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CASE STUDY

Grid Unlocked: The Mechanics of Cross-Border Electricity Sharing

An electricity trading project between Indonesia and Malaysia is lowering power costs, raising revenue and cutting greenhouse gas emissions.

Overview

In West Kalimantan, Indonesia, oil fuels all power generation, negatively affecting both the environment and the economy. Because oil is the most costly fuel for power generation, its dominant use in West Kalimantan has resulted in high electricity costs. The average cost of power generation is more than $0.25 per kilowatt-hour (kWh).

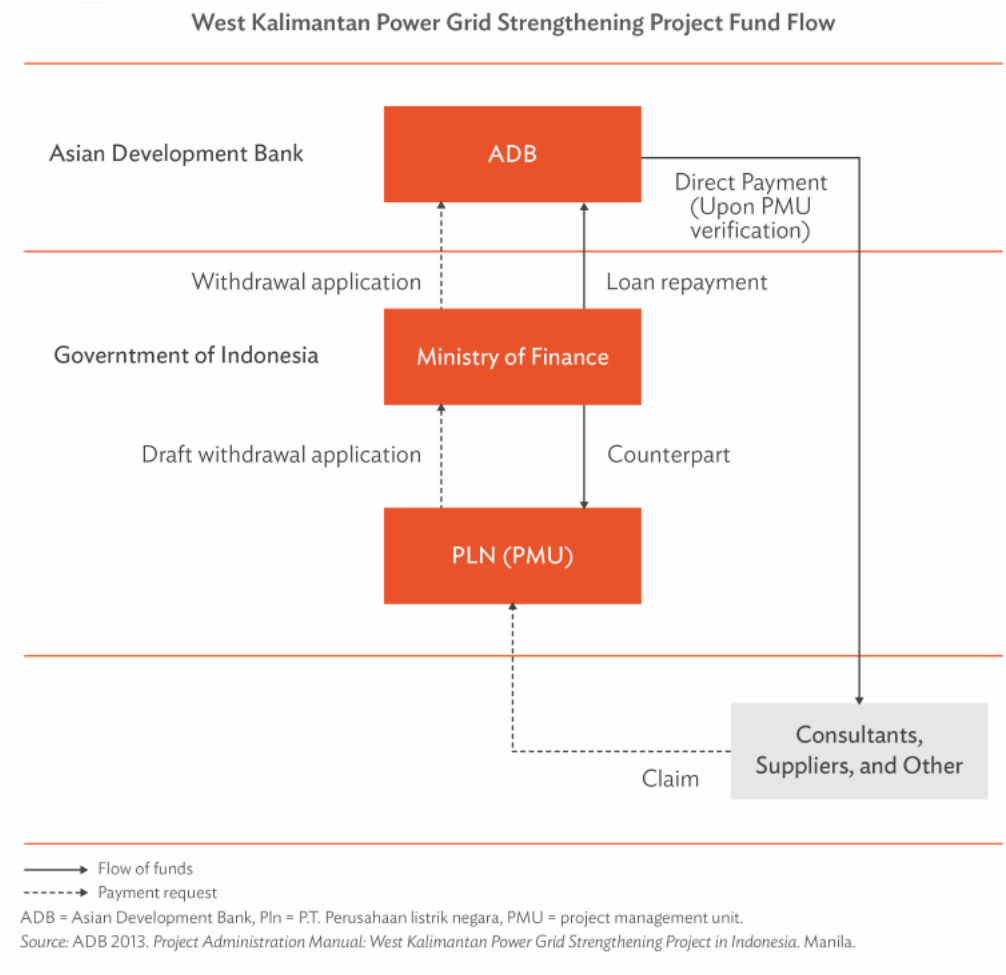
This high cost presents a major obstacle to the ability of P.T. Perusahaan Listrik Negara (PLN), the state electric utility, to invest in new assets and maintain current assets, hampering electricity supply and economic growth, especially since West Kalimantan urgently needs additional electricity to meet increasing demand, which will reach 600 megawatts (MW) by 2020, from about 200 MW in 2012. Even if the country decides to develop its abundant coal resources, it will take time because development of this resource will require about 7-10 years.

Overdependence on oil exposes the country to price shocks. When global oil prices soared in 2007 and 2008, oil-based power generation became too costly for Indonesia. The government had shut down

some of its oil-fired power plants, leading to rotating blackouts nationwide. Oil dependency also has environmental repercussions because fossil fuels emit greenhouse gases, contributing to climate change and harming health.

West Kalimantan explored cross-border power supply as a way to meet rising demand for electricity at a lower cost. To extend energy supply to the West Kalimantan grid, PLN aims to import 230 MW of low-cost (about $0.10 per kWh) hydropower-generated electricity from Sarawak, Malaysia, to the West Kalimantan grid. Through financing from the Asian Development Bank (ADB), the West Kalimantan Power Grid Strengthening Project helped Indonesia build a transmission line from Bengkayang, West Kalimantan to the Malaysian border. Malaysia will finance transmission line extension from the border to Mambong, Sarawak.

- Geographical location: West Kalimantan
- Type of energy project: Cross-border power trade-Regional interconnection



Project snapshot

Dates	• **August 2013:** Loan approval date • **June 2018:** Project completion date

Cost	• **US$ 49.5 million:** Loan amount
Institutions and Stakeholders	**Financing** • Asian Development Bank **Executing agency** • P.T. Perusahaan Listrik Negara **Others** • Indonesia: Borrower

Solutions

Power exchange agreement

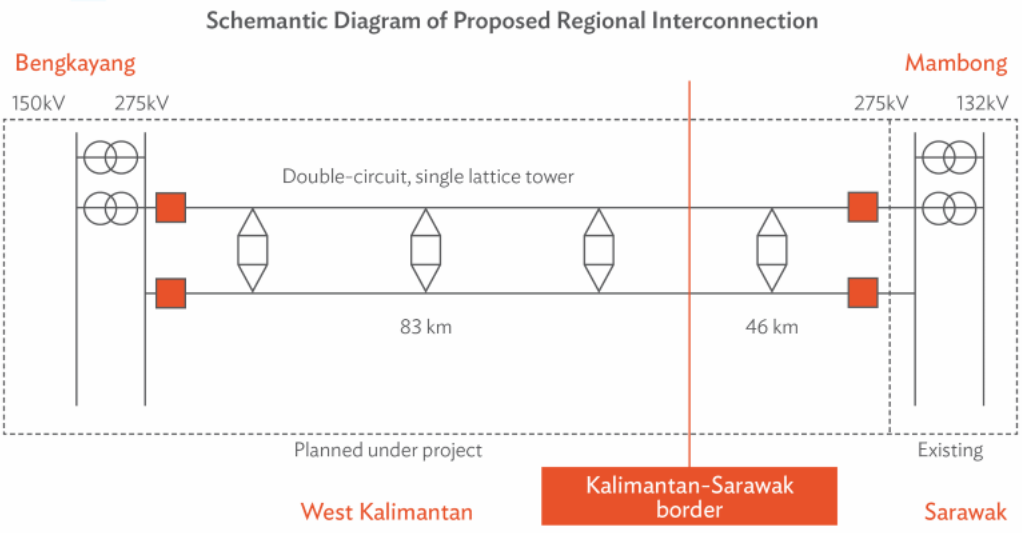
In 2012, PLN and its counterpart in Malaysia, Syarikat SESCO Berhad (SESCO) signed a 20-year power exchange agreement that stipulates take-or-pay and take-and-pay prices during Phase 1 (i.e., first 5 years). PLN will purchase from SESCO about 50 MW of capacity as base load on a take-or-pay basis and another 180 MW of capacity under a take-and-pay contract. Phase 2 provides for long-, medium-, or shortterm purchases of a maximum capacity of 230 MW.

Cross-border interconnection

The project will connect Indonesia and Malaysia using a 275-kilovolt (kV) regional interconnection high voltage transmission line (HVTL) between Bengkayang, West Kalimantan and Mambong, Sarawak. To provide access to electricity in West Kalimantan, the project will also construct two 150 kV HVTLs, from Bengkayang to Ngabang and from Ngabang to Tayan.

The project will augment the existing 275/150 kV substation at Mambong in Sarawak while constructing a new 275/150/20 kV substation in Bengkayang, West Kalimantan. Further extension of the grid within West Kalimantan will require construction of a new 150/20 kV substation in Ngabang and a four-line feeder extension in the 150 kV Tayan and Bengkayang substations. Potentially, the grid interconnection could exchange

an estimated 230 MW per hour between the two systems. A $2 million grant component will provide 8,000 new households with access to electricity by 2016.



hvtl = high voltage transmission line, km = kilometer, kV = kilovolt
Source: ADB 2011. *Initial Environmental Examination: Strengthening West Kalimantan Power Grid.* July. Manila.

Construction of the HVTL corridor

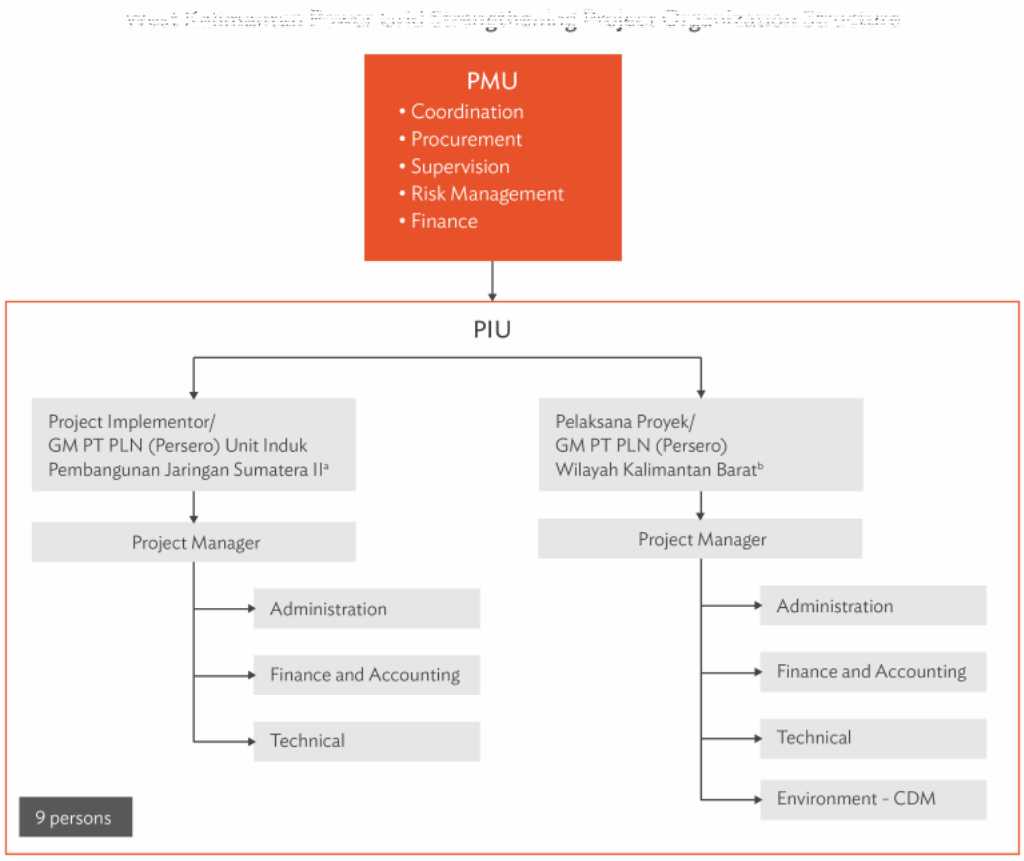
The power grid corridor consists of 83 kilometers (km) of 275 kV transmission line connecting West Kalimantan and Sarawak, and 145 km of 150 kV HVTLs within West Kalimantan. The HVTL corridor will traverse a rural landscape, with flat to moderately hilly terrain and few secondary urban centers.

Because the corridor is adjacent to existing roads, the transmission lines will have minimal impact on the area through which it passes. The route also avoids sensitive ecosystems (e.g., parks and protected forests, houses and schools, and high concentrations of high-value economic trees). No houses or other structures were relocated.

The project includes four contract packages. Package 1 covers construction of the 275 kV transmission line between Bengkayang substation and the border at Sarawak, East Malaysia. Package 2 covers construction of the 275/150 kV substation at Bengkayang. Package 3 deals with the 150 kV transmission line between Bengkayang substation, the new Ngabang substation, and the substation in Tayan. Package 4 includes construction of the 150/20 kV substation at Ngabang and the Tayan substation extension.

Project implementation

As the executing agency, PLN is responsible for overall project implementation. One project management unit handles all procurement, planning, project supervision, monitoring, accounting, and consolidated reporting, and also coordinates with the project's Sarawak counterpart. A second project implementation unit supervises day-to-day operations and fulfills monitoring and reporting requirements.



PIU = project implementation unit, PMU = project management unit
[a]Sumatera II Regional Transmission Construction Unit.
[b]West Kalimantan Regional Unit.
Source: ADB 2013. *Project Administration Manual: West Kalimantan Power Grid Strengthening Project in Indonesia.* Manila.

Regional power trade and cooperation

The 275 kV interconnection between West Kalimantan and Sarawak mainly supports power trade between Indonesia and Malaysia. However, this project is part of a larger endeavor by the Association of Southeast Asian Nations (ASEAN) Power Grid Interconnection Development Project.

The ASEAN project encourages economic use of energy resources for mutual benefit, while enhancing power system security and creating opportunities for energy trading in the ASEAN electricity market.

The interconnection between West Kalimantan and Sarawak is one of many power projects that will comprise an envisioned ASEAN power grid. Although ASEAN's member states have vast energy resources, many areas still experience energy poverty. A joint approach in developing a borderless electricity industry will help member countries secure their energy supply in the midst of surging power demand.

Results

Improved energy supply for Indonesia

West Kalimantan Power Grid Strengthening Project will augment electricity supply to West Kalimantan and its adjacent provinces and increase reliability. The 150 kV HVTLs to Ngabang and Tayan will bring access to electricity to many households, and the grant component will connect about 8,000 new

households to the power grid, potentially reducing connection charges and connection time. Reliable power will create construction and maintenance jobs, boost the local and national economy, contributing to industrial growth and increasing trade, especially in rubber factories. Such activities will generate jobs, especially for low-income groups. Increased access to electricity will improve basic public services such as education, health, and water supply.

Increased income and exporting power for Malaysia

This interconnection project will also benefit Malaysia, which has long-term plans for power export. Low-cost power generation will earn Sarawak about $33 million.

Reduced cost of electricity production. Imported electricity will help West Kalimantan reduce the marginal cost of electricity production, from more than $0.25 per kilowatt-hour to about $0.18 per kilowatt-hour. Depending on oil prices, PLN potentially will save about $100 million and reduce its government subsidies.

Reduced carbon footprint

Indonesia heavily relies on oil for power, especially for West Kalimantan. Power from Malaysia will significantly reduce West Kalimantan's reliance on oil-fueled power plants. The project will help the island of Borneo reduce its carbon footprint by avoiding emissions that would otherwise have been produced by oil-based power generation plants.

Lessons

Reducing fossil-fuel dependency through regional cooperation

Many countries in Asia remain heavily dependent on fossil fuels (e.g., oil and coal) for power generation. Overreliance increases vulnerability to price shocks, carbon emissions, and pollution. With surging power demand, increased use of fossil fuels and lack of budget to maintain and rehabilitate distribution assets will further aggravate these effects. In Indonesia, exorbitant prices led to power outages in late 2000. Project implementers should consider renewable alternatives to power generation, within the country and elsewhere. Although West Kalimantan could continue to develop coal-fired power plants locally, it opted to access electricity from cleaner hydropower in Malaysia; lower prices and a smaller carbon footprint will offset the initial investments. Moreover, grid interconnection, in this case, can be implemented faster than coal power development, which could take about 7–10 years.

Careful planning

Project implementers planned the transmission corridor carefully to minimize the impact of construction and operation on farmland, communities, and international borders. They also implemented mitigation measures and a rigorous environmental evaluation to minimize environmental impact and avoid relocations.

Development of power trade and regional cooperation

As demand for energy continues to increase in many countries, development of local energy sectors may lag, thus causing power gaps. Countries may encounter difficulty in providing adequate energy, due to insufficient or absent finance or energy resources. International power trade may help solve these issues.

Power trade can yield both regional and national benefits, including regional cooperation. A regional grid such as that planned for the ASEAN Power Grid Interconnection Development Project, can tap the energy resources of member states and improve quality of life by accessing various sources of energy from other countries.

Resources

Asian Development Bank (ADB). 2013. ADB's First BIMP-EAGA Project to Bring Clean Energy to West Kalimantan

Asian Development Bank (ADB). 2011. Strengthening West Kalimantan Power Grid: Initial Environmental Examination

Asian Development Bank (ADB). 2013. West Kalimantan Power Grid Strengthening Project Reports and Recommendations of the President

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Cheaper, Cleaner, More Reliable: Reasons to Invest In Cross-Border Power-Trading

Meet the expert

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Sohail is a firm believer that the solution to climate change lies in new technology, and has applied new technology to many ADB projects as an energy specialist since 2001 in Afghanistan, Cambodia, PRC, India, Indonesia, Malaysia and Mongolia, among other Asian countries. With an academic background in engineering, business and entrepreneurship, before joining ADB he worked on wholesale electricity market design, pricing regulation, energy efficiency and demand management for the state power utility and independent regulator in Melbourne, Australia.

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