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Indonesia is developing three geothermal power units with a total capacity of 320 megawatts.

SARULLA GEOTHERMAL PROJECT

Tapping Indonesia's Geothermal Resources

- Increasing energy demand in Indonesia can potentially curtail economic growth. Dependence on fossil fuels exposes Indonesia to frequent changes in the price and supply of oil and coal, and increases greenhouse gas emissions that contribute to climate change.
- Indonesia urgently needs to diversify its energy supply mix to sustainably meet increasing demand. Rising prices for oil and coal have already cost Indonesia $18.55 billion in 2012, nearly twice the cost of energy subsidies in 2010.
- In 2014, the Asian Development Bank, the Government of Indonesia, a private sector developer, and commercial banks collaborated to tap the vast potential of geothermal energy.
- This partnership is expected to result in three geothermal power plants with a total capacity of about 320 megawatts. The added capacity will help Indonesia address electricity shortages and energy poverty, reduce dependence on fossil fuels, and harness largely untapped geothermal resources.

CONTEXT

Indonesia has shown strong economic growth in recent years. Its annual gross domestic product (GDP) grew an average 6% per year in 2009–2012,[1] while electricity demand increased 9% per year, casting a dark shadow on the sustainability of economic growth.[2] Higher demand exposes Indonesia to frequent shifts in the availability and cost of oil and coal, higher greenhouse gas emissions, and increased vulnerability to climate change. Indonesia depends heavily on coal and oil for its energy supply. In 2009, oil was the country's dominant source of energy (32%); coal accounted for 19%. Notably, the share of coal is increasing strongly, at the expense of oil.[3]

The global rise in oil prices has already strained Indonesia's coffers. In 2012 and 2013, the electricity subsidy reached Rp103.3 billion and Rp101.2 trillion,[4] respectively.[5] In fiscal year 2013, the Government of Indonesia allocated $18 billion to petroleum product subsidies and $9 billion to electricity subsidies, equaling around 2.5% of GDP and 25% of total government expenditures.[6] When global oil prices dropped in late 2014, Indonesia raised oil prices and decreased its energy subsidies.[7] In addition, increased demand for energy exacerbates the power crisis already felt in some regions (e.g., North Sumatra and Bali), where power shortages have caused frequent blackouts for more than a year. Indonesia also experiences energy poverty because a significant portion of its population, primarily those living in rural areas and the outer islands, lack access to electricity (footnote 2).

PROJECT SNAPSHOT

LOAN APPROVAL DATE:
December 2013

LOAN AMOUNT:
$350 million ($250 million from ADB ordinary capital resources, $80 million from the ADB Clean Technology Fund, and $20 million from Canadian Climate Fund for the Private Sector in Asia under the Clean Energy Financing Partnership Facility)

BORROWER:
Sarulla Operations Limited (SOL), Sarulla Power Asset Limited, Kyuden Sarulla Private Limited, OrSarulla Incorporated, and PT Medco Geopower Sarulla

GEOGRAPHICAL LOCATION:
Sarulla Geothermal Working Area, North Sumatra Province

TYPE OF ENERGY PROJECT:
Geothermal energy

EXPECTED PROJECT COMPLETION DATE:
August 2018

1 Asian Development Bank (ADB). 2013. *Proposed Loan and Administration of Loans to Sarulla Operations Limited, Sarulla Power Asset Limited, Kyuden Sarulla Private Limited, OrSarulla Incorporated, and PT Medco Geopower Sarulla for the Sarulla Geothermal Power Development Project in the Republic of Indonesia.* Manila. www.adb.org/sites/default/files/projdocs/2013/42916-014-rrp.pdf

2 World Wide Fund for Nature. June 2012. *Igniting the Ring of Fire: A Vision for Developing Indonesia's Geothermal Power.* http://awsassets.wwf.or.id/downloads/geothermal_report.pdf

3 ADB. 2011. *Trends in Energy Efficiency.* http://www05.abb.com/global/scot/scot316.nsf/veritydisplay/1a65dd16a3c538acc125786400514251/$file/indonesia.pdf

4 Approximately $10.3 million and $1.009 trillion, respectively, based on July 2013 currency equivalents.

5 Perusahaan Listrik Negara. 2013. *Annual Sustainability Report.* http://www.pln.co.id/dataweb/AR/ARPLN2013-Sustainability.pdf

6 International Institute for Sustainable Development. 2014. *Indonesia Energy Subsidy Review.* March. http://www.iisd.org/gsi/sites/default/files/ffs_indonesia_review_i1v1.pdf

7 Bloomberg. 2014. Interview with Indonesian Finance Minister Bambang Brodjonegoro. http://www.bloomberg.com/video/indonesia-to-cut-fuel-subsidies-by-year-end-minister-gQWdr8BwROmjfdZa8rn4kA.html

Indonesia clearly needs to diversify its energy mix and increase energy supply to meet demand. Fortunately, Indonesia has rich geothermal resources owing to its location at the edge of the Pacific plate, where geothermal energy is estimated at about 29 gigawatts (GW) and equivalent to 40% of the geothermal resource base worldwide. Indonesia has worked hard to tap this resource, but the steep cost of investment and lack of government capacity hinder further development.

In 2014, the Asian Development Bank (ADB) collaborated with the Government of Indonesia, private sector developers, and commercial banks to finance the Sarulla Geothermal Power Project. The project is now helping Indonesia develop steam resources and construct, operate, and maintain three geothermal power generation units with a total capacity of about 320 megawatts (MW) (footnote 1). The Sarulla Geothermal Power Project is in the Tapanuli Utara district of North Sumatra province. It is the largest single-contract geothermal power project in the world to date.[8]

SOLUTIONS

Stimulating private sector participation. Indonesia has long recognized the urgency of diversifying its energy supply mix as well as the opportunities offered by its rich geothermal sources. In 1993, Indonesia engaged Union Oil Company of California (UNOCAL) to explore the country's geothermal resources. When the Asian financial crisis affected the country's financial position, UNOCAL sold its concession back to Perusahaan Listrik Negara (PLN), the government-owned electricity utility. Consequently, the government issued a policy statement encouraging private sector participation in the exploration of geothermal resources exploration, thus allowing PLN to invite qualified companies to join in an independent power producers' (IPPs) bidding process to attain the Sarulla development rights. In 2006, a consortium formed by Itochu Corporation, Ormat International, and Medco Power Indonesia won the right to explore and develop the geothermal site at Sarulla. Kyushu Electric Power Company joined the consortium in 2007. The sponsors jointly developed the Sarulla project through its operating company, Sarulla Operations Limited (SOL).

Conducting a preliminary study. SOL conducted a preliminary assessment of the power plant site to guide project planning and implementation. The assessment scrutinized wells that will be used for production to determine the types of equipment needed to produce steam and plan for other equipment should abnormal conditions arise during the steam production process. The study developed a plan for distributing steam to power plants for conversion into steam and then electricity. It also assessed the topography to determine the optimal locations for the plants and the boundaries of construction activities.

Finding financing. Developing geothermal resources requires an immense up-front investment as the drilling program essentially advances the cost of fuel supply. Drilling hikes up the up-front capital cost for geothermal plants, which can reach more than three times the amount invested in conventional coal and oil plants. This challenge is invariably balanced by limited ongoing operating cost during the lifetime of the project.

[8] Kable. 2014. Sarulla Geothermal Power Project, Indonesia. http://www.power-technology.com/projects/sarullgeothermalpowe/ (accessed 28 December 2014).

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A combination of loans from ADB, the Japan Bank for International Cooperation, the Clean Technology Fund, and local commercial banks is financing the integrated construction of the three geothermal power generating units in Sarulla.

The developers asked ADB and the Japan Bank for International Cooperation (JBIC) to financially support the Sarulla Geothermal Power Project in 2007. In 2011, with the support of an extended political risk guarantee by JBIC, the developers sought financing from commercial banks. During financial structuring, the project benefited from concessional support from the Clean Technology Fund (CTF) and the Canadian Climate Fund for the Private Sector in Asia. Through a combination of loans from these lending facilities, the project was able to raise $1.17 billion to finance the integrated construction of three separate power-generating units. This financing structure was considered a breakthrough because financing for large-scale projects is typically arranged on a staged or phased basis.

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Preliminary testing, development activities, and construction of the power plants are under way in the project site.

ADB's $80 million concessional funding was crucial because the project could not service additional senior debt due to low tariffs and sponsors could not contribute more equity. Mezzanine loans from CTF ($80 million) and the Canadian Climate Fund for the Private Sector in Asia ($20 million) helped retain the project's bankability given the costs of integrated financing. It was CTF's first loan deployment in Indonesia and a clear demonstration of CTF's added value. The loans benefit from the support of a 20-year business viability guarantee letter from the Ministry of Finance, which backstops the offtake[9] obligations of the national electric utility buying the generated power (footnote 1).

[9] Offtake is the purchase of bulk power by an electricity distributor or energy company from a particular generating project.

Formulating a joint operating contract. In a 30-year joint operating contract (JOC), PT Pertamina Geothermal Energy, the project's state-owned concession holder, grants SOL the right to use and explore the geothermal field.[10] The JOC, which is the largest contract for a geothermal power project that capitalizes on the large-scale potential of highly productive geothermal resources, also governs development of the geothermal steamfield and provides the framework and scope for construction of the geothermal plant.[11] The scope of work included the construction of three plants at two locations, Silangkitang (220 MW) and Namora (110 MW), as well as transmission lines from both plants to PLN's grid. The project has three phases: The first phase would be in operation in 2016, the second phase in 2017, and the third phase would be operational in 2018.[12] The consortium has already started preliminary testing and development activities at the site. It initiated construction of the power plants in the second half of 2014.

Finalizing an energy sales contract. In addition to the JOC, SOL entered into a power purchase agreement with PLN. The contract states that SOL initially will sell electricity to PLN for $0.067 per kilowatt-hour and allows incremental increases (2% per year) for 30 years.[13]

Finalizing the energy sales contract is a major milestone. However, the rising prices of raw materials and increasing cost of power plant equipment and well redrilling rendered the original tariff, established by SOL during the bidding stage, unfeasible. Therefore, SOL presented a tariff adjustment proposal to PLN in July 2008. After several rounds of negotiation, a Principle Agreement formalized the final adjustments on 1 April 2010.

Construction design. At the outset, the project defined the construction work required to develop the geothermal power plant. The design included building new well pads[14] and improving existing pads, drilling new wells, building access roads, and installing all necessary equipment and pipelines. Construction began in June 2014 and will continue for about 3 years.[15]

RESULTS

When completed, the Sarulla Geothermal Energy Project will (i) address electricity shortages in some areas, particularly North Sumatera and energy poverty in rural areas; (ii) reduce dependence on fossil fuels by diversifying the energy supply mix, and (iii) maximize geothermal energy.

10 Ormat Technologies. 2013. The 330 MW Sarulla Geothermal Power Project in Indonesia Signed Project Agreements. April. http://www.ormat.com/news/latest-items/330-mw-sarulla-geothermal-power-project-indonesia-signed-project-agreements

11 Baker & Mckenzie. 2013. Baker & McKenzie Advises on the Sarulla Geothermal Power Project in Indonesia. April. http://www.bakermckenzie.com/news/SarullaGeothermalPowerProjectIndonesia/

12 Perseo. 2013. PLN Signs Power Purchase Agreement of PLTP Sarulla with Medco – Ormat – Itochu – Kyushu Consortium. http://www.pln.co.id/eng/?p=2959

13 L.X. Richter. 2013. PLN and Pertamina Sign Contract on Sarulla Project. *Think Geo Energy*. http://thinkgeoenergy.com/archives/14774

14 Well pads are areas that have been cleared for drilling meant for extraction. A well pad may consist of multiple wells.

15 ADB. 2013. *Environmental Impact Assessment: Sarulla Geothermal Power Development Project.* October. http://www.adb.org/sites/default/files/projdocs/2013/42916-014-esia.pdf

Decrease dependence on fossil fuels. When the power plants are operational, they will help reduce Indonesia's dependence on fossil fuels. By tapping an abundantly available and renewable energy source, the project will provide the country a 330 MW increase in electricity supply from geothermal energy.[16] Thus, this largest geothermal power plant contract in Indonesia will demonstrate the viability of geothermal energy as an answer to the country's energy needs.

Cleaner source of energy. Geothermal power plants typically emit less than 10% of the greenhouse gases (GHGs) emitted by fossil-fueled thermal plants. Once completed, the Sarulla Geothermal Project is expected to avoid 1.3 million tons of carbon dioxide emissions per year, and will be well positioned to capitalize on any carbon trading credits that may become available.[17]

Improvement in local economy. Increased electricity supply will directly benefit the local government and community where the project site is situated. Increased access to electricity can perk up businesses, thereby generating more jobs. This multiplier effect to the local economy can provide higher incomes for businesses and households alike.

LESSONS

Ensure environmental and social aspects of the projects are addressed ahead of time. Geothermal energy projects are complex and require extensive drilling and construction. Many will require land acquisition, not only for the power plant but also for related facilities such as transmission lines and towers. These facilities may rest on land with rich vegetation inhabited by indigenous people. To meet the environmental and social safeguards requirements of ADB and JBIC, the project developers designed a resettlement plan that will not immediately relocate residents affected by the project site. The project will procure land through negotiated settlements and take it in stages as construction progresses. The project also committed to re-vegetate any areas affected by construction.[18]

Need for strong sponsors with commitment to the country. The project site was initially explored by UNOCAL, which reduced its losses by selling back its exploration rights during the Asian financial crisis, thus delaying Indonesia's energy plans. This experience shows the importance of strong and firmly committed sponsors who can source financing in a creative or innovative manner to keep a project running. Strong collaboration and a comprehensive feasibility plan demonstrated that investments in the largely unexplored geothermal sector can be beneficial in the long run, not just to the developers but also to all stakeholders.

[16] ADB. 2013. *Environmental Impact Assessment: Sarulla Geothermal Power Development Project.* http://www.adb.org/sites/default/files/projdocs/2013/42916-014-esia.pdf

[17] J. Surtani et al. 2014. *Sarulla-Energising the Geo-Sector. Project Finance International Special Report.* May. http://www.pfie.com/sarulla-re-energising-the-geothermal-sector/21144994.fullarticle

[18] ADB. 2013. *Final Resettlement Report: Proposed Loan to Sarulla Operations Limited, Sarulla Power Asset Limited, Kyuden Sarulla Private Limited, OrSarulla Incorporated and PT Medco Geopower Sarulla for the Sarulla Geothermal Power Development Project in Indonesia.* October. Manila. http://www.adb.org/sites/default/files/project-document/79108/42916-014-ino-rp-01.pdf

Need for a strong understanding of the geothermal sector. In countries like Indonesia, the Philippines, and Japan, accessible and available geothermal energy remained largely untapped owing to lack of know-how and capacity. It is important to have a partner which has extensive knowledge about geothermal energy, which may be quite a complicated resource to access. It is important to have some drilling expertise. In this project, Kyushu Electric and Ormat have extensive experience harnessing geothermal energy. They have the technology and equipment to maximize efficient use of the varied composition of geothermal fluid, which in this case includes steam, brine, and gases. They also know how to reinject geothermal fluid into the reservoir, maintaining sustainability and mitigating the negative effect of gases.

Volatility of prices associated with power plant construction. The rising cost of raw materials, power plant equipment, and drilling activities are major causes of construction delay in geothermal power plants. For the Sarulla Geothermal Power Project, SOL had to request tariff adjustments when the contract price became unviable. Several rounds of negotiation were necessary before the government and SOL could agree on a mutually beneficial tariff. Therefore, budget allocations for such projects must include the possibility of price increases or a contingency fund to cover the funding gap.

Keywords

Geothermal, geothermal energy, energy, renewable, energy financing, financing, Sarulla, Indonesia

For further reading

- http://www.adb.org/projects/documents/sarulla-geothermal-power-generation-project-rrp
- http://www.adb.org/news/adb-supports-renewable-energy-investing-indonesian-geothermal-plant

For further information

- Lazeena Rahman, investment specialist, Private Sector Operations Development (lrahman@adb.org)
- Aiming Zhou, senior energy specialist, Sector Advisory Service Division, Sustainable Development and Climate Change Department (azhou@adb.org)
- Dongxiang Li, advisor, Economic Research and Regional Cooperation Department (dongxiangli@adb.org)