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# Transforming the Power Sector in Developing Countries

Indonesia's Diversification Challenge

Dr. Robert F. Ichord, Jr.





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Cover photo: Geo Thermal/Flickr. Geothermal installation in Central Java, Indonesia.

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## EXECUTIVE SUMMARY

This report, the third in the Atlantic Council Global Energy Center series *Transforming the Power Sector in Developing Countries*, examines the issues and strategies in Indonesia for power sector transformation within the framework presented in the first report. Indonesia is a critical country for international power sector transformation, and the United States has major strategic, economic, and environmental interests in supporting this transformation. This report addresses a fundamental question: How can Indonesia's growing electricity needs be met in a clean, efficient, and affordable manner?

Indonesia is assuming an increasingly important role in both global energy markets and global efforts to address climate change. Its large and expanding population together with steady economic growth of about 5 percent per year have spurred increasing demand for energy. Indonesia has a long history of oil and gas production and membership in the Organization of the Petroleum Exporting Countries, but is currently a major net oil importer and on its way to becoming a gas importer in the next decade. Indonesia is also a major coal producer and exporter, and coal's domestic role, especially in the power sector, has been increasing. Rising energy demand and heavy fossil fuel dependence are causing steady increases in carbon dioxide (CO<sub>2</sub>) emissions—supplemented by massive releases of CO<sub>2</sub> from burning forests on Kalimantan and Sumatra—and contributing to severe air pollution in nearby Singapore and other Southeast Asian states.

Indonesia's current president, Joko Widodo, known as Jokowi, came into office in 2014 with ambitious plans to develop Indonesia's infrastructure, including adding 35 gigawatts (GW) of electric power generation. Although much of this capacity will continue to be coal-based, under the president's plans gas and renewables will increase their shares of the generation mix. Indonesia also signed the Paris Climate Change Agreement and pledged to reduce CO<sub>2</sub> emissions by 29 percent by 2030 and expand renewable energy's share of the energy mix to 23 percent by 2025.

Indonesia faces many challenges in keeping up with the rapid growth in energy demand in an environmentally sustainable manner. The energy sector is dominated

by state monopolies, notably the state-owned electric company PLN and oil and gas company Pertamina. However, the country is dependent on private funding and external finance for a substantial share of its planned investments.

“The Indonesian government must come to grips with the need to restructure the sector and put in place a professional energy regulatory capacity in order to attract the financing needed to keep up with demand.”

Efforts to reform and restructure this state governance system have met major resistance from vested interests, while court decisions have reinforced the dominant role of the state in owning and managing the sector. However, despite strong nationalistic and bureaucratic constraints, the electric power sector is moving to diversify its sources of generation. Major expansion of natural gas generation, both in large combined cycle plants and in smaller, decentralized systems on the various islands, is occurring. Infrastructure to move and regasify liquefied natural gas (LNG) throughout the islands is under construction with significant foreign involvement. Although Indonesia remained the fifth-largest LNG exporter in both 2015 and 2016,<sup>1</sup> declining domestic gas production and slow progress in attracting new exploration investment have prompted Pertamina to plan for LNG imports, and a major contract was signed in June 2017 for imports from the Australian North West Shelf operator Woodside to begin in 2019.

Renewables are well-suited to the geographically dispersed archipelago. While development has thus far lagged that of other developing countries, there are signs that investments in solar and wind energy are picking up and the government is providing attractive

<sup>1</sup> International Gas Union, *2017 World LNG Report*, 11; top exporters were Qatar, Australia, Malaysia, Nigeria, and Indonesia.



An LNG tanker passes boats along the coast of Singapore February 3, 2017. *Photo credit: Reuters/Gloystein Henning.*

feed-in tariffs. However, PLN has resisted buying more expensive renewable energy given subsidized retail tariffs and has moderated the goal for renewables in its expansion plan. Hydropower remains the largest contributor to renewable energy generation, with financing from China and the international banks. Small-scale renewables are also included in the government's programs to expand full electricity access to 97 percent of the population by 2020.

The struggling international coal market has affected Indonesia, the world's largest steam coal exporter, increasing pressures on the government to use more coal domestically. New plants are employing more efficient ultra-supercritical technology, but the land and pollution impacts have garnered opposition from local communities. The development of Indonesia's world-class geothermal energy potential has also been constrained by limited access to forested areas and local tensions.

This report offers several strategic suggestions for consideration by Indonesian policy makers and stakeholders. Fundamentally, the Indonesian government must come to grips with the need to restructure the sector and put in place a professional energy regulatory capacity in order to attract the financing needed to keep up with demand. Experience from countries like Mexico can be useful in developing an appropriate strategy for moving from this single-buyer monopoly structure to a more open, competitive system. Reform could accelerate Indonesia's transformation to a more diversified power system and a cleaner, more efficient fuel mix.

Indonesia's large and growing energy market is important to the United States. The Donald Trump administration should build on the April 2017 visit of Vice President Mike Pence to further cooperation and commercial engagement with Indonesia in the energy sector.



## INTRODUCTION

Indonesia's position in the global energy market has been changing over the past decade as its domestic oil and gas production has continued to slide while primary energy consumption has risen by 4 to 6 percent, and the role of coal has grown both domestically and as an export. Indonesia's energy sector represented the eighth-highest level of global energy sector carbon emissions in 2016.<sup>2</sup> When emissions from the burning of forests and peat are included, Indonesia jumps to fifth among global emitters. Moreover, with the fourth-largest population in the world, over 630 million, and low per capita income of \$3,895 in 2017,<sup>3</sup> Indonesia's demand for energy—along with its CO<sub>2</sub> emissions—will continue to grow.

Although often overshadowed by significantly larger energy systems in China and India, Indonesia and its role in the Southeast Asian economy is extremely important. Indonesia's gross domestic product (GDP) has been growing approximately 5 percent annually over the last five years (5.02 percent in 2016).<sup>4</sup> This growth, combined with increases in urbanization and population, has stimulated primary energy consumption, which experienced nearly 6 percent growth in 2016.<sup>5</sup>

To accommodate this growth, the Jokowi government has emphasized the development of infrastructure and put in place an ambitious program to increase electricity capacity by 35 GW by end-2019. Indonesia has also adopted a policy to reduce CO<sub>2</sub> emissions by 29 percent by 2030 and increase the share of renewable energy to 23 percent of the energy mix by 2025.

This report, the third in the Atlantic Council Global Energy Center series *Transforming the Power Sector in Developing Countries*, examines the challenge of diversification of the electricity sector in Indonesia and suggests possible directions for future energy policy by

applying the same framework used in the first report. At its core, this report addresses a fundamental question: How can Indonesia's growing electricity needs be met in a clean, efficient, and affordable manner?

It addresses this question by examining a key structural characteristic of the Indonesia context—namely, that the Indonesian power sector is still largely state-dominated. The state-owned electric company PLN retains a monopoly over transmission and distribution and operates a substantial share of the 55 GW of installed generation capacity, about 75 percent of which is located on the islands of Java and Bali.

With respect to the energy mix, over 55 percent of electricity supply comes from coal, and coal will continue to play a major role in PLN's electricity supply plan for 2016-2025. However, government policy seeks to diversify the generation mix and develop gas, hydro, geothermal, and renewable energy sources. The government is also prioritizing completing the rural electrification program to achieve near universal access by 2020.

To accomplish these goals, improving the investment environment is critical. Indonesia's growing nationalistic policies and renowned bureaucracy present hurdles to investors. Moreover, while the government has made important strides in reducing both fossil fuel and electricity subsidies, mobilizing the resources necessary to keep up with electricity growth will require major efforts. A key question is whether Indonesia will be able to attract the private investment it seeks in the power sector without significant sector restructuring or reforms in the regulatory framework.

The following sections explore these challenges, followed by recommendations for policy makers and other stakeholders on strategic priorities and actions to address them.

2 BP, *BP Statistical Review of World Energy*, June 2017, <https://www.bp.com/content/dam/bp/en/corporate/pdf/energy-economics/statistical-review-2017/bp-statistical-review-of-world-energy-2017-full-report.pdf>, 47.

3 "World Data Atlas: Indonesia," Knoema, <https://knoema.com/atlas/Indonesia>.

4 Indonesia's GDP annual growth rate averaged 5.29 percent from 2000 until early 2017; see "Indonesia GDP Annual Growth Rate," Trading Economics, <https://tradingeconomics.com/indonesia/gdp-growth-annual>, May 5, 2017.

5 BP, *Statistical Review of World Energy*, June 2017, 8.

## THE CHALLENGE

### Meeting Growing Energy Demand and Changing the Fuel Mix

Indonesia faces the dual challenge of meeting rapidly rising domestic energy demand while simultaneously working to diversify its energy mix and move its portfolio away from what has traditionally been a heavy reliance on fossil fuels.

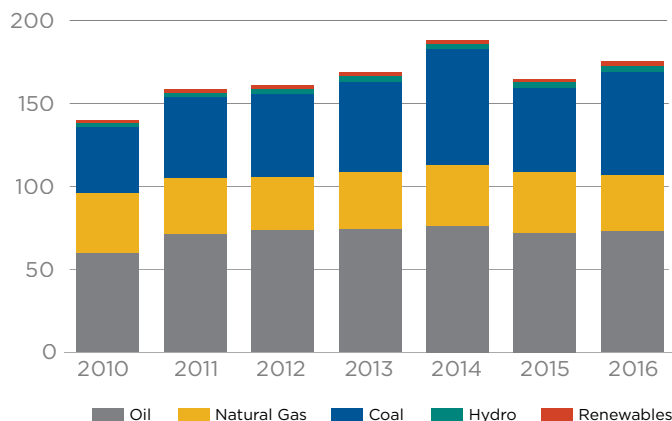
Indonesia’s primary energy consumption grew by an average annual rate of over 4 percent between 2010 and 2016.<sup>6</sup> According to BP’s 2017 *Statistical Review of World Energy*, oil was Indonesia’s largest source of primary energy in 2016, accounting for 41 percent, just ahead of coal (36 percent), gas (19 percent), hydro (2 percent), and other renewables (1 percent).<sup>7</sup>

Figure 1 shows the 2010-2016 growth in primary energy, especially the expansion of coal consumption.

Indonesia’s electricity growth rate over the same period has been even higher, between 5 and 8 percent.<sup>8</sup> The International Energy Agency (IEA) projects a 4.8 percent annual electricity growth rate to 2035, which would mean the addition of at least 4,000 megawatts (MW) per year, not including replacements for older units.<sup>9</sup> In its 2016-2025 electricity supply business plan, PLN uses an 8.3 percent demand growth assumption (see Figure 2).<sup>10</sup>

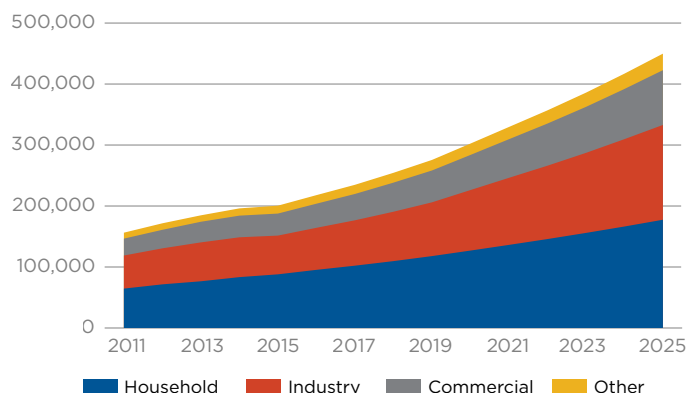
Indonesia is highly energy intensive relative to other countries in the region, driven in part by years of energy price subsidies. As seen in Figure 2, the industrial and commercial sectors, where the potential to increase energy efficiency is high, account for around 50 percent of total electricity consumption. The government has set 2025 targets for reducing intensity by 17 percent for industry and 20 percent for the commercial sector. As incomes rise and urbanization increases, household demand is expected to grow significantly, from about 59 percent currently to 78 percent in 2035.<sup>11</sup> To improve household efficiency, stronger efforts are needed to improve the energy efficiency of appliances, which

Figure 1. Indonesia’s Primary Energy Consumption 2010-2016 (million tonnes of oil equivalent)



Source: BP, *Statistical Review of World Energy*, various years, 2011-2017.

Figure 2. Indonesia’s Electricity Consumption: Realized (2011-2015), Estimated (2016), and Projected (2016-2025) (terawatt hours)



Source: PLN, RUTP 2016-2025 Electricity Supply Business Plan, 2017, Tables 4.7 and 6.25.

6 Calculated using BP’s *Statistical Review of World Energy* reports for 2011-2017.

7 BP, *Statistical Review of World Energy*, June 2017, 9.

8 PLN RUTP Business Plan for 2016-2025, Table 4.7.

9 International Energy Agency, *Southeast Asia Energy Outlook – WEO 2013 Special Report*, OECD, IEA, 2013, 53.

10 Baker McKenzie, “PLN’s 2017-2026 Electricity Supply Business Plan Issued,” April 5, 2017. See summary and link to business plan at <http://www.bakermckenzie.com/en/insight/publications/2017/04/plns-2017-2026-electricity-supply/>.

11 Galvin Jones, *The 2010-2035 Indonesian Population Projection*, United Nations Population Fund Report, [http://indonesia.unfpa.org/application/assets/publications/Policy\\_brief\\_on\\_The\\_2010\\_%E2%80%93\\_2035\\_Indonesian\\_Population\\_Projection.pdf](http://indonesia.unfpa.org/application/assets/publications/Policy_brief_on_The_2010_%E2%80%93_2035_Indonesian_Population_Projection.pdf).

would also reduce energy intensity in the industrial and commercial sectors.

As these figures demonstrate, the parallel challenge of moving away from heavy fossil-fuel dependence in electricity and in overall primary energy is monumental. In the electricity sector, government policy calls for diversifying the fuel mix and reducing coal's share in the energy mix. President Jokowi proposed a goal of 23 percent renewables in electricity generation by 2025. Meeting this will be difficult, given that only 10 percent of electricity production came from renewables in 2015. Strong political and economic interests have questioned this goal, and are proposing to reduce it in favor of gas.

However, while some entrenched interests oppose the 23 percent target, analysis from the International Renewable Energy Agency's Indonesia country report suggests the potential for a quicker transition, including a scenario for Indonesia to achieve a 29 percent share of renewable energy in the power sector by 2030. This analysis forecasts greater potential for photovoltaic (PV) development than the government's plan, projecting the addition of 47 GW, or about 3.1 GW per year.<sup>12</sup>

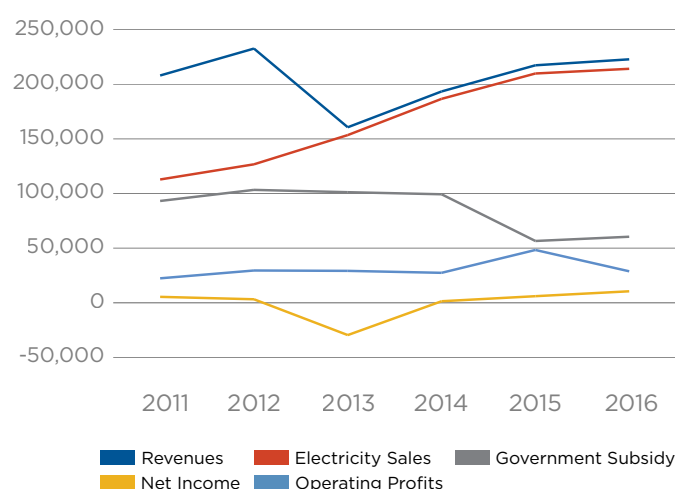
### Improving Governance and Transparency

While many developing countries have sought to improve the efficiency of their electricity systems through reforms designed to decentralize ownership and management and create competition, Indonesia has retained a centralized structure dominated by a single state utility—PLN. PLN is the second-largest state company in Indonesia, with revenues of 222,821 billion rupiah (\$16.8 billion) in 2016. PLN's net income has almost doubled since 2011, and total assets have nearly tripled over 2011-2016 to 1,274,576 billion rupiah (\$96.5 billion).<sup>13</sup> The size and scope of the 48,000-employee-strong PLN bureaucracy has given rise to serious questions about its management's efficiency and transparency.

Issues related to the use of funds are complicated by the extensive system of retail subsidies for fossil fuels (e.g., diesel, kerosene, and liquefied petroleum gas, or LPG) and electricity. These subsidies have encouraged rising domestic consumption at the expense of exports. Following years as an oil and gas exporter, Indonesia became a net oil importer in 2003, while domestic gas production peaked in 2010. Amid the low international oil price environment since late 2014, the Indonesian government has worked to reduce subsidies, and the amount the government provided in energy subsidies dropped from \$36 billion in 2012<sup>14</sup> to \$24 billion in 2014.<sup>15</sup> This number was further reduced to just \$11 billion in the audited 2015 budget, while only \$7 billion for subsidies was included in the approved 2016 budget. The biggest fossil fuel subsidy reduction was for diesel, which was reduced from 1,000 to 500 rupiah per liter in 2017.<sup>16</sup>

Although electricity subsidies have also fallen, their share of total energy subsidies has risen from 30 percent in 2014 to 40 percent in 2015, reaching 54 percent in 2016.<sup>17</sup> For PLN, government subsidies have

Figure 3. PLN Financial Highlights 2011-2016 (billion rupiah; 13,331 rupiah = \$1, mid-2017)



Source: Perusahaan Listrik Negara (PLN), Annual Report 2016 via "Perusahaan Listrik Negara (SOE)," Indonesia-Investments, <https://www.indonesia-investments.com/business/indonesian-companies/perusahaan-listrik-negara-pln-soe/item409?>

12 International Renewable Energy Agency, *Renewable Energy Prospects: Indonesia*, March 2017, 5-6.

13 Perusahaan Listrik Negara (SOE), in Indonesia-Investments, [www.indonesia-investments.com](http://www.indonesia-investments.com), see Table with Financial Highlights from PLN's Annual Report of 2016.

14 Asian Development Bank, *Fossil Fuel Subsidies in Indonesia: Trends, Impacts and Reforms*, 2015, 5.

15 Global Subsidies Initiative and International Institute for Sustainable Development, *Indonesia Energy Subsidy Briefing*, September 2015, [https://www.iisd.org/gsi/sites/default/files/ffs\\_indonesia\\_newsbriefing\\_Sep2015\\_eng.pdf](https://www.iisd.org/gsi/sites/default/files/ffs_indonesia_newsbriefing_Sep2015_eng.pdf).

16 Global Subsidies Initiative and International Institute for Sustainable Development, *Indonesia Energy Subsidy News Briefing*, March 2017, <https://www.iisd.org/gsi/sites/default/files/ffs-indonesia-news-briefing-march-2017-en%283%29.pdf>.

17 Lucky Lontoh and Lasse Toft, "Indonesia Approves Revised 2016 Budget - Subsidy Update 2016," Global Subsidies Initiative, International Institute for Sustainable Development, July 26, 2016, <https://www.iisd.org/gsi/news/indonesia-approves-revised-2016-budget-subsidy-update>.

Table 1. Major Coal Producers in Indonesia (2013-2015), in million metric tons

Mining Companies	2013	2014	2015
Bumi Resources	82.3	84.6	82.25
Adaro Energy	52.3	55.3	50.4
Kideco Jaya Agung	37	40	39
ITM (Banpu)	28.6	29.1	28.4
Berau Coal	23.5	24.2	26.55
Bukit Asam	15.1	16.4	19.3
<b>Total</b>	<b>238.8</b>	<b>249.6</b>	<b>245.9</b>
<b>% Production</b>	<b>49%</b>	<b>51%</b>	<b>52%</b>

Source: Sylvie Cornot-Gandolphe, Indonesia’s Electricity Demand and the Coal Sector: Export or Meet Domestic Demand, Oxford Institute for Energy Studies, March 2017, <https://www.oxfordenergy.org/publications/indonesias-electricity-demand-coal-sector-export-meet-domestic-demand/>, 13.

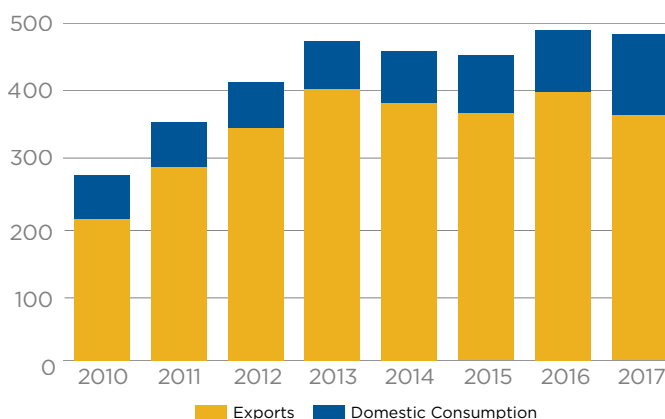
dropped from 44.7 percent of revenues in 2011 to just 27.1 percent in 2016.<sup>18</sup> Although PLN’s net income has doubled, its operating profit has not grown much, limiting its ability to maintain and expand the system. It should also be noted that the accountability and transparency of PLN’s financial position is limited due to the lack of a professional utility regulator.

### Tackling Environmental and Social Problems

Urbanization, deforestation, coastal zone development, and air pollution are putting tremendous pressure on Indonesia’s environment and tropical ecosystems. Air pollution in major cities like Jakarta, Bandung, Surabaya, and Medan exceed World Health Organization PM 10 and PM 2.5 standards for airborne particulate matter. The combination of forest-, peat-, and land-clearing fires in Kalimantan and Sumatra, increased combustion of coal in the power sector, biomass use for cooking, and transport-related particulate emissions creates serious air quality problems—and health impacts.<sup>19</sup>

The expansion of coal mining, mainly in Kalimantan, has increased deforestation, flooding, and water contamination, affecting rice and aquaculture economies and local communities. Coal mining concessions have been given for operations in “conservation forests” and companies have not fulfilled their reclamation requirements.<sup>20</sup> As of November

Figure 5. Indonesia’s Coal Production\* 2010-2017 (Estimated) (millions of tons)



\*National production equals exports and domestic consumption. Source: Fitri Wulandari and Eko Listiyorini, “Coal’s Recovery Too Good to Resist for Indonesia, the World’s Biggest Exporter,” Live Mint, January 13, 2017, <http://www.livemint.com/Industry/80hflfrBjfXapHk7es4JsK/Coals-recovery-too-good-to-resist-for-Indonesia-the-world.html>.

2016, local authorities had issued 10,818 mining business permits (IUPs) without proper oversight or records. The Indonesian government has tried to introduce measures to better regulate the coal mining industry, and a system of “clean and clear” certificates (CnCs) was established to confirm that the mining companies were compliant with tax and environmental

18 Perusahaan Listrik Negara (SOE), Indonesia-Investments, calculated from Financial Table.

19 See Satya Widya Yudha, “Air Pollution in Indonesia: Challenges and Imperatives for Change,” The National Bureau of Asia Research, April 11, 2016, <http://www.nbr.org/research/activity.aspx?id=665>, for data on several health studies.

20 Mike Ives, “Indonesian Coal Mining Boom Is Leaving Trail of Destruction,” *Yale Environment* 360, December 17, 2015, [http://e360.yale.edu/features/indonesian\\_coal\\_mining\\_boom\\_is\\_leaving\\_trail\\_of\\_destruction](http://e360.yale.edu/features/indonesian_coal_mining_boom_is_leaving_trail_of_destruction).

requirements. However, only around 6,404 CnCs had been issued by November 2016.<sup>21</sup>

Unlike the oil and gas sector, the Indonesian coal industry is very fragmented, comprised mainly of domestic companies, many small operators, and community mines. A recent Oxford Institute for Energy Studies report on the Indonesian coal industry identified Indonesia's leading coal producers, shown in Figure 4, which accounted for 52 percent of production in 2015.<sup>22</sup>

Indonesian coal production peaked in 2013, and then held steady in 2014-2015 at about 460 million tons, during which time exports fell. However, rising prices in late 2016 led to increased production and exports. The government, despite its expressed intent to curtail coal production and exports to ensure adequate supplies for new domestic coal power plants, has not stopped producers from expanding production. The government's target of 419 million tons was substantially surpassed in 2016, with production reaching 434 million; it is forecast to rise to 489 million in 2017.<sup>23</sup>

Geothermal development is another significant option for Indonesia's energy future, given its estimated power potential of 27-29 GW and more than 252 locations. In fact, Indonesia is home to around 40 percent of the world's geothermal power potential,<sup>24</sup> and the government has an ambitious goal to add 7.2 GW of geothermal capacity by 2025. Twelve locations are currently producing, and about 1.6 GW of new fields are under development. However, geothermal is not without its issues—land and forest management constraints have posed challenges to companies interested in geothermal energy development. In 2014, the government passed Law No. 21, which separated geothermal development from mining activities and sought to streamline approvals for access to resource areas in forested land. Despite these efforts, conflicts with local communities and officials remain, and the implementation process has been slow.<sup>25</sup>

## Increasing Access and Affordability

With a per capita income of only \$3,895 in Indonesia, energy affordability is a key issue for Indonesian leaders, and a major driver of energy subsidy programs. Along with affordability, access to energy is also a key concern, and connecting the remaining 12,659 villages (out of a total of 74,754 villages) that lack electricity is a high priority. Government and international donor programs have funded PLN's rural electrification programs for many years. The government's most recent Bright Indonesia program has set a target of connecting 10,300 villages by 2019, which would bring service to an impressive 97 percent of the population. PLN is also promoting island solar photovoltaic systems as well as gas-fired systems to replace diesel generators.

## Achieving Power Sector Financial Viability

With the help of large external borrowing, PLN has sought to keep up with growing electricity demand. However, sporadic and widespread electricity shortages are commonplace and the government has come under increasing criticism for delays and uncertainties in major projects. Greater private capital mobilization is clearly required to meet future generation, transmission, and distribution needs. Amid these pressures, PLN has found it increasingly difficult to borrow due to its credit problems. The Indonesian government recognizes the scope of these needs and the limitations of PLN's capacity; however, the challenge of creating a commercially viable power system after years of subsidies and inefficient monopoly control is daunting. Despite the incentive provided by favorable feed-in tariffs, private investors see these risks in PLN's financial position as well as the bureaucratic and regulatory obstacles to project approval and construction.

21 "New Regulations in Indonesia's Coal Mining Industry," Indonesia-Investments, December 8, 2016, <https://www.indonesia-investments.com/news/todays-headlines/new-regulations-in-indonesia-s-coal-mining-industry/item7426?>

22 Sylvie Cornot-Gandolphe, *Indonesia's Electricity Demand and the Coal Sector: Export or Meet Domestic Demand*, Oxford Institute for Energy Studies, March 2017, <https://www.oxfordenergy.org/publications/indonesias-electricity-demand-coal-sector-export-meet-domestic-demand/>.

23 Fitri Wulandari and Eko Listiyorini, "Coal's Recovery Too Good to Resist for Indonesia, the World's Biggest Exporter," Live Mint, January 13, 2017, <http://www.livemint.com/Industry/80hf1frBjfxApHk7es4JsK/Coals-recovery-too-good-to-resist-for-Indonesia-the-world.html>.

24 Suharmanto Puji, Fitri Annisa Nor, and Ghaliyah Sitti, *Indonesian Geothermal Energy Potential as Source of Alternative Energy Power*, KnowledgeE, 2015, <https://knepublishing.com/index.php/KnE-Energy/article/view/325/1239>.

25 See Fransiscus Rodyanto, "Indonesia's Geothermal Potential: A Legal Review," *Renewable Energy World*, July 27, 2016, <http://www.renewableenergyworld.com/articles/ucg-content/2016/07/27/indonesias-geothermal-potential-a-legal-review.html>.

## TOWARD A COMPREHENSIVE DIVERSIFICATION STRATEGY

### Creating a Sound Policy, Legal, and Regulatory Environment

**Priority: Indonesia needs to strengthen its regulatory framework for the power sector by creating an independent, professional energy utility regulator and permitting private build, own, and operate investments in power generation.**

The Jokowi government has given strong policy priority to the electricity sector with its 35 GW capacity addition program (described in the generation mix section below) and made efforts to streamline the procedures for investment projects. Although the state's dominance in the sector will continue, the program is a departure from the past, as the private sector, both foreign and domestic, is also expected to play a much greater role. To attract private investment, the government and PLN will need to improve revenue generation in the sector and establish more rational and predictable tariff policies. Although overall electricity subsidies have been reduced along with fossil fuel subsidies, the government lowered electricity tariffs for low-voltage customers in March 2016 only to increase rates for most customers in 2017.

One of the most important changes that needs to be made is that the Indonesian government should adopt the international best practice of creating a separate energy utility regulator. Such efforts will need to overcome obstacles that stymied past efforts to create such a body. For example, while the 2002 Electricity Law No. 20 called for unbundling the PLN and creating an Electricity Market Supervisory Agency, the law was revoked by the Constitutional Court in a 2004 ruling that found that a competitive market violated the requirement that electricity is a public good over which the state has exclusive control. Law 20/2002 was replaced by Law 30/2009, which did not include the provision to create an independent energy regulator.<sup>26</sup>

The lack of a professional and transparent regulator contributes to the political and bureaucratic

fragmentation impeding oversight of the sector. The removal of Minister of Energy and Mineral Resources Sudirman Said, a champion of a power diversification policy, during President Jokowi's second cabinet reshuffle in August 2016, added to policy and regulatory uncertainty. Said was viewed as a reformist minister, but according to speculation was at odds with a high-placed official of the powerful Golkar Party over alleged corruption.<sup>27</sup> Following the abortive appointment of Archandra Tahar, quickly disqualified due to his dual citizenship in the United States, in October 2016 Jokowi appointed Ignasius Jonan, a former corporate executive and minister of transportation, as minister of energy and minerals. Although Jonan has little energy experience, he has moved quickly to issue several important regulations in power and gas as discussed below.

### Developing an Efficient Institutional and Market Structure

**Priority: Indonesia needs to unbundle PLN and begin to create a more open and competitive system with third-party access for power generators.**

Indonesia needs to follow the example of other countries, for example Mexico, and restructure the PLN, currently a state-owned, vertically integrated electricity monopoly. The Indonesian government must face the reality of this inefficient monopoly, create an independent regulator, and design an unbundled market that recognizes the fragmented nature of the island economy and the necessity of diversifying and promoting greater private and community investment in decentralized renewable and gas systems. As discussed, such reforms will likely require a new law and involve further challenges in the courts by vested interests.

Substantial decentralization of electricity sector management is needed, along with market rules allowing third-party access for generators and

<sup>26</sup> See International Energy Agency, "Electricity Law (No. 30/2009)," March 20, 2015, <https://www.iea.org/policiesandmeasures/pams/indonesia/name-140166-en.php> and Baker McKenzie, *New Presidential Regulation to Accelerate Indonesian 35GW Power Generation Program*, February 2016, [http://www.bakermckenzie.com/-/media/files/insight/publications/2016/02/new-presidential-regulation-to-accelerate/al\\_ap\\_powergenerationprogram\\_feb16.pdf?la=en](http://www.bakermckenzie.com/-/media/files/insight/publications/2016/02/new-presidential-regulation-to-accelerate/al_ap_powergenerationprogram_feb16.pdf?la=en).

<sup>27</sup> Alexander R. Arifianto, "Jokowi's Second Cabinet Reshuffle: Implications for Indonesian Politics," *Jakarta Post*, August 2, 2016, <https://www.pressreader.com/indonesia/the-jakarta-post/20160802/281749858728542>.



Lumbung coal mine in Central Kalimantan, Borneo, in 2013. *Photo credit: IndoMet in the Heart of Borneo/Flickr.*

distributors and net metering. While center-periphery relations will always be an issue in Indonesia's Javanese-dominated political system, government and PLN attempts to overly centralize governance of the non-Java Island systems will likely be ineffective. The economies of these outer islands are growing rapidly and investment decisions will need to be responsive to this growth. Although regions are required to develop electricity plans, centralizing investment project reviews in the Board of Investments is not a viable long-term solution. Independent System Operators for the major island systems, initially part of the main PLN transmission grid but unbundled from PLN generation, should be considered. Rules for non-PLN generators to have non-discriminatory access to the grid could then be developed.

However, there are also risks in decentralizing investment, licensing, and procurement decisions to local officials. Corruption problems, as seen in the local management of coal mining concessions in Kalimantan, will likely continue to be a challenge.

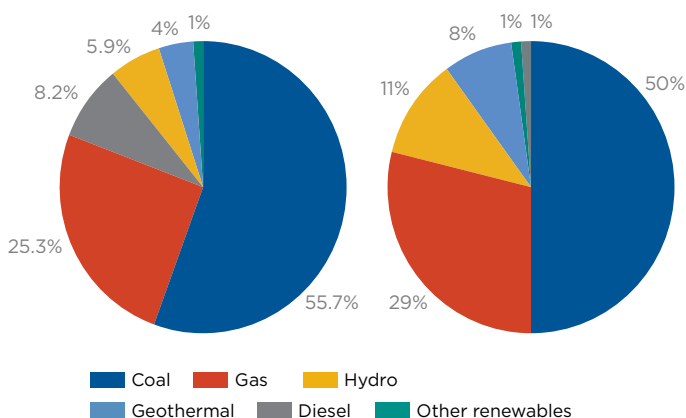
The Ministry of Energy will play a critical role in the development of the power sector and its capacity should be increased. However, a clear structural and functional separation of policy, regulatory, and system operational responsibilities is imperative.

### **Achieving a Cleaner and More Resilient Generation Mix**

**Priority: Indonesia needs to reinforce its national commitment to reducing dependence on coal, improve the environment, and strengthen its efforts in renewable energy and energy efficiency.**

It is important that Indonesia's electricity diversification plans succeed. The economic and environmental costs of continuing with a coal-dominated strategy are high, and growing, despite the perceived advantages on a narrow cost-per-btu (British thermal unit) basis. The economic and environmental advantages of greater efforts to tap Indonesia's renewable energy resources are becoming increasingly clear as the technologies improve and costs continue to fall. One analysis suggests that the cost of coal power in Indonesia,

Figure 6. Indonesia’s Electric Generating Capacity 2015 and 2025 (Planned) by Source (percent)



Source: PWC, Release of Long-Awaited 2016-2025 RUPTL: A Positive Sign for IPP Investors, July 2016, <https://www.pwc.com/id/en/publications/assets/eumpublications/newsflash/2016/PwC%20Indonesia-eum-newsflash-2016-59.pdf>; Fedina Sundaryani, “Gov’t Tones Down Expectations on Renewable Energy,” Jakarta Post, June 24, 2016.

taking into full account environmental and climate costs, is 11 cents per kilowatt hour (kWh), which would make renewables very competitive.<sup>28</sup>

In 2015, Indonesia had an installed electric generating capacity of 55.5 GW, about 55.7 percent of which was coal-based, 25.3 percent gas-fired, 8.2 percent from diesel generators, and 5.9 percent hydro, 4.0 percent geothermal, and 0.9 percent other renewables (see Figure 6). In May 2015, not long after the Jokowi government came into power, the government announced a plan to increase capacity by 35 GW by end-2019 at an estimated cost of \$88 billion.<sup>29</sup> Under this plan, coal would maintain its lead role, accounting for 20 GW of the increased capacity, gas-fired units would increase by 11.3 GW, and renewables 3.7 GW, the last comprised of 2.4 GW hydro, 1.2 GW geothermal, and 120 MW wind. However, the ambitious plan has run into many obstacles, and the Ministry of Energy and

Mineral Resources announced in November 2016 that only 19.7 GW would be achieved by 2019—11.4 GW from independent power producers and 8.3 GW by PLN.<sup>30</sup> In early 2017, President Jokowi said the target should be recalculated but the National Energy Council decided to maintain it.<sup>31</sup>

In addition to the 2019 crash program, the government formulated a medium-term target for 2025 in the National Energy Policy that proposes to achieve 23 percent renewables by 2025 and reduce coal’s share to 50 percent. This target was in line with Indonesia’s Paris commitment to reduce greenhouse gas emissions. However, PLN has raised concerns about the high costs of renewables, and in its 2016-2025 business plan, released in mid-2016, reduced the 2025 renewables target from 23 to 19.6 percent, and increased the share of gas from 24.3 percent to 29.4 (see source in Figure 6).

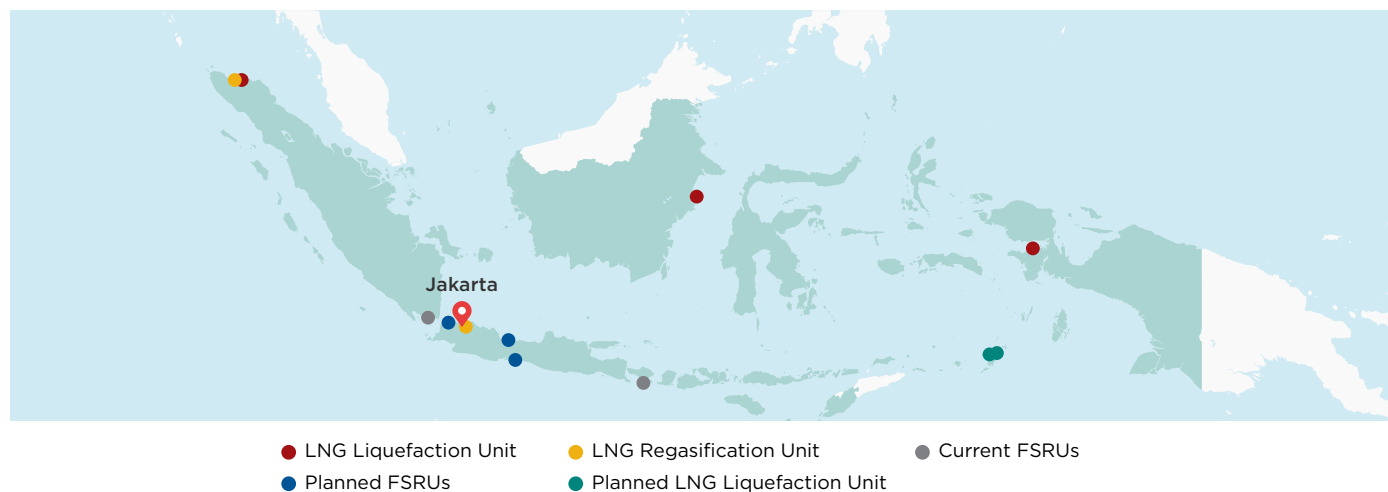
**Gas Development:** The importance of gas in Indonesia’s overall energy and power strategy is clearly growing. The government aims to create a system of LNG terminals that would supply power plants and industries and link the islands. The Japanese, who have a domestic sea and land LNG transport system, have been deeply involved in advising and funding these efforts in Indonesia. Both Tokyo Gas and Osaka Gas are involved in gas infrastructure projects, as are shipping companies from South Korea and Japan.<sup>32</sup>

Plans are in place to add seven floating storage and regasification units (FSRUs) and construct sixty-two small land-based regasification plants by 2020.<sup>33</sup> Indonesia has two operational FSRUs in Jabar and Labuhan Maringgai in West Java, and two have been approved, in Cilegon in West Java and Jateng in East Java, while distribution pipelines in Java and Sumatra are planned to connect these facilities to demand centers.<sup>34</sup> In February 2017, Pertamina and PLN, together with Japanese trading houses, agreed to build a \$1.8 billion, 1,760 MW gas-fired power plant in West

28 Richard Bridle, “The True Cost of Coal and Renewables in Indonesia,” International Institute for Sustainable Development, Global Subsidies Initiative, June 20, 2017, <https://www.iisd.org/blog/true-cost-coal-and-renewables-indonesia>.  
 29 “Indonesia Releases Its 35 GW Power Capacity Addition Plan,” Enerdata, May 6, 2015, <https://www.enerdata.net/publications/daily-energy-news/indonesia-releases-its-35-gw-power-capacity-addition-plan.html>.  
 30 “Indonesia Energy Ministry Admits Only 56.5% of the 35GW Power Program Completed by End of 2019,” Rambu Energy, November 16, 2016, <https://www.rambuenergy.com/2016/11/indonesia-energy-ministry-admits-only-56-5-of-the-35-gw-power-programs-completed-by-end-2019/>.  
 31 “Indonesian Energy Council Maintains 35GW Power Plant Completion Target,” Rambu Energy, January 23, 2017, <https://www.rambuenergy.com/2017/23/Indonesia-energy-council-maintains-35GW-power-plant-completion-target/>.  
 32 Karen Thomas, “Small-Scale LNG Supplement: Indonesia – Big Plans for Small-Scale LNG,” LNG World Shipping, April 2016, [http://www.lngworldshipping.com/news/view,smallscale-lng-supplement-indonesia-big-plans-for-smallscale-lng\\_42723.htm](http://www.lngworldshipping.com/news/view,smallscale-lng-supplement-indonesia-big-plans-for-smallscale-lng_42723.htm).  
 33 “Indonesia Plans Five More FSRUs in 2017,” Natural Gas World, June 8, 2016, <https://www.naturalgasworld.com/indonesia-plans-five-more-fsrus-in-2017-18736>.  
 34 Edwin Soetirto, *Gas Commercialization Strategy in Indonesia*, RISC Advisory, May 2016.



Figure 7. Indonesia's Gas Infrastructure



Source: Karen Thomas, "Small-Scale LNG Supplement: Indonesia – Big Plans for Small-Scale LNG," LNG World Shipping News, April 25, 2016, [http://www.lngworldshipping.com/news/view,smallscale-Ing-supplement-indonesia-big-plans-for-smallscale-Ing\\_42723.htm](http://www.lngworldshipping.com/news/view,smallscale-Ing-supplement-indonesia-big-plans-for-smallscale-Ing_42723.htm).  
 Map credit: FreeMapVectors.com.

Java that would use gas from a nearby FSRU.<sup>35</sup> During his visit to the United States in 2015, President Jokowi signed an agreement with General Electric (GE) for 40 x 25 MW aero-derivative gas systems, and in March 2017 the president was able to inaugurate 500 MW of small (25-100 MW) gas units in eight locations in Banka Island, Lampung in South Sumatra, Pontianak in West Kalimantan, Bengkalis in Riau Island, and Nias and Medan in North Sumatra.<sup>36</sup>

However, while gas may be increasing in importance for Indonesia's domestic energy picture, without new gas discoveries, Indonesia will need to import increasing volumes of LNG. LNG imports could reach 1.9 billion cubic meters (bcm) in 2024 assuming a production decline of 5 percent per year.<sup>37</sup> PLN currently takes about 80 percent of the gas delivered to the domestic market, and the planned growth in the company's gas generating capacity, as well as that of the independent power producers, will require increasing domestic supplies. Pertamina has projected gas demand growth of 4.8 percent during 2015-2025 and the Ministry of Energy and Mineral Resources expects small amounts of LNG imports in 2019. Pertamina has already signed an agreement with Cheniere to source LNG from

Cheniere's Corpus Christi project in the United States beginning in 2019,<sup>38</sup> and a significant long-term LNG sale and purchase agreement was signed in June 2017 between Pertamina and Australian North West Shelf operator Woodside that would start in 2019 and ramp up supplies from global markets to 0.6 million tons in 2022, with the possibility of further increases to 1.1 million tons (about 1.5 bcm) from 2024 onwards.<sup>39</sup>

The Indonesian government is debating the nature of the institutional structure to oversee and coordinate this national gas program. A proposal to create a national gas aggregator has received public attention, but there are risks in creating a central control mechanism given the well-known problems in Indonesia's bureaucracy. Andrew Seck, vice president for LNG marketing and shipping for Anadarko Petroleum Corporation, has commented:

... there is a danger that the move to a national aggregator might slow down the recent activity, which has stimulated competition from a number of smaller private companies. Indonesia needs an investment framework which encourages foreign direct investment and maximum involvement by multiple domestic players.<sup>40</sup>

35 Diarmaid Williams, "\$1.8 Billion Deal Signed for Indonesian Gas-Fired Power Plants," Power Engineering International, February 1, 2017, <http://www.powerengineeringint.com/articles/2017/02/1-8bn-deal-signed-for-indonesian-gas-fired-power-plant.html>.

36 "Indonesia Adds 500MW into Power Grid from New Mobile Power Plants," *Jakarta Post*, March 19, 2017, <http://www.thejakartapost.com/news/2017/03/19/indonesia-adds-500-mw-into-electricity-grid-from-new-mobile-power-plants.html>.

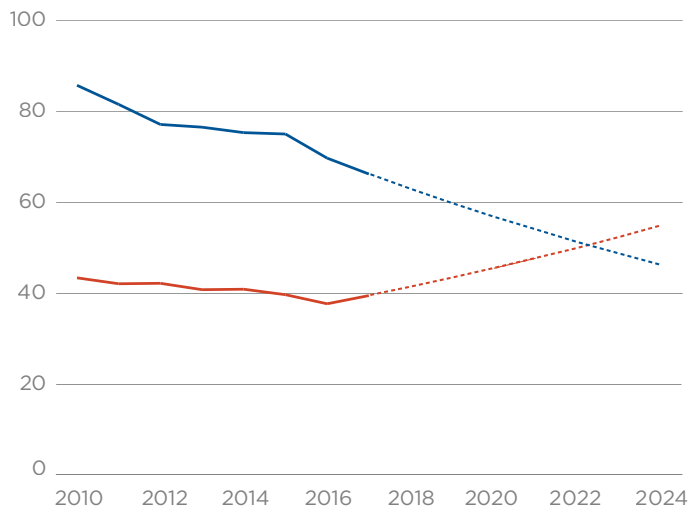
37 Howard V. Rogers, *Asian LNG Demand: Key Drivers and Outlook*, Oxford Institute for Energy Studies, Paper NG106, April 2016, 54-5.

38 "Indonesia: Govt Prepares Rules to Anticipate LNG Imports," Hellenic Shipping News Worldwide, March 18, 2016, <http://www.hellenicshippingnews.com/indonesia-govt-prepares-rules-to-anticipate-Ing-imports/>.

39 "Woodside in LNG Supply Deal with Indonesia's Pertamina," Offshore Energy Today, June 6, 2017, <http://www.offshoreenergytoday.com/woodside-in-Ing-sale-agreement-with-indonesias-pertamina/>.

40 Andrew Seck, "Lower Gas Prices: Threat or Opportunity for Indonesia?" GasTech News, February 22, 2016.

**Figure 8. Indonesia's Natural Gas Production and Consumption, 2010-2016 (Actual), 2017-2024 (Projected) (billion cubic meters)**



Source: BP, Statistical Review of World Energy, various issues; see sources 30 and 31, projected by author.

The chairman of Indonesia's House of Representatives commission dealing with energy and mineral resources is also reportedly developing a bill to create a special energy holding company for state-owned enterprises in both upstream and downstream oil and gas.<sup>41</sup>

**Geothermal Development.** Aside from gas, another potential diversification option is to utilize Indonesia's geothermal potential. However, institutional and local political issues have hindered Indonesia's efforts to develop its 29 GW of geothermal potential. The Indonesian government is planning to have a total geothermal capacity of 6,023 MW online by 2020 and to raise its share to 5.8 percent of the overall energy mix by 2025. However, these targets will be difficult to achieve given the costs and the requirement for

about sixty wells a year costing \$7-10 million per well.<sup>42</sup> The Asian Development Bank (ADB) estimates that adding 3 GW of geothermal would require \$4 billion in equity investment and \$9.5 billion in debt (based on assumptions of \$4500/kW and 30 percent equity).<sup>43</sup>

The government has identified twenty-one geothermal resource blocks, with an estimated capacity of 1,065 MW and investment cost of \$4.26 billion for potential development.<sup>44</sup> Twelve of these areas will be offered in 2017, five in auctions to private developers and seven to state companies, i.e., Pertamina, PLN, and PT Geo Dipa.<sup>45</sup>

In addition to the high upfront exploration and field development costs, project investment in geothermal projects has been slowed by local land and forest issues and other regulatory and political hurdles. After years of geothermal electricity generation from its plants at the Darajat and Salak fields (total 413 MW) in West Java, Chevron decided, in late 2016, to sell its Indonesian geothermal subsidiary, along with its Mak-Ban geothermal operation in the Philippines, to Star Energy Group Holdings, a group controlled by businessman Prajogo Pangestu.<sup>46</sup> This pullout follows years of continuing frustration with trying to reach agreement to develop fields in South Sumatra, even though Chevron had concessions for the areas and was prepared to make major investments in exploration.

Despite these obstacles and setbacks, some projects have moved ahead. The first 110 MW unit of a three-unit, 330 MW, \$1.6 billion geothermal plant was completed in 2016 by a consortium including Medco Power Indonesia, Kyushu Electric, and other Japanese companies (using Ormat technology)<sup>47</sup> in Sarulla, North Sumatra.<sup>48</sup> Following its acquisition of Chevron properties, Star Energy, together with Ayala Corporation from the Philippines and the Electricity

41 "House Preparing Bill on Special Energy Holding Company," *Jakarta Post*, February 13, 2017, <http://www.thejakartapost.com/news/2017/02/13/house-preparing-bill-on-special-energy-holding-company.html>.

42 Marianne Estioco, "Indonesia's Red-Hot Geothermal Energy Goals under Threat as Sky-High Costs Bite," *Asian Power*, April 27, 2016, <http://asian-power.com/power-utility/in-focus/indonesia%E2%80%99s-red-hot-geothermal-energy-goals-under-threat-sky-high-costs-bite>.

43 Asian Development Bank and the World Bank, *Unlocking Indonesia's Geothermal Potential*, 2015, <https://www.adb.org/sites/default/files/publication/157824/unlocking-indonesias-geothermal-potential.pdf>, 16.

44 Alexander Richter, "Indonesia Plans to Tender 21 Geothermal Working Areas 2016-2017," *Think Geo Energy*, January 18, 2016, <http://www.thinkgeoenergy.com/indonesia-plans-to-tender-21-geothermal-working-areas-2016-2017/>. Article contains list of the 21 areas.

45 "Indonesia Energy Ministry to Offer 12 Geothermal Work Areas This Year," *Rambu Energy*, May 22, 2017, <https://www.rambuenergy.com/2017/05/indonesia-energy-ministry-to-offer-12-geothermal-working-areas-this-year/>.

46 Chevron, "Chevron Announces Sale of Geothermal Operations," Press Release, December 23, 2016, <https://www.chevron.com/stories/chevron-announces-sale-of-geothermal-operations>; and Antonia Timmerman, "Indonesia: Barito Pacific to Acquire Affiliate Firm Star Energy," *Deal Street Asia*, December 27, 2016, <https://www.dealstreetasia.com/stories/indonesia-barito-pacific-to-acquire-affiliated-firm-star-energy-61458/>.

47 Kyushu Electric Power Co., Inc., Sarulla Project, [www.kyuden.co.jp](http://www.kyuden.co.jp), 2017.

48 Alexander Richter, "First 110 MW Unit of Sarulla Geothermal Project Reaching Completion," *Think Geo Energy*, October 6, 2016, <http://www.thinkgeoenergy.com/first-110-mw-unit-of-sarulla-geothermal-project-reaching-completion/>.

Generating Public Co., aims to develop up to 1 GW of geothermal capacity by 2020.<sup>49</sup>

The ADB, World Bank, and US State Department have sought to promote the development of Indonesia's geothermal resources by supporting and encouraging improvements in the regulatory environment and the creation of financial mechanisms (such as those used by the Inter-American Development Bank in Mexico) to mitigate upfront exploration risks. To this end, the Indonesian government established a Geothermal Fund Facility of about \$300 million in 2011, but the Ministry of Finance delayed the development of a system for project disbursements.<sup>50</sup>

This stalled situation changed in May 2017, when the new Minister of Finance Sri Mulyani Indrawati decided to move ahead with a mechanism that would use a state-owned infrastructure financing company, PT Sarana Multi Infrastruktur (PT SMI), to provide funds to companies to mitigate the risks during the exploratory stage.<sup>51</sup> The Ministry of Finance is budgeting \$224 million to provide to PT SMI this year.<sup>52</sup> The government is also offering a package of fiscal incentives for geothermal operators, including exemption from import duties and import taxes, tax allowance for 30 percent of income tax for six years from investment costs, loss carry forward for up to ten years, shortened depreciation, and tax deductions on dividends and value-added-tax-free status for exploitation and exploration.<sup>53</sup>

*Hydropower Development.* Hydropower is currently Indonesia's largest source of renewable energy generation, and major new projects are underway and in the planning stages. Indonesia's current installed capacity is about 5 GW and an additional 1 GW is slated for development in the PLN expansion plan; according to the International Hydropower Association, approximately seven hydropower stations, amounting to 1,559 MW, are reportedly under construction, with

ten additional projects under consideration. The World Bank is supporting a large 1,040 MW pumped storage project in western Java with a \$640 million loan.<sup>54</sup> However, it should be noted that while Indonesia's technical hydro potential is estimated at around 75 GW, only about 8 GW is thought to be economically viable.<sup>55</sup>

*Solar and Wind Development.* Solar and wind are also emerging as additional options to diversify Indonesia's domestic energy supply away from fossil fuels. However, compared with many other developing countries, solar and wind development in Indonesia has been limited and dominated by the Ministry of Energy and PLN. Despite this limitation, new measures are spurring private investment. Following a new solar decree in mid-2016, projects are starting to come online in response to a favorable feed-in tariff of 14.5 to 25 cents per kWh depending on the region, with twenty-year power purchase agreements (PPAs). Additionally, an initial 250 MW target and longer-term 5 GW solar goal are also driving investment.<sup>56</sup>

International companies like Conergy, Enfinity, and ASEAN Power are developing ventures with local companies for utility-scale PV projects and 15.3 MW of solar projects are reportedly under construction. However, uncertainty regarding the regulatory framework remains, due to parliamentary and PLN opposition to paying for higher-cost renewables and cuts to renewable energy programs due to the tight budget resulting from lower oil, gas, and coal revenue. In August 2016, the Ministry of Energy and Mineral Resources cut the renewables budget from 2.1 trillion to 1.7 trillion rupiah.<sup>57</sup>

Despite the common assumption that Indonesia has limited wind potential, the Figure 9 resource map shows several prospective areas for wind energy development—and some companies are beginning to develop wind farms. UPC Renewables and its domestic

49 Lenie Lectura, "AC Energy Acquires Chevron Geothermal Assets in Indonesia," *Business Mirror*, April 3, 2017, <http://www.businessmirror.com.ph/ac-energy-acquires-chevron-geothermal-assets-in-indonesia/>.

50 Asian Development Bank and the World Bank, *Unlocking Indonesia's Geothermal Potential*, 92.

51 Parker O'Halloran, "New Funding Schemes in Jakarta to Encourage Geothermal Exploration," *Think Geo Energy*, May 31, 2017, <http://www.thinkgeoenergy.com/new-funding-schemes-in-jakarta-indonesia-to-fund-geothermal-exploration/>; "Editorial: Funding Geothermal Exploration," *The Jakarta Post*, June 5, 2017, <http://www.thejakartapost.com/academia/2017/06/05/editorial-funding-geothermal-exploration.html>.

52 Alexander Richter, "Indonesia Allocates \$224 Million for Geothermal Drilling Fund," *Think Geo Energy*, July 10, 2017, <http://www.thinkgeoenergy.com/indonesia-allocates-224-million-for-geothermal-drilling-fund/>.

53 Communication citing quote by Rida Mulyana, Director General for New and Renewable Energy & Energy Conservation, in the brochure for the August 4-6, 2017, Indonesia International Convention & Exhibition 2017 at the Jakarta Convention Center, Jakarta.

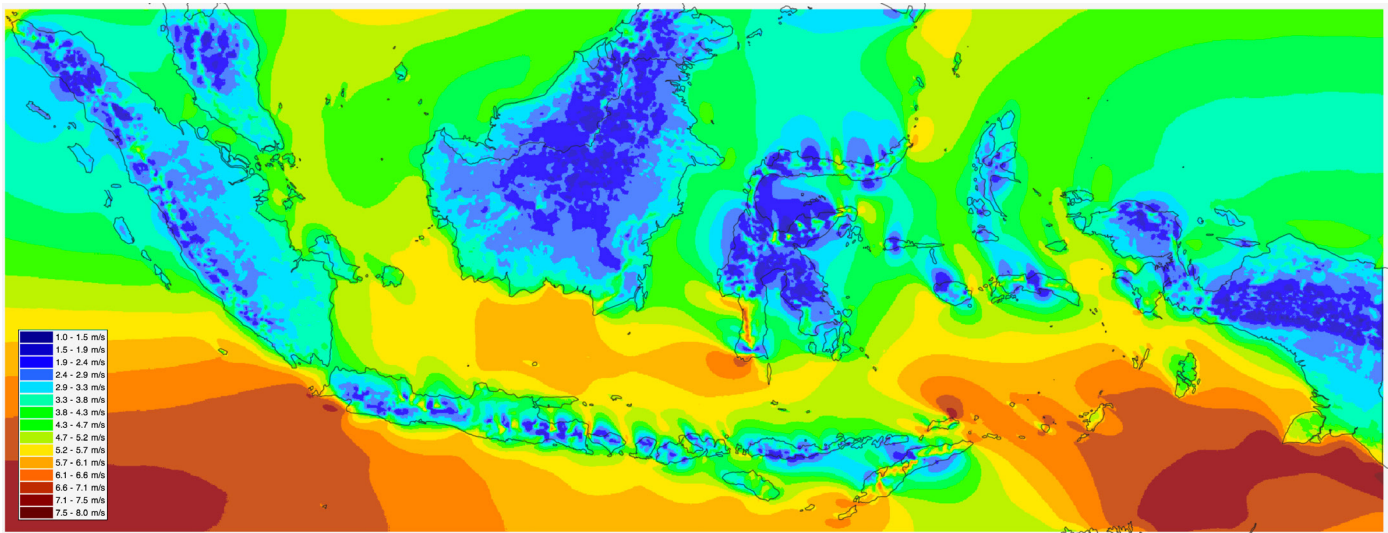
54 "Indonesia," International Hydropower Association, updated in May 2016, <https://www.hydropower.org/country-profiles/indonesia>.

55 Ibid.

56 Andre Susanto, "New Government Decree to Accelerate the Indonesian Solar Market," *Solar Plaza*, July 22, 2016, <https://www.solarplaza.com/channels/markets/11591/new-government-decree-accelerate-indonesian-solar-market/>.

57 Fedina S. Sandaryani, "Budget Cuts Jeopardize Indonesia's Renewable Energy Plans," *Jakarta Post*, August 8, 2016, <http://www.thejakartapost.com/news/2016/08/08/budget-cuts-jeopardize-indonesia-s-renewable-energy-plans.html>.

Map 1. Wind Energy Resources of Indonesia



Source: EMD International A/S, <http://indonesia.windprospecting.com/>.

partner PT Binatek Energi Terbarukan are developing 1,000 MW of wind projects, including a 70 MW farm in Sidrap, South Sulawesi, and a 50 MW venture in Bantul, Yogyakarta Province, on Java. The UPC group has PPAs with PLN and has received funding from the US Overseas Private Investment Corporation for the Sidrap project.<sup>58</sup>

Despite these bright spots in new renewable projects, expanding renewable energy continues to be hampered by PLN's financial situation and the strongly held view that coal is the least-cost energy option. To overcome these barriers, setting up a separate utility to buy renewable energy has been proposed,<sup>59</sup> but it is unlikely to gain much traction given PLN's interest in maintaining control over generation projects and opposition from vested interests in Parliament.

*Nuclear Power Development.* Looking to the long-term development of the power sector, Indonesia continues to grapple with the question of nuclear power. Among large developing countries, Indonesia is one of the few that has not pursued commercial nuclear generation. However, Batan, the Indonesian nuclear agency, sees nuclear coming into the mix around 2027.<sup>60</sup> Batan is investigating several plant designs, and is building a 10-15 megawatts-electric experimental power reactor

at Serpong, Banten Province, as a first step, as well as evaluating potential sites for a large nuclear power plant.<sup>61</sup> In some locations, like Muria in Central Java, this has been met with protests by the local community.

In addition to public opposition, there is a lack of consensus across the government. While a March 2015 Indonesian government white paper on national energy development to 2050 included a scenario with five gigawatts-electric of nuclear energy by 2025,<sup>62</sup> then Minister of Energy and Mineral Resources Sudirman Said stated, before leaving office in July 2016, that nuclear was off the table.

Political questions aside, Batan has technology cooperation agreements with several countries, including China, Japan, South Korea, the United States, and Russia, and concluded an agreement with China's Nuclear Engineering Corporation in August 2016 to cooperate in developing a high-temperature gas-cooled reactor in Indonesia.<sup>63</sup> As noted in the second report in this series, on China, the Chinese are aggressively pursuing nuclear projects in the developing world. Indonesia is also interested in smaller modular reactors—however, they are under development and not expected to be commercially available before 2022 at the earliest. This raises the

58 "Indonesia," UPC Renewables, <http://www.upcrenewables.com/indonesia/>.

59 Saurabh Mahapatra, "Indonesia Attracts \$327 Million Renewable Energy Investment in Q1 2016," Clean Technica, April 25, 2016, <https://cleantechnica.com/2016/04/25/indonesia-attracts-327-million-renewable-energy-investment-q1-2016/>.

60 "Indonesia," International Atomic Energy Agency, Country Nuclear Power Profiles, 2016, Section 2.2, <https://cnpp.iaea.org/countryprofiles/Indonesia/Indonesia.htm>.

61 Ibid., sections 2.3.1 and 2.3.5.

62 "Nuclear Power in Indonesia," World Nuclear Association, August 2016.

63 "China and Indonesia to Jointly Develop HTGR," World Nuclear News, August 4, 2016, <http://www.world-nuclear-news.org/NN-China-and-Indonesia-to-jointly-develop-HTGR-0408165.html>.

broader question of whether nuclear will be able to compete over the long term given falling renewable energy prices and projected growth of a competitive gas market.

## Expanding Electricity Access to the Poor and Rural Areas

**Priority: Indonesia needs to deliver on its new policy to allow private and foreign companies to introduce decentralized renewable technologies to meet the needs of the over twelve thousand villages currently lacking access to electricity.**

With thousands of islands and remote communities, Indonesia is ideally suited for decentralized renewable energy systems. The government has made important strides in bringing electricity and LPG fuels to these isolated communities and is now focusing on both replacing high-cost diesel generators and installing solar PV, mini-hydro, and biomass systems. PLN's 1000 island solar PV program aims to develop 620 MW by 2020.<sup>64</sup>

Caterpillar's efforts to deploy its initial overseas hybrid solar-diesel mini-grid systems in Indonesia are one promising development.<sup>65</sup> These systems, which include solar PV modules and state-of-the-art energy storage combined with advanced monitoring and control systems, can run as small as 10 kW. These efforts, along with GE's gas aero-derivatives and Japanese LNG ISO (International Organization for Standardization) containers and intra-island transport systems, could provide a good combination for many of the islands.

Substantial donor support is furthering decentralized power development. The US Millennium Challenge Corporation's \$332.5 million Green Prosperity Program provides grants to local communities for expanding renewable energy, increasing productivity, and improving land use management.<sup>66</sup> The ADB has also been a leader in Indonesia with many projects, including an innovative renewable energy demonstration effort in partnership with the Netherlands to develop a 100 percent renewable energy system on the island of Sumba.<sup>67</sup>

Indonesia is becoming a key proving ground for decentralized and off-grid energy systems in the developing world. Although the government's rural electrification program started as a way of reducing dependence on expensive diesel generation, the falling costs of these energy systems and their improved design and reliability are spurring strong international and domestic interest in commercialization. While limitations on private and foreign ownership of small systems in the islands have constrained development in the past, the new Minister of Energy and Mineral Resources Ignasius Jonan approved new regulations in late 2016 that have opened the door to private commercialization by businesses to provide electricity to unelectrified areas. The regulations provide a framework that defines how businesses can acquire "business area concessions" and calculate and receive electrification subsidies from the government.<sup>68</sup>

## Collaborating with Neighbors on Regional Networks and Markets

**Priority: Indonesia needs to accelerate efforts to improve its electricity transmission system and expand and strengthen interconnections with other ASEAN countries to further stimulate investment and trade in renewable energy and natural gas.**

Indonesia is a founding member of the Association of Southeast Asian Nations (ASEAN) and is the largest primary energy producer and consumer in the group. Indonesia accounts for about 25 percent of installed electricity capacity in ASEAN countries and provides substantial gas and coal exports to the ASEAN and broader Asia region. Indonesia is the main source of coal for the many new coal plants that are being built in Thailand, Vietnam, the Philippines, and Malaysia, and there is also the potential for Indonesia to develop its hydropower and geothermal resources for export as electricity to Malaysia and Singapore.

Although ASEAN launched an integrated energy program in the 1990s, progress under the program in completing cross-border electricity interconnections has been slow. Nevertheless, eight electricity interconnects have been put in operation and a new plan was approved by the ASEAN energy ministers

64 Moch. Sofyan, *PLN - Solar PV Development Plan*, Solar Workshop, Energy Indonesia, February 8, 2013, <http://energy-indonesia.com/03dge/0130227pln-taiyoko.pdf>.

65 Lisa Cohn, "What's behind Caterpillar's New Hybrid Microgrid Play? Here's a Deeper Look," Sun-Connect: Off-Grid News, May 26, 2016.

66 "Indonesia Compact," Millennium Challenge Corporation, <https://www.mcc.gov/where-we-work/program/indonesia-compact>.

67 See Asian Development Bank, *A Renewable Energy Future*, December 17, 2015, <https://adb.exposure.co/202b89660181cb5f92406f8d53876205> and "Sumba Iconic Island: 100% Renewable Energy," Sumba Iconic Island, June 6, 2016, <http://sumbaiconicisland.org/sumba-iconic-island-100-renewable-energy/>.

68 Andre E. Susanto, "Indonesia's New Rural Electrification Regulation," PV Tech, December 8, 2016, <https://www.pv-tech.org/guest-blog/indonesias-new-rural-electrification-regulation>.



Solar panels installed to provide electricity in Sumba Island, Indonesia. *Photo credit: Asian Development Bank/Flickr.*

covering 2016 through 2025.<sup>69</sup> No electricity links currently exist between Indonesia and systems in Singapore, Peninsular Malaysia, or the Philippines. A high priority of the ASEAN plan is a transmission line connecting Peninsular Malaysia to Sumatra, but the need for submarine high-voltage direct current cables makes interconnection with the peninsula expensive. Challenges aside, Indonesia clearly has the potential to develop its geothermal resources on Sumatra for export to the mainland Southeast Asia grid.

A transmission interconnect was completed in early 2016 between Sarawak and West Kalimantan enabling around 50 MW of imports from hydro units at the Murum hydro facility in Sarawak.<sup>70</sup> Future projects are planned for Sumatra to Singapore and Batang Island to Singapore.

The evolving ASEAN electricity network will require close coordination with the parallel ASEAN gas system—as new efforts build on the existing gas links between Indonesia and Singapore and Malaysia from

the Natuna offshore gas field, new FSRUs and other gas infrastructure are installed, and Singapore strives to become an LNG storage and trading hub for the region.

### **Attracting Domestic and International Investment and Financing**

**Priority: Indonesia must create a more welcoming policy and regulatory environment to attract the private investment needed to meet the growing electricity demand, and should consider green bonds and other financial mechanisms to mobilize capital for clean energy diversification.**

Indonesia wants to bring on 43 GW of new electricity generation by 2019, of which 24,914 MW is slated to be financed by the private sector and 18,027 MW by PLN. The estimated investment needed from the private sector is \$42.4 billion, while PLN requirements are \$40 billion, including \$24 billion for transmission and distribution. Meeting these funding needs will

69 ASEAN Centre For Energy, *ASEAN Plan of Action for Energy Cooperation (APAEC) 2016-2025*, December 2015, <http://www.aseanenergy.org/wp-content/uploads/2015/12/HighRes-APAEC-online-version-final.pdf>.

70 “Indonesia,” International Hydropower Association.

be difficult, and the Asian Development Bank's 2015 assessment found that there will likely be a sizable funding gap.<sup>71</sup>

In the past, state banks from China, South Korea, and Japan have provided loans and credits to PLN for coal plants. China provided \$4.34 billion for Indonesian coal plants from 2008 to 2013 and the China Development Bank is financing the controversial 990 MW Indramayu coal plant in West Java, the expansion of which is opposed by local residents.<sup>72</sup> The Japanese are financing a Java-Sumatra transmission line that will provide power from a coal power plant in South Sumatra to Java,<sup>73</sup> while South Korean investors have reportedly made commitments for a \$2.8 billion coal project in South Sumatra.<sup>74</sup>

This ongoing investment in coal raises questions about the future of Indonesia's energy transition, and whether these major Asian coal technology exporters will shift the focus of their lending to finance private, non-coal projects.

The Chinese government has pledged major support for Jokowi's overall infrastructure effort, including promising to provide \$15 billion for power out of the \$63 billion in indicated support for infrastructure.<sup>75</sup> Chinese investment in Indonesia has more than doubled since 2015, and President Jokowi has met with President Xi Jinping numerous times in the last two years. Direct overall Chinese investment in Indonesia is estimated to have been \$1.6 billion from January to September 2016.<sup>76</sup>

Aside from the focus on coal and on gas infrastructure, there is growing interest among investors in hydro and renewables. One large Chinese-financed hydro project—a \$17 billion, initially 700 MW facility in North

Kalimantan being developed by the China Power Investment Corporation and Anhui Conch Cement—is currently underway. South Korean companies are pursuing a 145 MW hydro project in Lampung, have signed a Memorandum of Understanding for a \$230 million hydro project in South Sulawesi, and have committed \$100 million for solar projects.<sup>77</sup>

There are signs of increasing investor interest in non-hydro renewable energy. The Ministry of Energy and Mineral Resources announced that investments in renewable energy for the first half of 2016 totaled \$870 million, or about 63.5 percent of the 2016 target, with geothermal accounting for the largest share.<sup>78</sup> Indonesia has yet to issue green bonds, although a World Bank green bond was used to support a geothermal energy project.<sup>79</sup> Indonesia could also learn from the growing experience in other countries in this area.

However, despite increasing interest, future investment prospects remain clouded by nationalist positions of key institutions with respect to the extent and implications of private ownership of power system assets. PLN, in its role as a single state buyer of electricity, enters into PPAs with private companies based on tenders or direct appointment negotiations, and several thousand MWs of agreements were completed in 2015 and 2016 on this basis. State-provided feed-in tariffs for renewables range from 10 to 25 cents per kWh and power purchase prices for coal are 6 to 12 cents depending on the size of the unit and whether it is mine-mouth.<sup>80</sup>

The Indonesian Constitutional Court ruled in December 2016 that BOO (“build, own, and operate”) schemes were contrary to the security of the nation and private companies should transfer assets back to PLN at the end of their leases. The Ministry of Energy and Mineral

71 Pradee Thara Kan, “Indonesia Energy Sector Assessment,” ADB Papers, No. 9, December 2015.

72 International Energy Agency, *Boosting the Power Sector in Sub-Saharan Africa: China's Role*, OECD/IEA, 2016, [https://www.iea.org/publications/freepublications/publication/Partner\\_Country\\_SeriesChinaBoosting\\_the\\_Power\\_Sector\\_in\\_SubSaharan\\_Africa\\_Chinas\\_Involvement.pdf](https://www.iea.org/publications/freepublications/publication/Partner_Country_SeriesChinaBoosting_the_Power_Sector_in_SubSaharan_Africa_Chinas_Involvement.pdf), 17; “Indramayu Power Station,” SourceWatch, December 4, 2016.

73 “Japan becomes Potential Investor for Indonesia in 2016,” Tempo.co, December 20, 2015, <https://en.tempo.co/read/news/2015/12/20/056729241/Japan-Becomes-Potential-Investor-for-Indonesia-in-2016>.

74 *Jakarta Globe*, “South Korean Investors Eye \$9.7b of Investments in Indonesia,” <http://jakartaglobe.id/economy/south-korean-investors-eye-9-7b-investments-indonesia/>.

75 Ben Otto and I Made Sentana, “Indonesia Banks on \$63 Billion from China,” *Wall Street Journal*, April 1, 2015, <https://www.wsj.com/articles/indonesia-banks-on-63-billion-from-china-1427896422>.

76 “Why Indonesia Is Chasing China's Billions,” Bloomberg News, November 1, 2016, <https://www.bloomberg.com/news/articles/2016-10-31/china-deepens-economic-ties-with-indonesia-as-investment-doubles>.

77 *Jakarta Globe*, “South Korean Investors Eye \$9.7b of Investments in Indonesia”; “Foreign Investment: Bilateral Cooperation Indonesia and South Korea,” Indonesia-Investments, May 17, 2016, <https://www.indonesia-investments.com/news/todays-headlines/foreign-investment-bilateral-cooperation-indonesia-south-korea/item6823?>

78 Sandaryani, “Budget Cuts Jeopardize Indonesia's Renewable Energy Plans.”

79 “Green Bonds Attract Private Sector Climate Finance,” World Bank, June 10, 2015, <http://www.worldbank.org/en/topic/climatechange/brief/green-bonds-climate-finance>.

80 Assegaf Hamzah & Partners, *New Power Purchase Procedures and Prices*, Indonesia, AHP Client Alert, January 22, 2015, <http://www.ahp.co.id/clientalert/AHPClientAlert-2015January22.pdf>.

Resources followed this ruling with a regulation (MEMR Regulation 10) clarifying that new independent power producers will have to transfer their facilities to PLN at the end of their contract periods.<sup>81</sup> In addition to this provision, Regulation 10 introduces several mandatory power purchase agreement provisions that in the view of Baker McKenzie may affect the

bankability of projects by changing the allocation of risks between PLN and the developer.<sup>82</sup> While the effect of this regulation on investors remains to be seen, it appears inconsistent with the critical objective and essential assumption in the Ministry's power plan of an expanding role for private investment.

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81 "Power Producers Must Hand Over Their Plants to PLN at the Contract's End," *Jakarta Globe*, February 2017, <http://www.jakartaglobe.beritasatu.com/business/power-producers-must-hand-plants-pln-contracts-end/>.

82 Baker McKenzie, "Bankability Concerns over New Generation of Indonesian Power Purchase Agreements," February 2, 2017, <http://www.bakermckenzie.com/en/insight/publications/2017/02/bankability-concerns-power-purchase-agreements/>.



## CONCLUSION

President Jokowi came into office with an ambitious plan to spur economic growth and investment, especially in energy and infrastructure, and signaled his intention to diversify Indonesia's fuel mix and achieve significant increases in renewable energy.

However, despite these positive signs, there are powerful internal and external forces in favor of continuing to build coal plants and export coal. The weak coal export market, as well as growing internal demand for coal in the power sector, has put pressure on the government to use coal domestically.

The use of gas is expanding and policy priority is focused on developing both large and small gas generation units as well as new gas pipelines and LNG regasification units. Given declining domestic gas production, global gas market trends, the high costs of developing offshore domestic gas fields, and problems with Indonesia's oil and gas regulatory regime compared with those of other countries, it seems likely that Indonesia will become a significant gas importer in the next decade. LNG import contracts are being signed, including with US and Australian LNG exporters.

The monopoly position of PLN remains a major bottleneck to sector progress and investment mobilization. Indonesia needs to come to grips with this issue and implement basic reforms to open the market, create independent regulation, and provide third-party access.

Indonesia's position on the equator, large archipelago geography, and location on the ring of fire provide Indonesia with high renewable energy potential, especially solar, biomass, and geothermal. The improved economics of both large-scale and small-scale renewables, together with natural gas, gives Indonesia viable alternatives to coal, which is causing serious environmental, economic, and health problems. The Indonesian government should in particular examine more carefully the prospects for solar photovoltaics, as recommended by the International Renewable Energy Agency.

A more vigorous diversification strategy, including intensified efforts to improve energy efficiency, is needed to advance Indonesia's Paris Climate commitment. Indonesia is also an important Asian market for the United States, especially if the new Trump administration wants to pursue a stronger energy technology and LNG export strategy. Vice President Pence's April 2017 visit to Indonesia initiated a new trade dialogue and furthered commercial interests of US companies in the energy sector. A comprehensive Indonesian energy diversification strategy would bolster US international environmental as well as commercial interests, and enhance the United States' competitive position vis-à-vis China in the region.

## ABOUT THE AUTHOR



**Dr. Robert F. Ichord, Jr.** is currently a nonresident senior fellow at the Atlantic Council Global Energy Center and is CEO of Ichord Ventures LLC, a consulting company providing energy advisory services to both the private and public sectors. He has a distinguished forty-year career in the US government working on international energy security, development, and climate change issues. He served from 2011 to 2015 as deputy assistant secretary for energy transformation in the State Department's Energy Resources Bureau, where he advanced US interests in sustainable energy development, electricity sector and market reform, nuclear safety, and renewable energy and energy efficiency. Prior to State, he managed and supported large energy assistance programs in Asia, Near East, Europe, and Eurasia for the US Agency for International Development, pioneering many innovative regulatory reform,

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