way the project was supervised, especially regarding the application of ADB's social safeguards requirements, as well as the correct interpretation and application of EPC contracts. These variations caused implementation difficulties for some of the subprojects and project delays in general.

Information management is one strategy to ensure that the implementation of multi-year projects transitions smoothly in the case of reorganization or project personnel changes. Complete record-keeping and documentation of the project's progress would be helpful, as well as standard operating procedures for information- and documentation-sharing, and handover among personnel. PLN also needs to institute project documentation continuity and a turnover procedure that may be put in a manual of operations to be shared within PLN, among its implementing units, project implementation consultants, and contractors.

IV. CONCLUSION

In line with the government's overall strategy to expand the country's electricity supply based on a least-cost and environmentally sustainable manner, and improve power supply efficiency and reliability, the ADB implemented two projects to expand renewable energy use and energy access in remote islands of eastern Indonesia, as well as remove power supply bottlenecks in Java-Bali and Kalimantan.

Although confronted with challenges such as poor contractor performance, land acquisition complications, and issues of right of way, the Renewable Energy Development Sector Project was rated *successful* based on its relevance to Indonesia's power sector strategy, effectiveness, efficiency and sustainability. The Power Transmission Improvement Sector Project, on the other hand, was rated *less than successful* mainly because of implementation delays that affected the project's effectiveness and efficiency.

Despite the challenges, however, both projects were able to respond accordingly through design changes, relocation, and cooperation with relevant national and local government units. Ultimately, the projects had positive impacts on power supply and delivery in Java-Bali, Kalimantan, and the remote eastern islands.