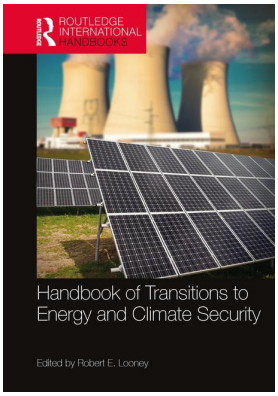

Handbook of Transitions to Energy and Climate Security

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Indonesia's energy trilemma

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Indonesia's energy trilemma

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Introduction

As one of the largest developing and emerging countries, with a population of roughly 250 million and Southeast Asia's biggest economy, Indonesia faces three dilemmas. Coined by the World Energy Council in 2020, the energy trilemma characterizes the balancing act Indonesia is subject to regarding its energy equity, energy security, and environmental sustainability.[1] Due to the country's energy demand growing 7% per year, it is becoming increasingly difficult to achieve and ensure energy access for Indonesia's people and economy, and reduce emissions.[2] Similar to other developing countries, rising energy consumption is following the increase in gross domestic product (GDP), and consequently Indonesia is struggling to meet its domestic energy demand.

The chapter examines Indonesia's energy trilemma. First, Indonesia's energy equity policy goals are discussed, from its energy subsidies to its plan for increasing its power grid capacity. Second, its energy security is broken down to its national energy plan, as well as fossil fuel and renewable energy opportunities. Third, the country's environmental sustainability is discussed, challenged by its increasing reliance on coal for power generation. Each section provides government policy, and concludes with constraints being met by each component in the energy trilemma. Fifth, the challenges facing Indonesia's energy sector are discussed. Sixth, the risks that exist to keeping Indonesia's policies of managing its energy trilemma from being successful are examined. As Indonesia faces its energy trilemma, it appears that the government is giving more weight to both energy equity and energy security, over environmental sustainability.

Energy equity

Overview

No doubt, Indonesia recognizes strengthening its energy equity as high priority. There are two parts to energy affordability for Indonesia: expanding the electricity grid for providing more Indonesians with access to electricity, and making energy accessible to Indonesians through the use of energy subsidies.

Government policy

Presently, Indonesia subsidizes diesel and electricity. In distorting market prices, these subsidies drain the government's budget and discourage energy conservation. When energy prices are high, the problem is exacerbated, and the government pays more money for these subsidies. For years subsidies have diverted funds away from the Indonesian government. In a significant policy decision on January 1, 2015, Indonesia eliminated petrol subsidies and put a cap on the diesel subsidy. However, an additional $1.4 bn in 2015 was still earmarked for the diesel subsidy,[3] taking money away from the government that could contribute to Indonesia's long neglected infrastructure. As the diesel subsidy still exists, it uses up funds that could be spent on energy capacity growth. Further, an electricity subsidy has kept Indonesian electricity prices below the market price, and diverted government funds to pay for this subsidy. This is reported to cost the government $6.2 bn in 2015, or 5% of the total government budget.[4] Energy subsidies distorting market prices for diesel and electricity weaken Indonesia's energy security and contribute to rising carbon emissions.

In fairness, Indonesia made great strides in reducing the burden of subsidies on the government's budget. Indonesia, similar to other countries, took advantage of the steep drop in oil prices in 2014 and removed its decade-old gasoline subsidy that was previously a constant drain to the government's budget. The subsidy, originating during the Suharto era after the world's first oil shock in the 1970s, nearly took up 13.5% of the budget, but saved the government $18 bn in 2015 after it was scrapped.[5] However, in 2015 the government was accused by some analysts of flip-flopping on its subsidy removal policy, as some months it did not set gasoline to market prices.[6]

Indonesia is also slowly decreasing the electricity subsidy, and making it available only to the most impoverished citizens. The government is planning to reduce its electricity subsidy from the 2015 budget to the 2016 budget by nearly two-thirds.[7]

As Indonesia's economy is rapidly growing, it is working to increase access to electricity for all of its people as well as industry. Indonesia targets complete electrification by 2020, and the power sector is the major driver to increased energy demand. From 2015 to 2019, electricity demand is expected to increase by an average of 8.7% per year. However, Indonesia is having difficulty creating new capacity as demand rises. As of late-2014, Indonesia's total grid capacity was at 51.62 gigawatts (GW).[8] State-owned Perusahaan Listrik Negara (PLN), Indonesia's sole energy provider, is tasked with meeting the country's plan to add 35 GW worth of new power stations by 2019, however private sector financing is necessary in order to meet this target. The makeup of the 35 GW will consist of 20 GW of coal, 13 GW of natural gas, and 3.7 GW of renewables (primarily hydropower and geothermal).[9] Ministry of Energy and Mineral Resources Director General of Electricity Jarmin says that the bulk of the new power capacity will be added by private firms, 30 GW, while PLN will add 5 GW. In total, the program is expected to cost $72.5 bn.[10]

Indonesian President Joko (Jokowi) Widodo stated that his administration plans to reach 7.0% GDP growth during his five-year term. Due to a prolonged commodities slump, slowing growth in China, and the U.S. interest rate increase, in 2015 the economy averaged GDP growth of 4.7%, its lowest level in six years.[11] Increasing economic growth is at the forefront of Indonesia's policy. Despite the country's economic slump in 2015, the Economist Intelligence Unit predicts that Indonesia's economy will grow by an average of 5.5% a year from 2016 to 2020.[12]

Indonesia seeks to continue raising the wealth of its people and move from a lower income to a middle-income country, which requires more energy. By 2020 Indonesia's GDP is expected to rise by 60%, to $8,200, which will result in more Indonesians buying expensive

items that use energy such as automobiles and refrigerators. Presently, the government is following its Masterplan for Acceleration and Expansion of Indonesia's Economic Development (MP3EI) to become a developed country by 2025. In line with MP3EI, President Jokowi has reiterated the need for economic policy to focus on developing Indonesia into a production-oriented economy.[13] Indonesia targets the industrial sector to contribute 40% of GDP, up from a low of 23%. As such, increasing its GDP requires more energy capacity feeding into its grid.

Constraints

Indonesia's energy equity is constrained by its energy subsidies as well as the reliance on coal for its energy grid expansion. Despite Indonesia's goals of increasing its energy equity, costly diesel and electricity subsidies still remain in place. Even though the removal of the petrol subsidy was a huge boost to the government's budget, it is unclear if the government will always keep the price of petrol at market price, as oil prices constantly fluctuate. Indonesia's massive expansion of its grid capacity, reliant on coal, weakens its environmental sustainability. In all, Indonesia appears to be placing energy affordability high on its policy to-do list as it focuses on meeting the energy demand of its growing economy and population.

Energy security

Overview

Indonesia's energy security is in transition. Historically, Indonesia has been a net energy exporter. However, in the last decade, its energy supply and demand has changed. Discussed in this section are Indonesia's energy supply and demand, energy policy, and energy opportunities.

Demand

Indonesia's energy demand is rising rapidly simultaneously with its high GDP growth. As a result of increased energy demand, energy consumption is expected to rise by almost 30% by 2020.[14] Oil is integral to Indonesia's energy needs. Wood Mackenzie, an energy consulting firm, forecasts that Indonesia's oil demand will grow from 1.6 million barrels per day (bpd) in 2014 to 2.3 million bpd in 2030, largely driven by transportation use from its growing population. Indonesia's energy demand consumption is split as follows: residential sector (37%), industry (30.5%), transport (27.6%), and commercial services (4.9%).[15]

Supply

Growth in Indonesia's domestic energy demand causes its government to focus on strengthening its energy security. As a major fossil fuel producer and exporter, Indonesia is the world's largest coal exporter (the fourth-largest coal producer), the seventh largest liquefied natural gas (LNG) exporter (the tenth largest gas producer), and the largest exporter and producer of palm oil (used for biofuel) in the world. However, formerly a founding Member of the Organization of the Petroleum Exporting Countries (OPEC), Indonesia left OPEC in 2009 as a result of its shift to becoming a net oil importer in 2004. This shift is due simultaneously to Indonesia's production declining and its demand rising. Figure 17.1 shows the drastic decrease in oil production and rise in oil consumption. Its oil production has been in steady decline since the mid-1990s, and its oil production fields are dated; over 85% of Indonesia's oil production is from

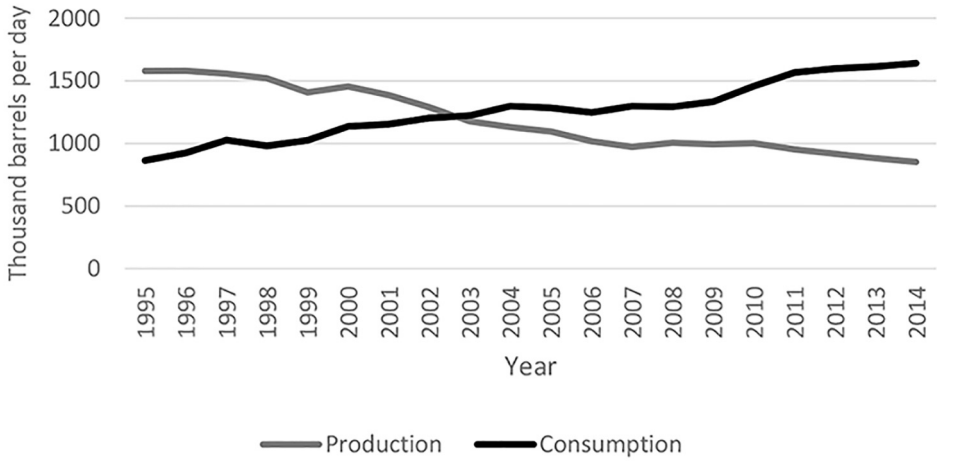

Figure 17.1 Indonesia's oil production vs. consumption
Source: BP, *Statistical Review of World Energy* (London: BP, 2015), http://www.bp.com/en/global/corporate/energy-economics/statistical-review-of-world-energy.html.

fields discovered before 1975. However, in December 2015 Indonesia rejoined OPEC, in order to strengthen its energy security from suppliers and to attract investment in its energy industry from OPEC member-countries.

Government policy

Following Parliament's approval of the National Energy Council's[16] new National Energy Plan (NEP14), Government Regulation No. 79/2014, the National Energy Council set Indonesia's most recent national energy policy in 2014. It is evident in the 2014 policy that the government strongly views energy as a scarce resource. This version replaced the 2006 National Energy Plan. The policy established four substantial policy changes reflecting a different energy security situation that the country was experiencing in 2006.

The first shift in policy is redirecting energy resources to the domestic market. As Indonesia historically has been an energy exporter to foreign markets across the globe, instead, it will redirect its hydrocarbons for domestic use in order to meet its energy needs. Second, the policy seeks to transition away from its reliance on oil and increase the use of gas, coal, and renewables. Figure 17.2 displays Indonesia's targeted energy diversification from 2012 to 2025, with oil dropping considerably and renewables significantly increasing in the share of its energy mix. In order for it to meet its target energy mix for 2025, it must increase its use of natural gas and coal by more than double, while renewable energy use must increase nine-fold.[17] NEP14 also established plans in place for energy emergency policy through the placement of energy emergency management structures and the buildup of oil buffer stocks. Finally, as Indonesia's electrification ratio currently is at 87.5%, it plans to achieve 100% electrification for its entire population by 2020.[18] By comparison, several of its regional neighbors – Singapore, Brunei Darussalam, Malaysia, Thailand, and Vietnam – have electrification ratios of 95% or higher.[19] However, achieving full electrification is a major challenge considering the geographic makeup of the country.

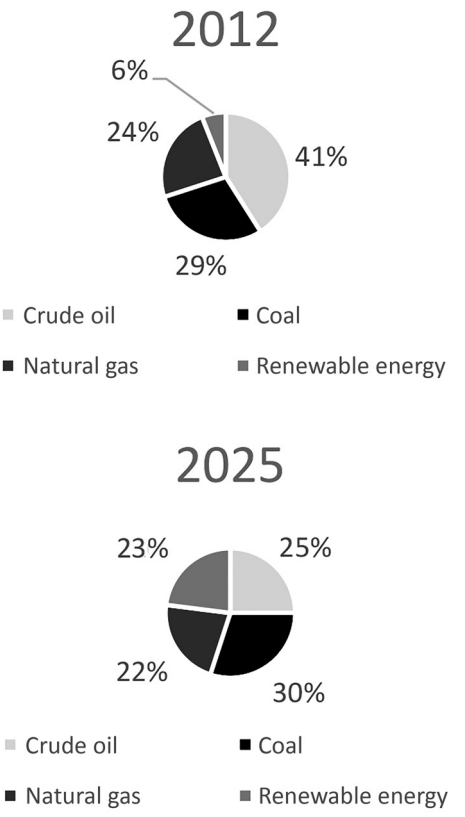

Figure 17.2 Indonesia's energy mix in 2012 and 2025
Source: International Energy Agency, 'National Energy Policy (Government Regulation No. 79/2014),' http://www.iea.org/policiesandmeasures/pams/indonesia/name-140164-en.php, 2014.

Fossil fuel opportunities

Indonesia's energy security is enhanced by its abundance of hydrocarbons. The country's fossil fuel opportunities include oil, gas, coal, and shale gas, as well as nuclear power. However, not all hydrocarbons are likely to have the same amount of use as others to meet Indonesia's energy needs. At current production rates, Indonesia's oil reserves are estimated at 23 years, natural gas at 59 years, and coal at 146 years.[20]

Currently Indonesia is in the process of transitioning from being an oil exporter to a net oil importer, as its oil market has been challenged with high consumption and low production. As of 2012 Indonesia had just 3.6 bn barrels of proven oil reserves. On the production side, its reserve replacement ratio stands at roughly 50%, and its production capacity suffers from lack of investment.[21] Although new project developments are limited, the Cepu Block is the only major new development, containing 600 million barrels in Central and East Java.[22]

While Indonesia's oil reserves are diminishing, its coal reserves are vast and likely to play a long-term role in its energy security. Coal has experienced strong production growth in the last decade. As displayed in Figure 17.3, in the last decade Indonesia's coal production has tripled and its consumption has doubled. Indonesia is the world's largest coal exporter, but seeks to

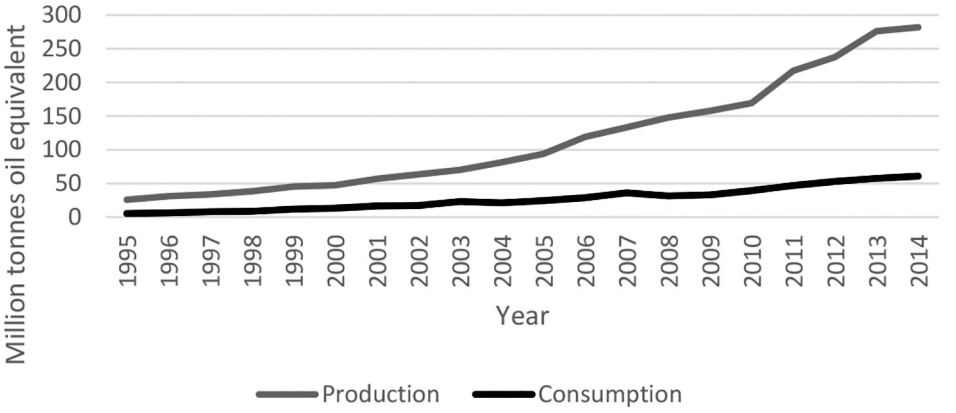

Figure 17.3 Indonesia's coal production versus coal consumption
Source: BP, *Statistical Review of World Energy* (London: BP, 2015).

redirect its reserves for domestic use. Coal is integral to achieving the government's goal for complete electrification across the archipelago.

Coal is an attractive option in accelerating Indonesia's large and rapid expansion of electricity production, as it is a domestic, readily available source. Power stations can be assembled quickly and inexpensively.[23] This is because coal is significantly cheaper for generating electricity in comparison to other energy sources, although its emissions are worse. Roughly 84.3% of extracted domestic coal is used for power generation.[24] To boost electricity generation, the government has discussed the possibility of a moratorium on the export of its coal. By comparison to oil, coal has experienced strong growth in the last decade. Coal is found throughout most of Indonesia's 34 provinces, with the most significant resources lying on the archipelago's two biggest islands, Sumatra and Kalimantan.

Although not as vast as Indonesia's coal reserves, its natural gas reserves can help meet the country's energy needs. With 103 Tcf of natural gas, Indonesia contains the world's 12th largest proven reserves.[25] However, in the past few years natural gas production has been in decline, while the country faces a shortage to meet its domestic supply. Poor infrastructure continues to make distribution for domestic consumption difficult. Its current production is found in East Kalimantan, Papua, and Sumatra, mostly offshore. Most of the reserves are found in low demand or remote areas. For example, Indonesia transports gas that has been liquefied from Papua to Lampung,[26] which is re-gasified prior to transferring the gas to customers.

In unconventional gas, Indonesia has abundant resources stemming from shale gas and coal-bed methane (CBM). The total reserves of shale gas and CMB are estimated at 570trn cubic feet and 450trn cubic feet, respectively.[27] The country hopes to develop its vast, untapped unconventional gas resources. However, regulatory issues and high cost compared to conventional gas must be overcome in order for these resources to boost Indonesia's energy supply. A report by the National Bureau of Asian Research (NBR) suggests that conventional gas will be the main source of Indonesia's new gas through 2030.[28] Still, the country has hopes to develop these resources in the long term.

Nuclear energy is tabled as a large, clean source of energy for the country to meet its future energy needs. Currently, the country operates no major nuclear reactors. On the other hand,

there are three small-scale reactors: a 100-kilowatt reactor in Yogyakarta, a 250-kilowatt gdp reactor in Bandung and a 30-megawatt (MW) reactor in Serpong, in Banten. However, NEP14 states that Indonesia will only develop nuclear energy as a last resort.[29] This is largely due to nuclear energy having a negative stigma attached to it, as Indonesia is a seismically active country.

Indonesia's large area reduces its seismic density, but it is risk prone to a major off-shore earthquake damaging its inland, for example the 2004 Indian Ocean earthquake and tsunami off the west coast of Sumatra.[30] The Fukushima Daiichi nuclear disaster in 2011, primarily caused by a tsunami, is a regional example that raises widespread questions about the safety of nuclear energy. Previously, Indonesia planned to construct and operate four nuclear power plants, installed by 2025 that would supply 6 GW to its energy grid. However, this plan was cancelled.[31]

Renewable energy opportunities

The potential for renewable energy is vast in Indonesia and could provide a lot of energy to its grid. Yet, presently it does not utilize many of its renewable energy resources. Indonesia uses just 5% of its renewable capacity. NEP14 prioritizes renewable energy, as the government intends to have renewables account for 23% of its energy mix by 2025. Renewable energy sources include the following: geothermal, hydro, biomass, offshore wind, and solar (Table 17.1).

Geothermal stands out as Indonesia's best opportunity for utilizing its renewable energy resources. As an archipelagic state, it is situated on the Pacific Ring of Fire, and it contains an estimated 29,215 MW of electricity potentially generated from geothermal. Indonesia contains 40% of the entire world's geothermal energy potential, the most of any one country, but is the third largest producer.[32] However, currently Indonesia has installed just 1,341 MW of its total geothermal capacity, or roughly 5% of its geothermal potential. While most renewables supply an intermittent source of energy, geothermal is unique in that its flow of energy is constant. Indonesia's geothermal reserves are also strategically located near the highest demand areas, which includes Sumatra (13,800 MW), Java and Bali (9,250 MW), and Sulawesi (2,000 MW).[33]

Traditionally, geothermal exploration has been difficult due to legal barriers as 42% of the country's geothermal potential is located in forest conservation areas. Previous law considered geothermal exploration as a mining activity, while mining activities have been halted under a moratorium, impeding project development. However, the new geothermal law in 2014 removed geothermal exploration as a mining activity, easing future geothermal development.[34]

Table 17.1 Renewable energy: installed capacity vs. potential capacity

Source	*Installed capacity*	*Potential capacity*
Biomass	500 MW	49,810 MW
Geothermal	1,341 MW	29,215 MW
Hydro	6,850 MW	75,000 MW
Wave	0.001 MW	49,000 MW
Solar	22.4 MW	4.8 kWh/m2/day
Wind	1.87 MW	3–6 m/s

Source: Ministry of Energy and Mineral Resources (Indonesia), *2014 Handbook of Energy and Economic Statistics of Indonesia*, 2014.

Indonesia also has a large amount of potential for hydropower. With 75,000 MW of potential, this renewable source offers the largest potential for renewable energy. Like geothermal, Indonesia is far from using hydropower's full potential, as its total installed capacity is just 6,850 MW. A major contributing factor is because most of its hydropower potential is found on the less inhabited, outer-lying islands, in provinces such as Papua. However, as the International Energy Agency notes, the installed capacity could increase for medium and large-scale resources as Indonesia plans to develop industrial zones in Papua and other rural areas under MP3EI.[35]

Even more than geothermal and hydropower, Indonesia is using a minimal amount of its solar power potential. Its solar power potential is estimated at 4.8 kWh/m^2/day, while installed capacity is at just 22.4 MW. Solar power could be an alternative source of power on remote islands, which typically rely on costly, polluting diesel-fired generators, prone to power outages. As the archipelago is located near the equator with strong intensity from the sun, Indonesia can benefit from solar power to meet its growing demand.

Indonesia is well endowed with great biomass energy potential, which is estimated at 49,810 MW of possible capacity. Thus far, only 500 MW is being used. Indonesia's biomass potential comes from many sources, including palm, cassava, molasses, jatropha, curcas, nyamplung, and corn. Palm makes up the bulk of biomass, as Indonesia is the world's largest producer.

Of the renewable energy sources mentioned, Indonesia's potential for wind energy and wave energy is less researched, and its potential is suspected to be small. The wind in Indonesia is slow, at just three to six meters per second. Its installed capacity is just 1.87 MW, but more research is being done to see if there is any additional potential from wind that the government may not be aware of through possible installation of offshore turbines.

Instead, perhaps Indonesia could benefit from wave energy, as it has been estimated that 49,000 MW could be generated.[36] Further research is also being done to get a better grasp on Indonesia's wave energy potential. Since Indonesia has a large coastline with over 17,000 islands, wave energy appears as a great opportunity.

Constraints

Indonesia's energy security is being constrained by its depleting oil reserves and the expansion of its energy grid. Despite the removal of the petrol subsidy and low oil prices, Indonesia's oil demand is expected to continue to substantially increase due to a rising per capita income and robust economic growth. Oil demand is estimated to increase by nearly 50% from 2014 to 2030.[37] As Indonesia develops its energy grid, more coal will be directed towards domestic consumption. However, Indonesia's coal reserves are vast.

Environmental sustainability

Overview

From rising emissions due to increased energy, to skyrocketing greenhouse gas emissions due to Indonesia's annual haze, environmental sustainability is increasingly becoming an issue of concern to the Republic of Indonesia. As a country with the second largest biodiversity in the world after Brazil, and a coastline of 80,000 km made up of 17,000 islands, Indonesia has much at stake if global temperatures and sea levels continue to rise. Contributing to climate change, Indonesia is increasing its reliance on coal, as 60% of its new power generation will come from that energy source. Further, it continues to emit large amounts of CO_2 due to the burning of its forests and peatlands, creating a haze that is a regular irritant to its regional neighbors.

Exacerbated by Indonesia's worst-ever haze on record, in 2015 it overtook Japan as the world's fifth largest CO_2 emitter.[38] Not only did its emissions rise, the 2015 haze cost the country roughly $16 bn in economic losses, or 1.9% of its total GDP according to the World Bank.[39]

In the UN's report, *Climate Change and its Possible Security Implications Indonesia*, it cites five devastating results for the world's largest archipelago. As 60% of all Indonesians live in the low-lying coastal areas, its population is at risk from the submergence of its cities. This could lead to massive internal and external migration of Indonesians. Home to over half of Indonesia's population, Java in particular is already one of the world's most densely populated islands. The report found that temperature increases over 2.5°C would drop agricultural productivity and decrease incomes. Rice yields would drop leading to higher imports, and decrease agricultural revenue between 9% and 25%, directly hindering Indonesia's fight against poverty. A loss of biodiversity is a risk to Indonesia's agriculture, fishery, and forestry. Due to the possibility of shifting seasonality, climate change could lead to uncertain weather patterns, largely affecting water availability. Last, human health could be negatively impacted due to an increase in infectious diseases.[40]

Indonesia's emissions are rising fast due to fossil fuel use, and are expected to double within the next 25 years (Figure 17.4). The bulk of the emissions are projected to come from the power sector and transportation. In September 2015, the country set targets to reduce greenhouse gas emissions by 29% by 2030, and reduce emissions by a further 41%, if it receives $6 bn in international assistance. However, the World Resources Institute (WRI), a leading environmental think-tank doubts Indonesia's ambitions or reality to meet this goal, citing vagueness in the country's emissions reduction plan.[41]

Government policy

As the government considers climate change and other important environmental topics, Indonesia has taken steps to reduce climate change. The 2009 Environmental Law strengthened local governments, civil society, and non-governmental organizations that work to mitigate

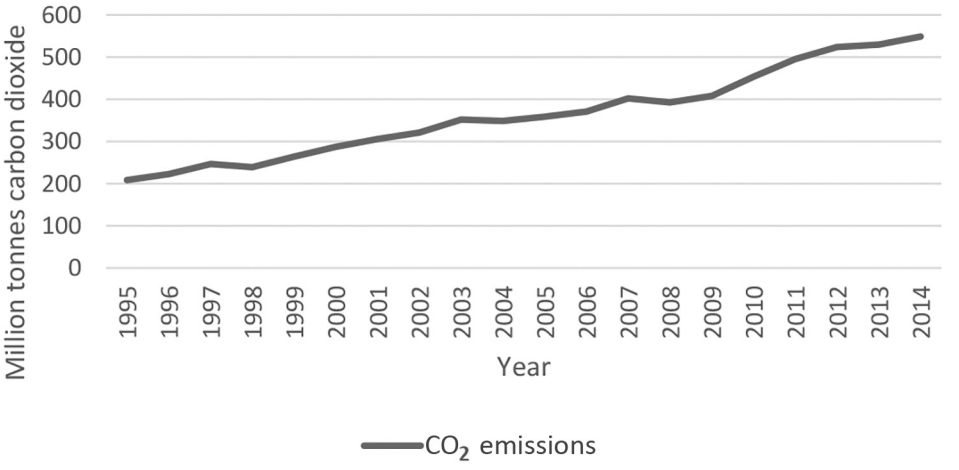

Figure 17.4 Indonesia's CO_2 emissions
Source: BP, *Statistical Review of World Energy*.

environmental pollution and damage. The law includes stricter penalties than previous laws, and imposes strict liability to companies that cause environmental damage from the use of hazardous material. Further the law requires that companies perform environmental audits as well as an Environmental Management statement, an Environmental Management Efforts-Environmental Monitoring Efforts Report or an Environmental Impact Assessment (AMDAL). Importantly, all mining companies must issue an AMDAL, carry out an environmental risk analysis, and obtain an environmental permit for mining operations.[42]

A few years after the passing of the 2009 Environmental Law, Indonesia introduced the presidential decree for NAPRGG. Presented by Indonesia's president at the time, Susilo Bambang Yudohoyono, NAPRGG set Indonesia's first GHG emission target at 26% unilaterally, and 41% if sufficient international assistance was provided, although the goal barring international assistance was increased to 29%, and extended until 2030. NAPRGG set the framework for all provinces to develop their own emissions-reduction plans. To keep development across the archipelago in line with reducing emissions, BAPPENAS was appointed as co-coordinator and issued guidelines at the national and sub-national level.[43]

To tackle emissions stemming from deforestation and forest degradation, Indonesia became a member country of the REDD and REDD+ programs. As most of Indonesia's GHG emissions are land- and forest-based, largely from the annual haze, these programs play a significant role in achieving its emissions reduction target. In order to help curb environmental damage in the country, in May 2011 the government enacted a two-year moratorium on new mining licenses for land that contains peatland and natural forest. As coal mining and palm oil contribute to Indonesia's emissions, its participation in these programs is an important step to reducing emissions from these two sources.[44]

Constraints

Due to rising energy demand and the country's high economic growth rate, Indonesia faces a dilemma in having the capacity to curb its emissions and protect its biodiversity. In strengthening its energy security, and simultaneously reducing emissions, the country will be able to achieve its policy and nearly quadruple its renewable energy supply by 2025. However, at 30% of Indonesia's energy mix targeted for coal 2025, the country appears likely to remain dependent on that source for energy.[45] Of the country's ambitious electricity capacity initiative to install 35 GW through 2019, 20 GW will be coal-powered.[46] In addition, carbon capture and storage (CCS) does not seem to be a viable solution. A study conducted by the World Bank found that CCS would reduce power output by almost one-third, and nearly double the price of electricity.[47] Therefore, while its targets for GHG reduction are ambitious, its reliance on coal for its energy mix seems counterintuitive.

Challenges

Despite Indonesia's many opportunities for a robust energy security, the government faces many challenges to implementing its desired policy. These include corruption, decentralization, lack of coordination between government agencies, a difficult investment climate, and infrastructure.

Corruption

Indonesia's endemic corruption is a constant hindrance to its energy security. The country's Energy and Mineral Resource Ministry and Pertamina, the state-owned company active in the

upstream and downstream oil, gas, and geothermal energy sectors, have a history of misusing state funds. High-profile government officials from the previous administration, former Energy and Mineral Resource Minister Jero Wacik, and former head of Indonesia House of Representatives Commission VII on energy, Sutan Bhatoegana, are on currently on trial after being named graft suspects by the Corruption Eradication Commission.[48] However, reducing corruption is at the forefront of President Jokowi's policy agenda.

In an effort to clean up Indonesia's "oil and gas mafia," Jokowi replaced all of the directors in the Energy and Mineral Resource Ministry as well as Pertamina in late-2014. Further, an oil and gas reform team was established – consisting of academics, anti-corruption proponents, and government officials – providing a number of recommendations for cleaning up Pertamina and the oil and gas industry at large. Indeed, Transparency International's 2015 Corruption Perceptions Index (CPI) ranked Indonesia 88 from a total of 168 countries – an improvement of 19 places up from 107 in the 2014 CPI.[49] Still, corruption remains a problem entrenched in the country.

Decentralization

The decentralization of Indonesia's government further challenges its energy security trilemma in making policy synchronization between the national and local governments difficult. A product of the country's transition to democracy, in 2001 it transferred decision-making power and budgetary resources away from the central government, to provinces, regencies, cities, and villages.[50] As a result, decentralization has provided local governments special rights and responsibilities related to its economic, energy, and climate policies. Local government grants land rights, as well as issuing concessions permits, and licenses for coal mining and renewable energy projects, among others. For example, regional governments receive 15% of net revenues from oil and 30% net revenues from gas.[51] Decentralization has increased the number of stakeholders involved in policy-making, decreasing government efficiency.

Lack of coordination between government agencies

Complicating Indonesia's ability to execute uniform policy for its economic, energy, and environmental needs is the lack of coordination amongst government agencies. At the cabinet level, there are also concerns arising from a lack of trust. For example, in August 2015 Vice President Jusuf Kalla and Coordinating Maritime Affairs Minister Rizal Ramli were disagreeing over Indonesia's energy policy to add 35 GW of new electricity capacity by 2020. Following a cabinet reshuffle in August 2015, on Rizal's second day on the job he commented that Indonesia's goal was unrealistic.

Difficult investment climate

Indonesia lags behind its regional neighbors in the ability to conduct business inside the country, negatively impacting its ability to attract investment for energy production and power generation. The World Bank's 2016 Ease of Doing Business Index ranked Indonesia 109. In comparison, other countries in Southeast Asia ranked as follows: Singapore (1), Malaysia (18), Thailand (49), Vietnam (90), and the Philippines (103).[52] This index considers factors such as starting a business, dealing with construction permits, and getting electricity, among others.

Following economic headwinds and the difficulty conducting business inside the country, the government enacted policies in order to boost its economy by attracting investment and create

a more business-friendly climate. The Indonesia Investment Coordinating Board established a one-stop service in order to speed up the amount of time for investors to get business licenses. Further, in late-2015 to early-2016 Indonesia released a series of targeted stimulus packages with the aim of boosting its economy and liberalizing it to foreign investment. The economic stimulus package targeted increasing the country's industrial competitiveness, accelerating electrification, cutting red tape, and lowering fuel prices, amongst others.[53]

Infrastructure

Indonesia's energy mix goals are weakened by its lack of infrastructure investment. The large expansion of renewable energy is reliant on investment in the transmission grid, as well as creating new power capacity from geothermal, solar, and wind.

Due to a lack of gas infrastructure the Energy and Mineral Resources Ministry's oil and gas directorate general estimates that it needs $32.42 bn[54] to finance the necessary investment. As of late-2014, the country has a total of 12,034 km of gas pipeline dedicated to open access pipeline, upstream pipeline, downstream pipeline, and private-use pipeline. By 2025 Indonesia plans to increase its total pipeline amount to 27,273 km.[55]

As a result, improving Indonesia's infrastructure is one of the Jokowi administration's key policy goals. Driven by a cut in the fuel subsidies, more capital is being allocated towards infrastructure for power plants, roads, ports, and dams. Reflecting the surge in infrastructure spending, Indonesia's infrastructure budget grew from 9.5% in the 2014 budget to 15% in the 2016 budget.[56]

Risks[57]

Compounding Indonesia's energy trilemma are risks, which include supply shocks that can increase the price of energy such as natural disasters geopolitics, and piracy. Additional risks include adverse global market/pricing conditions, and electricity outages. Natural disasters present perhaps the biggest risk to Indonesia's energy security.

Natural disasters

Due to its location, Indonesia is prone to natural disasters. As Indonesia is situated on the ring of fire, this presents the potential for disruptions to its energy security from volcanic eruptions, floods, earthquakes, and tsunamis. The most recent natural disaster was the 2004 tsunami that hit Indonesia's northern-most Aceh province. It killed 200,000 Indonesians and caused $4.4 bn in damage.[58] Floods regularly occur during the rainy season, from December to March. In the capital, Jakarta regularly floods every year, which cost roughly $380m in losses in 2014.[59] This is particularly disruptive to business and energy development because Jakarta is the heart of Indonesia's business and economic activity.

Geopolitics

Indonesia is also prone to geopolitics affecting its energy sector from the South China Sea disputes as well as turmoil in petro-states. China claims virtually all of the South China Sea as its own, becoming a Chinese lake. Indonesia's Natuna gas field, located in the Natuna waters from its Natuna island chain is at risk from Chinese aggression. It is one of the largest recoverable undeveloped gas fields in the world, at 46 Tcf, or 40% of Indonesia's total natural gas reserves.

The Natuna gas field is located within Indonesia's exclusive economic zone (EEZ). However, it overlaps with China's nine-dashed line map.[60] Tensions are rising in this area as China is increasingly assertive in the SCS, from placing an oil rig in waters claimed by Vietnam, to island building in waters contested with the Philippines. These tensions in the South China Sea could disrupt Indonesia's energy production and transportation.

Geopolitics far from Indonesia's shores could disrupt its oil imports, at a critical time when its oil consumption continues to grow. In 2014 Indonesia imported roughly one-third of its oil from the Middle East, and 18% from Nigeria.[61] The country receives the majority of its oil imports from petro-states located in volatile areas of the world.

Piracy

Indonesia is also prone to piracy along the Malacca Strait. Providing passage to one-third of the world's shipping, it is one of the major chokepoints for oil. Japan, Taiwan, and South Korea receive 75% of their oil imports from Africa and the Middle East from this strait, while China receives 37% of its total demand.[62] Pirates tend to target oil and palm oil tankers, which could take away from government revenues. In 2005 piracy was so high that Lloyd's Market Association of London designated the Malacca Strait a "war risk zone," although the situation improved a few years later. However, since 2014 there has been a dramatic rise in attacks, with Southeast Asia overtaking Somalia as the world's piracy hub. In 2014 there were 107 attacks and attempted piracy attacks – a 700% increase in five years.[63] Indonesia has limited funds and a large coastline; guarding against piracy in this strait is challenging. Piracy could disrupt its energy imports and exports.

Adverse global market/pricing conditions

Adverse global market/pricing conditions could also affect Indonesia. Oil and gas prices, currently at historical lows, do not necessarily help Indonesia's economy because it reduces the government's potential profits from oil and gas exports. Due to historically low global oil prices from a global oil supply glut, Pertamina's oil revenue decreased by 20% in 2014 compared to 2013, dropping from $3.06 bn to $2.4 bn, which lowers Indonesia's government expenditures as well. Due to a fall in other commodities, China's slowing economic growth has decreased government revenues on coal and palm oil. As Indonesia still heavily relies on commodities for its government's finances, and is one of the world's top exporters of these commodities, this weakens the government's development of its energy sector.

Conclusion

Indonesia appears to emphasize its energy equity and energy security over environmental sustainability. The difficulty in managing its energy equity, energy security, and environmental sustainability is not unusual for one of the world's largest developing countries. The country is in the process of substantially expanding its energy grid capacity, in order to meet its growing energy demand due to its fast expanding economy and growing population. However, this expansion is being done largely by exploiting coal-fired power plants, adding to its carbon emissions. Yet, Indonesia must meet the immediate needs of its population.

Notes

1 "Energy trilemma" refers to a country's difficulty in balancing energy security, i.e. managing energy supply and the ability to meet current and future demand; energy equity, i.e. the accessibility and affordability of energy across a populace; and environmental sustainability (supply- and demand-side energy efficiencies and development from renewable and low-carbon sources).
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