Green Finance in Indonesia

Barriers and Solutions

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Abstract

Indonesia's population growth, urbanization, and economic growth are driving growing energy demand, and greenhouse gas emissions (GHG). Although abundant in renewable energy resources, the country's economy and energy security is largely reliant on fossil fuels, with coal and gas generators risking asset stranding in a rapidly decarbonizing world. The government has pursued policy reform to support GHG reductions and accelerate the adoption of renewable energy. However, unclear incentives, historical subsidies, inconsistent policies, and concentrated monopoly structures that obscure cost transparency, are hampering the achievement of its targets. Under the current business-as-usual trajectory, increasing emissions and other associated climate impacts present a range of socioeconomic risks. Although studies indicate that it is technically feasible for Indonesia to undertake an affordable green transformation without jeopardizing economic growth and poverty reduction, there exists a large gap in financing. Increased investment from both private and public sectors is needed, as public funds alone are insufficient. This chapter identifies the market, policy, and governance barriers—including financial credit regulations, uncompetitive pricing, restrictive project scale, and limited access to information—to unlocking green financing for a low-carbon energy transition. We propose reform pathways via the development of mechanisms for market transparency that include the need for a wholesale electricity market and low emissions and renewable investments using tradable certificate-based policies (in particular CO_2 credits), harmonization of policies across ministries and agencies, and a reduction of electricity and fossil-fuel subsidies and cross-subsidies. Together, these measures are needed to create a transparent and lower risk investment landscape.

Keywords

Green finance · Energy finance · Energy transition · Renewable energy · Greenhouse gas emissions · Indonesia · Finance barriers

JEL Classification

F21 · G28 · O13 · Q21 · Q40 · Q42 · Q54

Introduction

Indonesia, represented by an archipelago of more than 17,000 low-lying islands, is the world's fourth most populous country—set to exceed 300 million by 2030—and home to an increasingly urban population (Siagian et al. 2015). In recent decades, Indonesia has experienced substantial economic growth, and has almost doubled its gross domestic product (GDP), reduced poverty levels by roughly half, and achieved middle income status. The Indonesian government has set targets to continue this

course, aiming to reduce its current poverty rate from 11% to below 4% and increase annual economic growth from 5.6% to 7.1% by 2025, while simultaneously reducing greenhouse gas (GHG) emissions by 29% (unconditional) below business-as-usual (BAU) by 2030. With international climate finance support, Indonesia's conditional target strives to achieve a 41% reduction below BAU by 2030.

Indonesia's steady growth has been accompanied by rising energy demand and GHG emissions. The country faces challenges in matching both energy supply and demand. As the largest energy consumer in Southeast Asia (IRENA 2017), the resource-rich nation is the world's fifth-largest producer of coal and second-largest net coal exporter (IEA 2017a). Regionally, Indonesia is the largest GHG emitter in Southeast Asia and one of the world's top-ten largest emitters (both including land-use, land-use change and forestry, or LULUCF), accounting for 1.7% of global emissions in 2012 (ADB 2016; CAIT 2017). While currently over 65% of emissions come from LULUCF, emissions from the energy sector could soon account for more than 50% (Wijaya et al. 2017).

In a post-Paris Agreement and Sustainable Development Goals (SDGs) context, a compelling opportunity now exists for Indonesia to significantly curb its emissions while realizing social and economic benefits. The country has abundant renewable energy options, including some of the world's greatest geothermal and hydropower potential in addition to solar, wind, ocean, and bioenergy opportunities (IRENA 2017). It is already the world's largest producer of biofuels and is scaling up efforts to access other renewable energy sources.

Evidence-based policies now inform Indonesia's energy plans and national outlook, and targets are in place to scale renewable energy options to meet 31% of total primary energy supply by 2050 (IRENA 2017). Timing is crucial, however, as energy demand is predicted to grow by 80% by 2030 (IRENA 2017), risking a "lock in" to economically unsustainable and emissions-intensive infrastructure that will be challenging to reverse in the long-term (IRENA 2017; Argyriou 2017). If no action is taken, the World Bank estimates that economic loss attributed to climate change in Indonesia will reach 2.5%–7.0% of GDP by 2100, alongside spiraling health and environmental costs (World Bank 2009). Further, Indonesia's Ministry of Finance estimates that without a green planning and budgeting strategy, the threats of climate change and natural resource degradation could reduce Indonesia's GDP growth from 7.0% to 3.5% by as early as 2050 (MoF 2015).

This chapter examines opportunities and challenges around increasing investment in, and contribution from, renewable energy, to meet anticipated demand and energy policy targets in Indonesia. It outlines the current situation and future outlook for Indonesia's energy mix and emissions profile, before providing targeted solutions capable of overcoming stated barriers related to policy and governance, financial mechanisms, and markets. The chapter provides a set of recommendations for increasing renewable energy adoption in Indonesia with a particular focus on options to further incentivize public and private sector financing.

Indonesia's Energy Context

Current Context

Energy consumption in Indonesia increased by nearly 65% between 2010 and 2014 (IRENA 2017), driven by rapid population and economic growth, urbanization, and an increase in transportation and industrial activity. With a final energy demand of 128.8MTOE in 2015 (NEC 2016), Indonesia now accounts for over 36% of total energy demand in Southeast Asia (IEA 2017b). With energy demand closely tied to economic activity, electricity demand increased by 150% between 2000 and 2015 (IEA 2017b) to a total of 251 TWh (UNDP 2018a). Despite having a significant renewable energy potential, Indonesia's energy consumption is highly dependent on fossil fuels. In 2014, 73% of total primary energy supply (TPES) was comprised of coal (31%), oil (30%), and natural gas (12%) (IRENA 2017) (Figure 1). The transport sector is currently the largest end-user of energy (excluding biomass) (NEC 2016; IEA 2017c).

Indonesia is not only a large energy consumer, but is also a net energy exporter (IEA 2017b), with coal being the largest commodity. This export-driven energy system, which reached 66% of total energy production in 2015 (NEC 2016), contributes to energy poverty, with more than 10% of the country's population still lacking access to electricity (IRENA 2017). However, with external shocks and volatility, alongside increasing domestic demand, the Indonesian government began shifting away from an export-driven market in 2014 in an effort to rebalance the

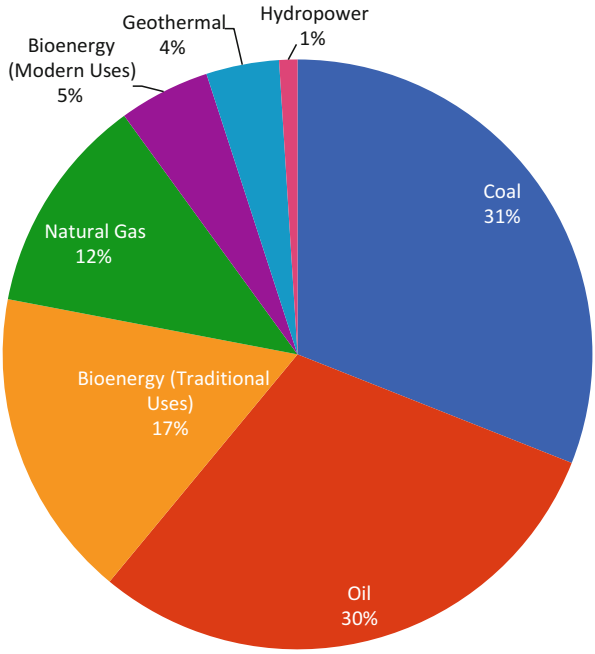

Figure 1: Fuel Mix in Primary Energy Supply, 2014. (Data from IRENA (2017))

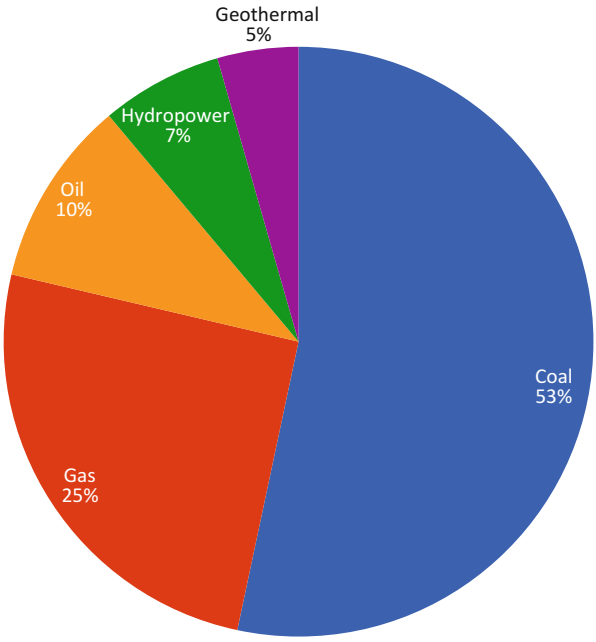

Figure 2: On-grid Power Generation in Indonesia, 2014. (Data from IRENA (2017))

energy mix toward increased energy independence (Cornot-Gandolphe 2017; IRENA 2017; Siagian et al. 2015). Indonesia's gas production, which similarly began mainly as an export market, it is now increasingly being diverted into domestic use to meet growing demand, although with declining domestic reserves, the country is increasingly dependent on imports (IEA 2017b). In 2015, imports from total primary energy supply reached 27%, consisting largely of crude oil, fuel, and LPG (NEC 2016).

The share of renewable energy in Indonesia's energy mix remains low (Figure 1). TPES from renewable sources was 27% in 2014, the majority of which consists of traditional use of bioenergy (17%) as well as modern renewable energy (10%) (IRENA 2017). Traditional uses of bioenergy however, have several significant negative consequences, including indoor air pollution that has been associated with 165,000 premature deaths in Indonesia per year (IRENA 2017) and large scale deforestation for palm oil-based biodiesel production, which has contributed to an increase in GHG emissions. For on-grid power generation (Figure 2), modern renewable energy contributed a small share of roughly 12% in 2014, with the remaining majority largely from coal-fired plants (53%).

Outlook

Based on a low GDP growth assumption of 5.6% per year and an average population growth of 0.8% per year, energy demand in Indonesia is predicted to grow at an

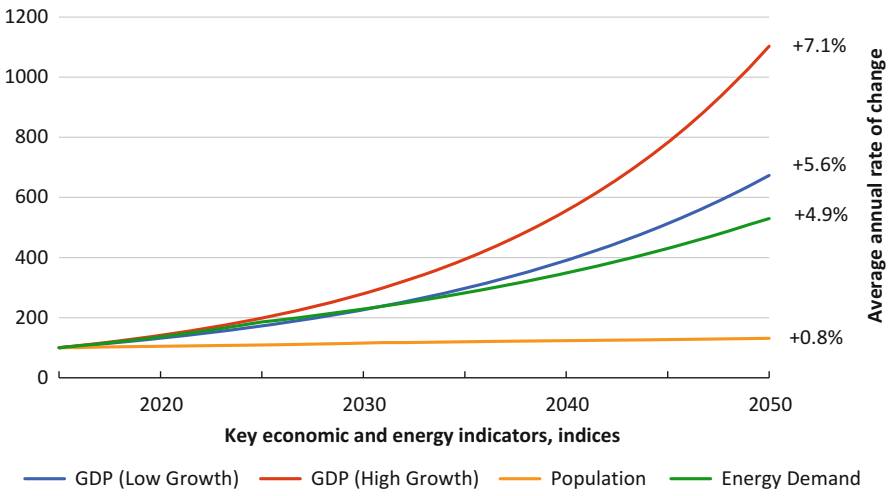

Figure 3: Economic Growth and Energy Demand up to 2050. (Data from National Energy Council (2016) and; Indonesia Energy Outlook NEC (2016))

annual rate of roughly 4.9%, reaching 682.3MTOE by 2050 (NEC 2016) (Figure 3). With continued economic growth, electricity demand is expected to increase by 6.86% per annum to a total of 688.9 TWh by 2030 (UNDP 2018a). It is important to note, however, that although electricity demand has risen, Indonesia's per-capita electricity consumption (of roughly 814 kilowatt hours (kWh) per-capita in 2014) is ~75% lower than the global average (of ~3,030 kWh) (IEA 2016a). To meet increasing demand under current government policies and pipelines, it is estimated that 50% of new installed electricity generation capacity will be from coal-power plants by 2030 (IEA 2017b). Industry's share of energy consumption (excluding biomass) is set to overtake transportation to dominate energy use by 2030 (IEA 2016b), driven by the country's plans to expand the sector's share of GDP from 21% in 2015 to 30% by 2035 (IEA 2017a), although both sectors' consumption is expected to more than double by 2030 (IRENA 2017).

The government has set targets to increase primary energy supply from modern renewable energy to 23% by 2025 and 31% in 2050, while lowering reliance on traditional bioenergy. For the power sector, renewables will contribute 23%, with total renewable energy capacity increasing from 8.7 GW (2015) to 45 GW by 2025, consisting primarily of large hydropower development as well as geothermal, solar PV, bioenergy, ocean power, and wind (Figure 4). The International Renewable Energy Agency (IRENA) has, however, projected that renewable capacity could be increased to 149.5 GW by 2025 if the government were to adopt more ambitious strategies and begin transitioning away from non-renewable capacity now (IRENA 2016). Harnessing this renewable energy potential is estimated to require over US$16 billion of investment per year until 2030 (Siagian et al. 2015; IRENA 2017).

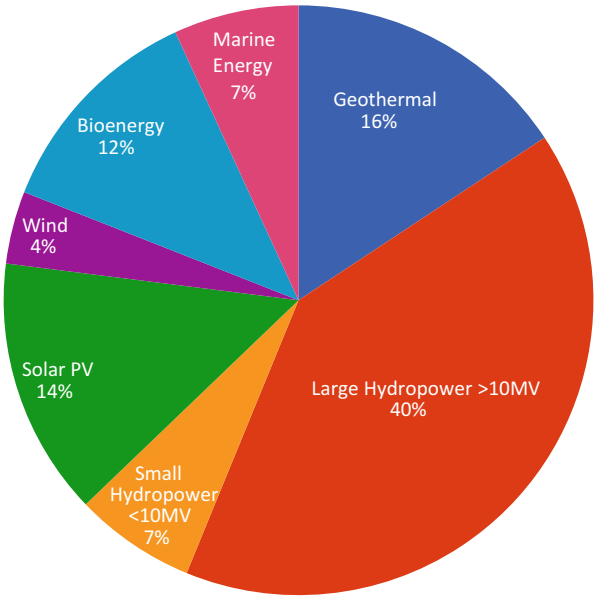

Figure 4: 2025 Power Sector Renewable Energy Targets. (Data from IRENA (2017))

While renewable energy is expected to play a larger role in the energy mix, given the overall increase in consumption, Indonesia is projected to remain heavily reliant on coal at 30%, oil at around 25%, and gas providing at least 22% in 2025 (IEA 2016b) (Figure 5). As per these targets, the Indonesian government has planned for a massive pipeline of coal production for both export and domestic use and currently plans to build 34.8 GW of coal-fired power plant capacity by 2025 (PWC 2016). The increasing share of coal in the energy mix until 2025 indicates that renewable energy investments alone will not be enough to displace the growth in fossil fuels,.

GHG Emissions

After ratifying the Paris Agreement in 2015, Indonesia submitted its nationally determined contribution (NDC) in 2016, with a target to unconditionally reduce GHG emissions to 2,037 MtCO2 against the 2,030 BAU scenario, which is projected to reach 2,869 MtCO2e (GoI 2016; Wijaya et al. 2017; UNDP 2018a), and as low as 1,693 MtCO2 with international support. The forestry and land-use sector currently dominates Indonesia's GHG emissions; however, energy emissions have been steadily rising, increasing by 70% between 2000 and 2012 (Wijaya et al. 2017). The energy sector is projected to become Indonesia's largest contributor to GHG emissions, accounting for around 50%–70% by 2025–2030 (IRENA 2017; Wijaya et al. 2017) (Figure 6). Within the energy sector, the power sector is the largest source of energy emissions (UNDP 2018a). With increasing electricity demand and reliance on coal for power generation, this rising trajectory is set to continue (UNDP 2018a). Indonesia will need to introduce significant and effective energy demand policies,

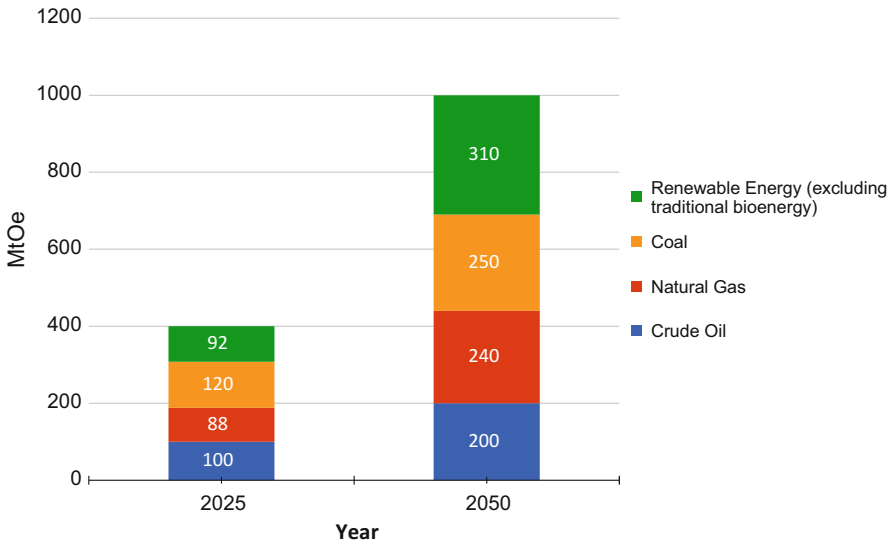

Figure 5: Fuel Mix in Primary Energy Supply Targets, 2025 and 2050. (Data from Wijaya et al. (2017))

along with energy efficiency mechanisms in order to meet both energy needs and accelerate the abatement required to meet NDC targets.

Potential of Renewable Energy

Indonesia's abundant renewable energy potential remains greatly underutilized. As shown in Figure 7, solar PV has the highest total renewable resource potential at 532.6 GW (IRENA 2017), although current government targets only aim to increase capacity to 6.4 GW by 2025. Due to its location in the "Ring of Fire" and volcanic geology, geothermal energy is another of Indonesia's greatest potential sources of renewable energy, estimated at 29.5 GW, or 40% of the world's total resource. Less than 5% of this potential has been utilized to date (Dutu 2016; Sugiawan and Managi 2016; NEC 2016), installed primarily for electricity generation. The utilization of hydropower additionally remains at an installed capacity of 11% of its potential (Sugiawan and Managi 2016; NEC 2016).

Initial investments to increase the share of renewable energy in Indonesia's energy mix may be high, however, the range of socioeconomic and health benefits delivered are anticipated to greatly outweigh costs in the long term. An analysis undertaken by the Deep Decarbonization Pathways Project (DDPP) in Indonesia found that investing in low- or zero-carbon electricity generation, fuel production, and transportation would cost Indonesia a maximum of 1.22% of GDP in 2020, decreasing to 0.54% in 2050 (Ucok et al. 2015). In comparison, total macroeconomic investment in Indonesia has risen from 22% of GDP in the early 2000s to

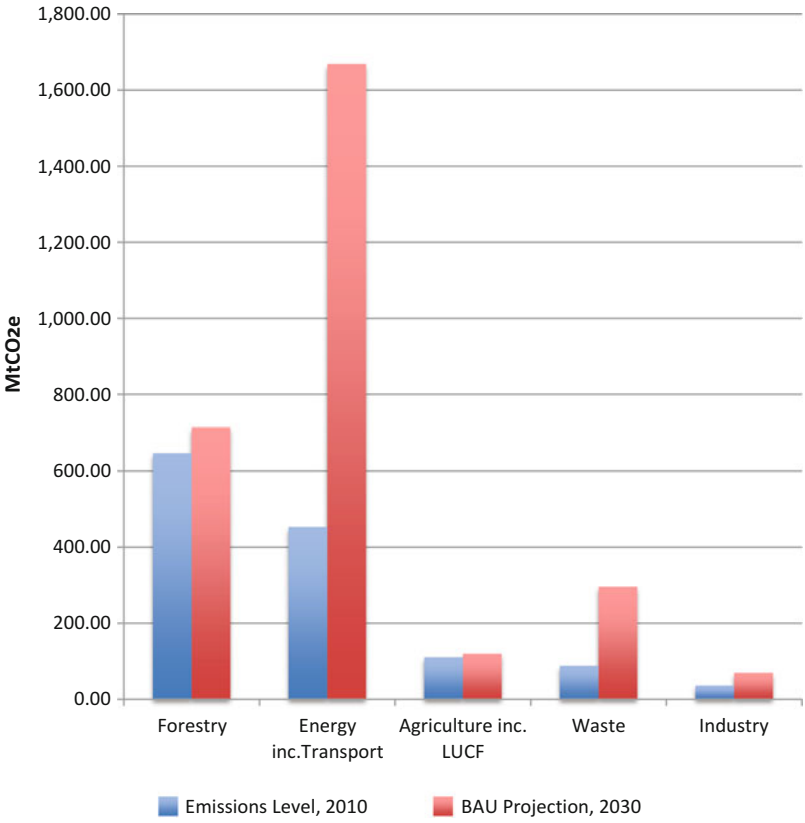

Figure 6: GHG Emissions by Sector. (Data from Wijaya et al. (2017))

about 35% a decade later. Renewable energy could also drive economic growth with the creation of a localized value chain by developing a manufacturing industry for renewable technologies such as solar PV panels.

There are an estimated 900 isolated grids across Indonesia's 1,000 permanently inhabited islands, many of which remain largely powered by inefficient and extremely expensive diesel generators. Transmission and distribution infrastructure is lacking, and off-grid renewable energy provides a viable option. Although often imported and sometimes expensive to install, modern biomass and solar PV have the potential to electrify 1.3 million households by 2020 (IRENA 2017). Argyriou (2017) explains that greater energy security can be achieved through strong action to enhance energy efficiency and switching to decarbonized electricity generation, reducing demand for imported petroleum products and thus susceptibility to external price shocks.

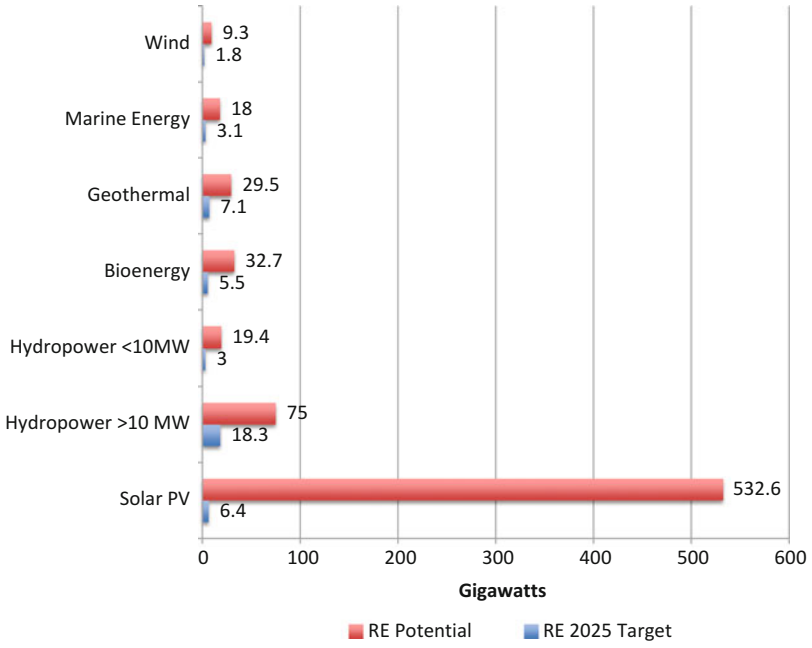

Figure 7: Renewable Energy Power Potential by Technology. (Data from IRENA (2017))

Green Finance

There are mixed and conflicting estimates about how much green finance is needed to transition Indonesia to achieve sustainable development. What is clear, however, is that current policies and incentives are not sufficient to create the enabling environment needed to meet Indonesia's future energy demands. Indonesia can go further with reform by promoting voluntary principles for green finance, collaboration to facilitate international investment in green bonds, and by improving the measurement of green finance activities and their impact.

Current Flows

Domestic

In 2015, Indonesia was the world's first country to launch a Climate Budget Tagging (CBT) tool to aid climate finance tracking and reporting for government and donor spending. However, few outcomes are available (CPI 2014), and uncertainty remains regarding climate finance flows. A 2014 study by the Ministry of Finance (MoF) and the Climate Policy Initiative (CPI) provides the most comprehensive inventory of public climate finance to date and identified that around US$951 million of climate-

specific finance was disbursed in 2011 (CPI and MoF 2014). The largest share (66%) came from national public financing through budget transfers between ministries, mostly for policy development and creation of enabling environments, in order to lay foundations that would stimulate direct investments. Of this US$951 million, 83% was allocated to land, forestry, and agriculture, with only 7% for energy. Further funding for the sector may emerge from its launching of Asia's first green bond in April 2018, issued by the OCBC NISP Bank, an Indonesian subsidiary of OCBC Singapore and backed by the IFC and World Bank. The sovereign bond, discussed in section "Policy and Governance Recommendations", is expected to build a climate portfolio to support Indonesia to meet its NDC targets. Its interaction or intended impact on climate adaptation is unclear, as financing remains challenging (Tänzler and Maulidia 2013).

International

The remaining 34% of the US$951 million disbursed in 2011 came from international development partners who contributed US$324 million. Most of this was bilateral finance in the form of grants and loans. Multilateral partners and international climate funds contributed a very small share of 4% (CPI and MoF 2014). Donors include the International Fund for Agricultural Development (IFAD), the Global Environment Facility (GEF), and United Nations Collaborative Programme on Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN–REDD). Much of this is channeled through the Indonesia Climate Change Trust Fund (ICCTF), which was established in 2009 to foster a more coherent approach to climate finance through pooling funding from various sources (Maulidia and Halimanjaya 2014).

In 2010, Indonesia designed its first carbon trust fund investment plan and unlocked US$400 million of funds to develop approximately 800 MW of new geothermal generation supply and support acceleration of investments in energy efficiency and renewable energy (CTF 2015). The funding allocation was revised in 2013 and again in 2015, with disbursement of these funds lagging, indicating that capacity and technical issues are bottlenecks in access to climate finance.

Private

To date, there has been limited research into private green finance in Indonesia. In 2012, the Indonesian Investment Coordinating Board undertook efforts to track private investments in low-carbon technology in Indonesia for the 2010–2012 period. It estimated that total private investment (not just green finance) was US$22.48 billion in domestic direct investment (DDI) and US$6.01 billion in foreign direct investment (FDI) (MoF n.d.). The most attractive sectors for private investors were agriculture, transport, and others, which accounted for 31.4% of DDI and 28.6% of FDI made in 2011 (MoF n.d.). Usually FDI would be an important source of finance for a developing country; however, of the G20 countries, Indonesia was ranked only 15th for investment attractiveness and 3rd for investment needs in 2016 (Care International 2017).

Despite Indonesia's renewable energy potential, investments in renewable energy infrastructure have comprised only a small share of overall private investment. Between 2006 and 2013, clean energy investments in Indonesia cumulatively reached US$5.71 billion (UNEP 2015). When considered in the context of overall private investment compiled by the Indonesian Investment Coordinating Board (see previous paragraph), it suggests that energy and renewable energy are a low priority for investors.

Indonesia's banks have only just started to incentivize green finance. The financial system is dominated by banking (Yoshino and Taghizadeh-Hesary 2015), holding 78.6% of total assets of all financial institutions (UNEP 2015). A review by Bank Indonesia of green financing by banks, which surveyed 29 banks between 2011 and 2013, found that in 2013, green investment was about US$1 billion, primarily for renewable energy (UNEP 2015); however, to date most banks deem renewable energy projects highly risky (International Climate Initiative 2017). Of all bank lending in 2013, the share identified as "green" only accounted for 1.4% (UNEP 2015).

Established in 2013, the Indonesian Financial Services Authority (OJK) was founded with the mandate to shift public and private investments toward financing climate-friendly activities in priority sectors (Maulidia and Halimanjaya 2014). In 2014, OJK became the key regulating authority for banks, non-bank financial institutions, and capital markets. Initiated by the OJK's launch of the 2015–2019 Sustainable Financing Roadmap, Indonesia's eight largest banks committed to implementing sustainable financing in 2015, with green financing set to become compulsory in 2018. This will require banks to include environmental sustainability standards as well as social and governance aspects in loan assessment in an effort to restrict lending to environmentally damaging projects—a powerful incentive for creating an enabling environment for green finance in Indonesia.

Future Financing Needs: Investing in Policy Commitments

The overall estimate for Indonesia's green financing needs, accounting for climate mitigation and sustainable development, varies widely, and has not been recently synthesized. The Global Green Growth Institute projects that for Indonesia to achieve annual average economic growth of 6.3%–6.8%, an estimated US$1.2 trillion will be needed over the next 5 years. Prior to the Paris Agreement, the UNEP estimated that an annual investment of between US$10.7 billion to US$15 billion was required to meet their target of a 26% reduction against BAU by 2020 (UNEP 2015). In comparison, the Indonesian government costed this at US$8.9 billion, and expected to directly contribute 18% of this amount, with the remainder to be met by private investment through FDI and DDI (GoI and GGGI 2013).

For power generation, significant investment is needed to meet both current and future demand. Some estimates are as high as US$12.5 billion per annum until 2020, of which 73% will need to be invested into energy production (Dutu 2016). In order to meet future demand, Indonesia's two main power systems in Java-Bali and

Sumatra (accounting for around 70% of national power generation) will need significant development, which BAPPENAS estimates at US$65 billion to US$78 billion (Volz et al. 2015). However, what is clear is that current policies and incentives, some which are outlined below, are insufficient to meet Indonesia's future energy demands.

Barriers to Financing an Increased Share of Renewables

The barriers examined in this section need to be addressed to achieve the overall aim of meeting Indonesia's climate mitigation ambitions, while simultaneously meeting its national development priorities related to energy security and growth. As demonstrated by Yoshino and Taghizadeh-Hesary (2015), these barriers manifest in a lower rate of return for renewable projects, when compared to fossil-fuel projects, at least as is perceived by the current investment community, which results in a higher risk of investment. Barriers in Indonesia relate to a range of categories, described in Table 1.

The following section outlines some key barriers in detail:

Financial Sector Barriers

The key barriers in the financial sector are related to the perception of high risk in renewable investment and the perception of high costs that, when combined with lack of subsidies, leads to projects that are uneconomical. Moreover, the mandated need for Indonesia's government-owned electricity company, PT Perusahaan Listrik Negara (PLN) to be the off-taker with the associated difficult power purchase agreement (PPA) structure, increases the risk and can make investments even more expensive to the commensurate higher cost of capital. In combination with the risk aversion and short lending horizons of Indonesian banks, financing is difficult to obtain. Specific barriers are the financial credit regulations, which make Indonesian banks averse to investment in renewables and energy efficiency projects, and lead to adverse risk perceptions and expected rates of return.

It is important to note that these financial sector barriers are tightly coupled with market and governance barriers discussed below, that collectively make it difficult to invest in renewable projects on a large scale.

Market Barriers

There are many issues impacting the ability of private sector investors to invest, including the perceived risks from an unstable policy landscape, inadequate feed-in tariffs, difficulty faced by independent power producers (IPPs) in signing off-take agreements with PLN as the single wholesale purchaser, and the general risk of

Table 1: Typology and Description of Key Barriers to Renewable Energy Finance in Indonesia

	Barrier	Description
Financial Sector	Financial credit regulations	Established to protect against risky lending practices in Indonesia, these are not suitable for clean energy finance, in particular for energy efficiency projects (EE), as they do not recognize the cash flows from energy savings as acceptable collateral.
	Risk perception and expected rates of return	There's a perception that renewable energy (RE) projects are riskier than fossil fuel projects, and therefore require a higher rate of return. This makes for higher interest rates and weighted average cost of capital (WACC), making such projects difficult to bank.
Market	Project Scale	The small scale of EE and RE projects means transaction costs are too high and banks require high collateral (often covering 80%–120% of the project volume, depending on perceived risk).
	Access to Information	Lack of information and awareness to enable appropriate risk assessment for RE and EE projects (e.g. information about EE technologies and their performance, up-to-date levelized cost of energy (LCOE) of renewables versus fossil).
	Distorted pricing	Driven by subsidies (explicit and implicit) and international geopolitical commercial agendas, resulting in low cost coal generation, the attractiveness of RE and EE projects is reduced, while policy uncertainty risk remains high. Transport fuel subsidies leading to delay in economic shift into electrified transport.
	Lack of price/cost transparency	Lack of transparency in how existing generation resources are priced/costed and translated into wholesale and retail costs. Furthermore, network use of system costs (distribution and transmission) is also not transparent.
	Incompatible timeframes	The banks that dominate Indonesia's economy, typically only provide loans that match their deposit timeframe (1–5 years), while EE and RE projects typically have multi-decade payback periods.
Policy and Governance	Incumbent industry structure and management tradition	Energy utilities structured as a small number of state-owned monopoly/monopsony businesses, with long-standing or committed procurement relationships with traditional suppliers.
	Policy environment with conflicting incentives and targets	Lack of binding RE and EE targets or emission trading schemes. Lacking standards from the government, along with issues in cross-ministerial coordination in enforcing EE and RE targets and standards. Conflicting policy signals, including both RE and emission reduction targets combined with

(*continued*)

Table 1: (continued)

	Barrier	Description
		high coal generation development plans. Increasing biodiesel targets, met from palm oil yields, is responsible for large-scale deforestation on peatlands that may contain methane.
	High Capital Costs in off-grid settings	In off-grid settings, the distribution network (poles, wires, and transformers) must also be built to connect off-grid RE projects to consumers. This total cost must be recovered from consumers as standard incentive mechanisms are only sufficient to cover the cost of electricity generation. This total cost is well above the average Indonesian residential tariff (US$12c/kWh) and the feed-in-tariff rates are insufficient to cover these costs.
	Inappropriate Renewable Energy Feed-In Tariffs	There are a range of so called "Feed-in-Tariffs" that in the Indonesian context, are only power purchase agreement (PPA) rates set by Minister of Energy and Mineral Resources (ESDM) regulations 12/2017 and 50/2017 that cap the price, that the State Electricity Company (PLN) must pay for renewable energy. These are set at 85% of a regional BPP (PLN's average benchmark wholesale cost of production). It was designed to ensure PLN does not increase its average purchase costs and therefore, is not, in fact, a subsidy.

doing business in Indonesia, according to GlobalEdge Insights Research (GlobalEdge 2018).

A range of critical market barriers exist relating to: project scale, access to information, distorted pricing, lack of price/cost transparency, and incompatible timeframes.

Vertical Integration

Vertical integration refers to the joint ownership of generation (or resource extraction), transmission, distribution, and retailing of electricity or other energy commodities. This results in disadvantages for small project scales, access to information, and distorted pricing.

Electricity supply is dominated by PLN, which, as the only provider in the country, has limited financial capacity to provide universal energy supply. International and local IPPs are encouraged to cover the gap, however, they can only sell energy through PLN, creating a potential conflict of interest. A low power tariff has defined consumer prices since 2003, further disincentivizing private investment (Volz et al. 2015). While new laws have attempted to stimulate new investment by

delineating IPP driven market opportunity—for example, the 2009 electricity law mandates that of the 34.8 GW of new coal-fired projects that are planned, 25.1 GW will come from IPPs (ADB 2016; PWC 2016)—PLN still holds the right of refusal for new energy incentives, which deters investment in renewable energy.

These ownership structures relating to the PLN, as well as Pertamina monopolies/monopsonies, are highly vertically and horizontally integrated, leading to several issues:

1. When looking at large monolithic organizations like PLN and Pertamina, there is a natural bias to invest in assets for scale, so owning generation is more attractive from a growth perspective than sourcing wholesale energy from IPPs.
2. Preference for larger scale projects in an environment where renewable projects, particularly from IPPs, are smaller and greater in number.
3. This is particularly challenging when IPPs invest in renewables whose cost is transparent under a PPA contracting structure, while PLN internal costs, for example, are not clear, and the true cost of electricity production from an internal project is not apparent.

Subsidies and Appropriate End-User Prices

Fossil-fuel subsidies create distortions in the investment market and mask other, potentially economically viable investments. For example, in the case of electricity, the cost of end use electricity is still subsidized both directly and indirectly. This is not ideal for the long-term interests of consumers or for PLN, where subsidies may make higher cost technologies look more attractive than they actually are, particularly in the context of local, edge of grid, or off-grid settings.

Energy efficiency policies also provide Indonesia with the opportunity to reduce demand for energy, and thereby reduce emissions generated from coal-fired power. In a 2017 study, the Asia Pacific Economic Forum (APEC) reported that Indonesia has an energy saving potential of 10%–30% in the industry, transport, household, and commercial sectors (APEC 2017). In 2014, an aspirational target was set to reduce energy intensity by 1% per year to 2025 by implementing economy-wide energy efficiency measures (GoI 2014), and decreasing total final consumption (TFC) by 17% by 2025 (IEA 2017b). If these goals are achieved, Indonesia could avoid the equivalent of 20 coal-fired power plants, saving US$10 billion in investment and avoid 341 MtCO2e of GHG emissions (IEA 2017b). These savings could be used to drive investment in renewable energy and support the country's NDC targets.

Policy and Governance Barriers: Policy Environment

The legacy of abundance of fossil fuels and the complexity of the Indonesian political landscape has left a legacy of institutional arrangements and a policy landscape that led to a range of barriers across the following categories: incumbent industry structure and management tradition, policy environment with conflicting

incentives and targets, high capital costs in off-grid settings, and inappropriate renewable energy feed-in tariffs.

Until 2014, fossil-fuel subsidies accounted for up to 3.1% of Indonesia's GDP or 25% of government spending, resulting in a long-term, historical underpricing of fossil-fuel powered energy (IEA 2016a). Combined with PLN's monopoly on energy, the subsidies resulted in a cycle of underinvestment, poor maintenance, and undersupply in energy infrastructure. For example, underdeveloped transmission networks and inadequate connections mean Indonesia has several separate larger-island grids. The relative cheapness of fossil-fuel energy also undermined investment in renewable energy, discouraging development and commercialization of relevant technologies and instead, driving consumption of fossil fuels. Transport represents 96% of subsidized consumption, which along with rising incomes and low interest rates, has increased passenger transport and congestion, which in turn increases GHG emissions (IEA 2016a). In 2015, the Indonesian government pledged to reform its approach to subsidizing energy, resulting in a subsidy reduction from US$19.3 billion in 2014 (3% of GDP) to US$5 billion (less than 1% of GDP) in 2016 (IEA 2016a). The results of this policy are still emerging, with a recent hiatus with the reinstatement of fuel subsidies ahead of the 2019 presidential election (Listiyorini and Singgih 2018), however, in the long term it is expected that this reform will be positive.

Conversely, renewable energy appears to have been disincentivized. In early 2017, the government introduced the Regulation of Minister of Energy and Mineral Resources No. 12/2017 on the Utilization of Renewable Energy Resources for Electricity Supply, which sets out the tariffs for a range of renewable energy, including solar PV, hydropower, and geothermal. In cases when the costs of renewable energy exceed the national average for fossil-fuel energy, renewable energy becomes uncompetitive, raising concerns that projects reliant on renewable energy may be rendered financially unviable or marginally competitive (Baker McKenzie 2017). However, this can be compared against the real cost of energy delivery (distribution and transmission for electricity and pipelines for natural gas and oil), which is not published explicitly. It is likely that in certain regions (edge of grid and other transmission network constrained areas), renewable energy will be economically viable (if taking into account the full cost to serve), and the numbers of these regions will increase with the constant reduction of renewable energy costs. The recently released power supply business plan (Rencana Umum Penyediaan Tenaga Listrik–RUPTL) has further disincentivized investment in renewable energy, adding another 27 GW of coal-fired power in the next 10 years and only 15 GW of renewables. Not only are the RUPTL's targets lower than in previous plans, resulting in confusion and instability in the policy environment, they also actively favor coal over renewable energy, risking significant stranded assets in domestic production and power plants (MEMR 2018).

In the past 5 years, Indonesia has introduced a sweeping array of legislation and policy reforms designed to bring about energy security, manage climate risk, and stimulate investment in green growth while maintaining economic growth. Policy changes are partially driven by the ratification of Indonesia's NDC in October 2016.

Table 2: Key Policies Guiding Climate Change

Nationally Determined Contribution (2016)
Presidential Decree 61/2011, National Action Plan to reduce GHG emissions (RAN-GRK)
National Energy Policy (NEP) under the Presidential Decree No. 5/2006
National Medium Term Development Plan 2015–2019 (RPJMN)
National Long-Term Development Plan 2005–2025 (RPJPN)
Regulation of Minister of Energy and Mineral Resources No. 12/2017
Presidential Regulation No. 18/206
Biofuels Mandate 2015
Regulation of the Financial Services Authority No. 51/POJK.03/2017, Regarding the Implementation of Sustainable Finance for Financial Services Institutions, Issuer Companies and Public Companies.

Evaluations of the impact and performance of these policies have been varied, as contradicting targets do not lead to the enabling environment required to increase the share of renewable energy. Policy and governance-related barriers are discussed in detail in this section, with potential solutions provided in the proceeding section. The key policies are summarized in Table 2.

Of these policies, three in particular are incongruous with supporting renewable energy growth: The National Action Plan on GHG Emission Reduction (RAN-GRK), the National Energy Policy (NEP), and National Energy Plan (NEP). When combined, these policies simultaneously pursue increased renewable energy targets while also embedding the role of coal in the country's energy future.

Although the RAN-GRK outlines Indonesia's targets for increasing modern renewable energy to 23% of TPES by 2025 and supports over 45 GW of additional renewable energy, the NEP establishes new targets for oil, gas, and coal to drive the remaining 77% of the TPES by 2025.

With all this, coal and oil remain Indonesia's primary energy sources, and these policies lack sufficient incentives to drive investment in renewable energy. A report by the Institute for Energy Economics and Financial Analysis (IEEFA) analyzed Indonesia's 2017–2026 National Energy Plan, and found that avoiding the expansion of coal-power generation and associated long-term contracts in Java-Bali could save the government US$16.2 billion in unnecessary expenditure (Chung 2017). Indonesia now faces an energy "trilemma" referring to "the conflicting goals that governments face in securing energy supplies, providing universal energy access and promoting environmental protection" (WEC and Wyman 2017).

Renewable Energy Prices and Tariffs

A recent report published under the Global Subsidies Initiative stated that the price being paid to renewable energy generators in Indonesia is the single most important factor in deciding the financial viability of a renewable energy project (Bridle et al.

2018). Yet setting a price that satisfies renewable energy developers and PLN has been a challenge, and the government has tried to develop a number of mechanisms to create an attractive price. The current legislation establishes clear rates (ESDM regulations 12/2017 and 50/2017 sets this at 85% of the local average generation cost, or BPP, in cases where it is above the national average generation cost; it is set at 85% of the national average generation costs where the BPP is equal to or below the national average). What it explicitly does not do, is provide a mechanism for PLN to recover any additional costs where renewables are more expensive than their current wholesale costs. This is the standard situation for a new technology that requires support. Currently PLN would therefore have to absorb the difference, making it unable or unwilling to increase its own costs by purchasing renewable power above market rates (Bridle et al. 2018). These are set at such a low level that there is, in fact, no subsidy at all, and these rates can be used by PLN to ensure its cost is not increased (Figure 8).

Overall there is a funding gap in all of PLN's operations (PLN 2017 Annual Report, 2018) and to address this, the MoF provides yearly financial support to fund the gap between PLN's actual revenue requirement and actual sales to prevent any deficit and shore up financial stability. However, the short-term nature of this support and with no clear allocation for how much new renewable energy PLN can purchase, means that PLN has not signed up to any PPAs at the established tariff rate. This has led some to question the profitability and bankability of the current regulation's feed-in-tariffs, which also encourages reliance on PLN rather than incentivizing private investment in renewable energy (Horn and Sidharta 2017).

Lack of Transparency

Renewable energy is increasingly becoming a cost-effective option for remote and rural electrification in Indonesia, particularly when local diesel prices rise above US$1/liter (Bridle et al. 2018). Yet the technical and economic viability of renewable energy continues to be distorted by those who seek to benefit from continued reliance on diesel and gas. This occurs at the local and national levels, as the government continues to negotiate and sign PPAs between PLN and private providers with limited transparency, indicating that cost-effectiveness and competition may be compromised.

This complex policy environment and the regulation and supply of energy is overseen by a wide array of actors—ministries, agencies, and other organizations—with equally complex management arrangements and delineation of responsibilities (Figure 9).

Recommendations

In order to address the barriers identified in the previous section, Indonesia will need to consider an array of options to increase investment in renewable energy. Summarized in Table 3, these will play a key role in enabling Indonesia to meet its NDC targets, and achieving energy security, energy access and ultimately, decarbonization

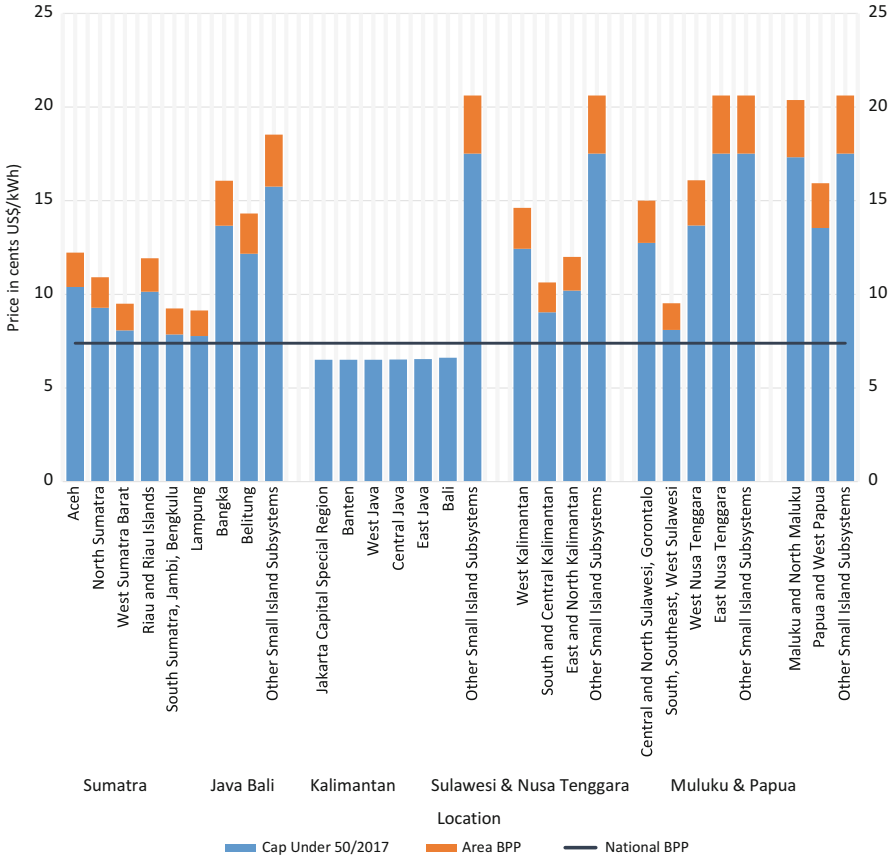

Figure 8: Caps on Power Purchase Prices Under Regulation 50/2017. (Source: Data from Ministry of Energy and Mineral Resources (2017))

As renewable technology improves, costs decrease and battery storage becomes increasingly viable (Wijaya et al. 2017), and when coupled with robust energy efficiency policies, total emissions reductions could be approximately 880 MtCO2 by 2025 and 1,341 MtCO2 by 2050. This section aims to outline some of the proposed recommendations, according to the previously profiled barriers.

Policy and Governance Recommendations

Policies

As described in the previous section, the current plans, policies, and regulations that govern and incentivize renewable energy project financing are overseen by multiple ministries and government bodies that often have overlapping responsibilities. A mechanism to set and implement common targets among these entities will be

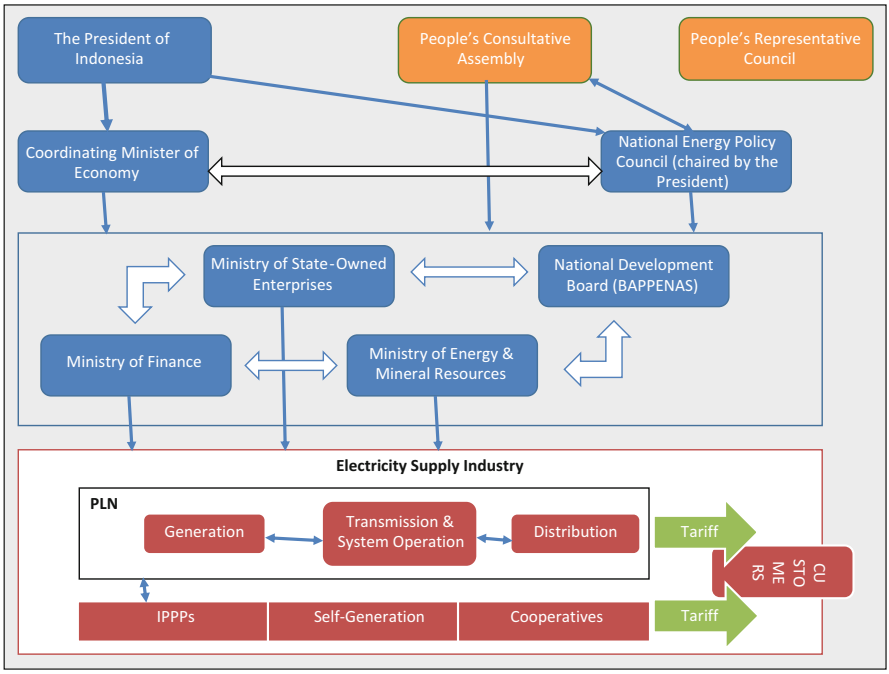

Figure 9: Summary of Indonesia's Electricity Governance. (Source: Reproduced with permission from Sriyanto (2017))

essential to harmonize policy and promote a collective sense of stewardship for the energy sector. If durable, enhanced policy coordination between ministries will send a strong market signal to give investors confidence.

New policies are encouraging. The Roadmap for Sustainable Finance—2015–2019 (or OJK—*Otoritas Jasa Keuangan),* for example, is designed to encourage green lending and improve the resilience and competitiveness of national financial service institutions. Its main body—the "Finance Services Authority" will eventually unlock fiscal resources and stimulate green products and services. Supporting this is new regulation that requires the banking sector to apply sustainable finance principles to business activities, including the incorporation of mandatory programs and annual reporting (GoI 2017 Regulation of the Financial Services Authority No. 51/POJK.03/2017). While currently delayed, these policies aim to incentivize the conventional banking sector to "green" its investment portfolios.

Replicating and scaling pilot programs, such as the Green Growth Program that is currently implemented by the government and the Global Green Growth Institute, can demonstrate how the government's existing planning instruments can achieve green growth outcomes. While still in a nascent, target-setting phase, this collaboration offers strong potential to increase the role of the private sector through both foreign direct investment and domestic direct investment.

Table 3: Summary of Potential Solutions Against Profile Barriers

	Barriers	Solutions
Financing	Financial credit regulations	Use of government balance sheet and credit rating to de-risk private investment in energy infrastructure. Revise regulations to allow green bonds or *sukuk* issuance against broader range of initiatives such as energy efficiency.
	Risk perception and expected rates of return	This can be readily addressed by ensuring sufficient subsidies are available to ensure economic returns. Additional reduction in risk perception and therefore expected rate of return should result in policy stability (e.g. recent regular alterations to the feed-in-tariff regulations) and regular updates of technology costs (LCOE).
Market	Project Scale	Develop guidelines for renewable energy and energy efficiency financing that might loosen current collateral requirements so that banks would find these projects more investment-ready.
	Access to Information	Investment in reference/pilot projects to build trust and/or pre-feasibility studies. Deploy publicly accessible energy resource and technology cost databases that are updated regularly. This will include GIS-based energy resource mappings (enhance and cement within or alongside the Indonesia One-Map program), regionally estimated LCOE and technology learning curves, and grid capacity margins at transmission and sub-transmission level showing value of renewable generation at these locations.
	Lack of price transparency	Introduction of single buyer-based locational marginal pricing based electricity spot market for large scale on-grid generation (e.g. >30 MW). This will create geographic and temporal price transparency, making it easier to value marginal benefit of new generation sources. Careful analysis needed to determine exact design (gross versus net pool, energy only versus capacity and energy, and so on).
	Distorted pricing	Introduction of transparency mechanisms for renewable subsidies in combination with a spot market for electricity prices, including certificate-based schemes for renewable energy, energy efficiency, and CO_2, and tariff reform and reduction of inefficient subsidies.
	Incongruous Timeframes	Market reform to single buyer pool with standardized PPAs can address this in combination with deployment of the range of green finance sources described above.

(*continued*)

Table 3: (continued)

	Barriers	Solutions
Policy and Governance	Incumbent industry structure and management tradition	This will be addressed through the market reform-based pricing transparency mechanisms mentioned above, including an electricity spot market, renewable energy certificate trading schemes, and carbon trading. Furthermore, increased information availability about energy technology costs, GIS-based renewable energy resource databases will allow for more transparency in capital expenditure costing.
	Policy Environment with conflicting incentives and targets	Revised target energy mix to accommodate up-to-date technology data. Introduce carbon pricing (cap-and-trade scheme is considered most efficient) or binding renewable energy target through renewable energy certificates. Harmonization of disparate policies and regulation is needed to ensure that there are no conflicts or gaps. This will be much easier if regulations are not changed regularly. Therefore, the stability of government energy policies has to be maintained as much as possible.
	High Capital Costs in off-grid settings	A range of mechanisms are needed to ensure off-grid settings are treated as appropriate. Mixture of grant and concessional loans to fund non-generation infrastructure (such as poles and wires and other network assets) in off-grid-areas while ensuring end-user tariff uniformity with existing customers. In cases where diesel is used as the primary source, the diesel subsidies can be redirected to fund the grants.
	Inappropriate Renewable Energy Feed-In Tariffs	The "feed-in-tariffs" under regulation 50/2017 need to be updated for actual LCOE of renewables in the specified regions, and additional subsidies provided to PLN from the government to fund the gap.

Incentivizing the Private Sector

A key approach followed around the world to increase transparency in electricity markets and ensure efficient operation, consumer pricing, and investment, has been the setting up of competitive liberalized markets. This began in the mid-1990s when the United Kingdom led the reforms around the world. The move has created an environment where the marginal cost of electricity production is transparently revealed at key transmission nodes throughout the electricity system, leading to a well-understood market where investors can assess risks and forecast revenues in a consistent way across technologies and locations. Locational and technological decisions can then be made in a rational and consistent way.

While the recent reform of fossil-fuel subsidies has been encouraging, there has been limited agreement and coordination on the speed at which this reform should take place. The reform provides Indonesia with the opportunity to take a long-term planning approach to energy pricing and more productive public spending (IEA 2016a). With further reform, the use of subsidies, cross-subsidies, and implicit subsidies can be minimized. Further, diesel and petrol fuel subsidies should be gradually removed for private vehicles in line with the development of a national policy for transport electrification. Together with strong renewable energy and CO_2 emission reduction policies, this will serve the dual goals of emissions reduction and energy security by reducing reliance of fossil-fuel imports.

Subsidy reform can help unmask the true LCOE of electricity provision. Technology cost assumptions can be updated to demonstrate that renewable energy sources are cost-competitive with coal- and natural gas-fired electricity generation. By updating the cost assumptions used to establish national energy mix targets, overarching policies can then be developed to reduce reliance on fossil fuels and simultaneously increase energy security and minimize the risk of stranded assets.

Addressing the risk in investment can also be partially achieved by incorporating the government's balance sheet and credit rating to underwrite loans and onboard sovereign risk. For example, Indonesia recently introduced its first sovereign green bond in April 2018 in partnership between the Government of Indonesia, the private sector, and UNDP. Totaling US$1.25 billion, the green *sukuk* (Islamic bond) is aimed at funding climate change—mitigation, adaptation, and biodiversity preservation (in accordance with Islamic law) (UNDP 2018b).

The challenges with transparency and stability (partially covered above) can be addressed through a mix of tradable certificate mechanisms and a liberalized power market, such as seen in Australian, South African, and Indian electricity markets (CCA 2015). Specifically we recommend some mix of the following:

Certificate-Based Schemes for Renewable Energy, Energy Efficiency, and CO_2

Due to the complex political and economic landscape of Indonesia and the mix of energy potential, a range of certificate schemes should be considered:

i. A tradable renewable energy target scheme

The current regulation used by Indonesia to set feed-in tariffs is opaque and changes frequently, highlighting the need for a transparent price. It should be replaced with a tradable renewable energy certificate similar to the Australian Renewable Energy Target (RET), which has successfully supported the deployment of around 5 GW large scale renewable energy projects (mostly wind with some large scale solar) and over 5 GW of rooftop PV (CEC 2017). The deployment of rooftop PV was also previously supported by strong state-based feed-in tariffs. The key feature of these schemes is a set market price, creating price discovery, and transparency (CCA 2015).

ii. An energy efficiency target scheme

This has been used in several jurisdictions around the world including the Australian states of Victoria and New South Wales. The mechanism is similar to a renewable energy policy that sets a target and uses tradable certificates and therefore offers the same transparency and stability benefits (CCA 2015).

iii. A tradable CO_2 certificate-based emissions reduction target and scheme

Several CO_2 emissions reduction schemes have been implemented around the world, including in the EU, several regions in the US, Australia, and China. They are closely related to a carbon tax, but respond more dynamically to abatement trajectories. These are agreed internationally to be the best mechanisms for reducing CO_2 emissions at the lowest cost. In the Indonesian context, given the sensitivity around increasing costs of energy to consumers, it may be preferable to implement a baseline-and-credit scheme rather than a cap-and-trade scheme, although the latter is the world's best practice option. These work in conjunction with a liberalized, competitive, wholesale electricity market.

Off-Grid Electrification

The above-recommended measures mostly apply to the bulk power system. Remote areas with off-grid/standalone power systems, including small home energy systems, pose a different but related set of challenges. These primarily relate to the ability of independent small system operators and IPPs to absorb significant financial and operational risks. The handful of local companies capable of installing PV grids tend to survive by building small contracts (under 5 MW) funded by PLN, involving the installation of PV solar and batteries with a 12-month guarantee. For other communities, the conditions to receive a commercial rate of return on a mini grid, without a PLN contract, are often not conducive to breaking even, as the developer must pay for the distribution, storage, and generation of supply, while providing a LCOE that is affordable to remote communities. Further, it is only recently that the quality of locally assembled PV solar cells has improved sufficiently to be deployed domestically. Without guarantees on productivity or reliability, the resulting breakdowns consign PV to continuing to remain a "poor man's energy" source for the time being, and there being an ongoing low preference for PLN. In some countries, including Japan, community-based funds that have been sourced through crowdfunding have successfully raised money from communities for investment in smaller-sized green energy projects.

PLN struggles to keep up with the electrification of remote areas and relies heavily on diesel generators, which are difficult to service to maintain a stable and cost-effective fuel supply, and require significant government subsidy. This risks exposing small cities and communities to future unpredictable volatile price shocks. Using diesel generators to meet growing demand puts upward demand pressure on biofuels (derived from palm oil), which may displace LULUCF activities.

A renewables-based micro-grid approach utilizing the rapidly decreasing costs of batteries and already cheap solar panels must be used, if there is any chance of addressing electrification without the use of fossil fuels.

Market Recommendations

Pilot Viable Biomass Power

With the underdevelopment of this technology option, governments should consider developing sustainable biomass power options by piloting the use of state or state-owned assets for biomass energy farms. This is in line with current government plans to increase the use of biofuels as per the Biofuels Mandate (2015). Meeting this target relies on increasing production in high-yielding oil crops, such as palm oil, and mobilizing private sector support via new decrees that mandate the transformation of biomass waste to biofuel for transport. The predicted quadrupling of biofuel production may impact the incentives for financing renewables, reducing the potential for biomass energy production and potentially demand for elective vehicles.

To stimulate investment, the government has issued several feed-in-tariffs for biomass, biogas, and municipal solid waste under Ministry of Energy and Mineral Resources regulations. This was further incentivized by Presidential Regulation No. 18/206 to expedite the development of waste-based power plants in seven of Indonesia's larger cities (Jakarta, Bandung, Tangerang, Semarang, Surabaya, Surakarta, and Makassar), in order to reduce the excess of waste accumulating at landfill sites and to produce electricity (PWC 2016). However, given the fledgling nature of this technology, the government should conduct pilots to demonstrate viability using state-owned assets.

Tariff Reform and Reduction of Inefficient Subsidies

One of the key challenges facing Indonesia (and other countries) is the distortionary impact of explicit and implicit energy subsidies, including locational cross-subsidies. In Indonesia these are particularly problematic in both electricity and the liquid fuels markets (diesel and petrol). They have led to adverse outcomes, specifically to disincentives for investment in renewable energy in the case of electricity (particularly in remote areas where the true cost of electricity supply is much higher) and in the case of vehicle fuels where it leads to excessive use of private vehicles, and is a disincentive to switch to public transport. Moreover, implicit subsidies given to PLN (which operates at a loss), distort investment decisions, as well as make it difficult to make rational investments. Therefore, Indonesia should:

1. Minimize the use of subsidies and cross-subsidies and implicit subsidies of PLN. Where social policy requires support for low-income families and regions, this should be done through direct grants.
2. Diesel and petrol fuel subsidies should be gradually removed for private vehicles in line with the development of a national policy for transport electrification. Together with strong renewable energy and CO_2 emission reduction policies, this

will serve the dual goals of emissions reduction and energy security by reducing reliance on fossil-fuel imports.

Conclusion

Indonesia faces huge challenges in matching energy supply and demand. Although abundant in renewable energy resources, the country's economy and energy security remain dependent on fossil fuels, risking a "lock in" to economically unsustainable emissions and pollution-intensive policies that will be challenging to reverse in the long term. While the Indonesian government has pursued policy to accelerate the adoption of renewable energy, unclear and often changing incentives, historical fossil subsidies, inconsistent policies, and concentrated monopoly structures continue to obscure cost transparency and hamper financial flows. Large financing gaps exist, despite increased global commitment and appetite for investment in renewables and the declining costs of renewable energy technologies. The creation of a stable policy landscape for renewable investment is reaching a state where timing is critical, as the demand for electricity is predicted to grow by 80% by 2030. This chapter identified the importance of accelerated renewable energy adoption in Indonesia, and proposed reforms to remove the market, financial, and governance barriers to unlock green financing and promote mechanisms for market transparency. These include the need for a wholesale electricity market, low emissions and renewable investments policies, using a range of tradable certificate-based schemes (most important being carbon emission trading schemes), policy harmonization across ministries and agencies, and a reduction in electricity and fossil-fuel subsidies and cross-subsidies. These may inform projects that are assessed and funded using Indonesia's new sovereign green bond, which in turn may be used to de-risk further investment. Together, these measures can create a transparent and lower risk investment landscape.

References

Argyriou M (2017) Taking the long view. ClimateWorks Australia. https://climateworks.com.au/sites/default/files/documents/publications/cwa_long_view_issues_paper_0.pdf. Accessed 5 Jan 2018

Asia Pacific Economic Cooperation (2017) Energy efficiency finance in Indonesia: current state, barriers and next steps. APEC Energy Working Group. https://www.apec.org/Publications/2017/10/Energy-Efficiency-Finance-in-Indonesia-Current-State-Barriers-and-Potential-Next-Steps. Accessed 27 Dec 2017

Asian Development Bank (ADB) (2016) Indonesia energy sector assessment, strategy, and road map. Available at https://www.adb.org/sites/default/files/institutional-document/189713/ino-energy-asr.pdf. Accessed 19 Dec 2017

Bridle R, Gass P, Halimajaya A, Lontoh L, McCulloch N, Petrofsky E, Sanchez L (2018) Missing the 23 per cent target: roadblocks to the development of renewable energy in Indonesia. International Institute for Sustainable Development. https://www.iisd.org/sites/default/files/publications/roadblocks-indonesia-renewable-energy.pdf. Accessed 16 Aug 2018

Care International (2017) G20 and climate change: time to lead for a safer future. https://www.care-international.org/files/files/CARE_G20_report.pdf. Accessed 14 Aug 2018

Chung Y (2017) Overpaid and underutilized: how capacity payments could lock Indonesia into a high-cost electricity future. Institute for Energy Economics and Financial Analysis. http://ieefa.org/wp-content/uploads/2017/08/Overpaid-and-Underutilized_How-Capacity-Payments-to-Coal-Fired-Power-Plants-Could-Lock-Indonesia-into-a-High-Cost-Electricity-Future-_August2017.pdf. Accessed 14 Aug 2018

Clean Energy Council (2017) Clean energy Australia 2016 report. https://www.cleanenergycouncil.org.au/policy-advocacy/reports/clean-energy-australia-report.html. Accessed 19 Jan 2018

Clean Technology Fund (2015) Investment plan for Indonesia/East Asia and Pacific: revision note. https://www.climateinvestmentfunds.org/sites/default/files/meeting-documents/revised_indonesia_ip_1.pdf. Accessed 27 Oct 2017

Climate Analysis Indicator Tool (2017) Indonesia. World Resource Institute. http://cait.wri.org/indonesia. Accessed 27 Oct 2017

Climate Change Authority (2015) Special review second draft report: Australia's climate policy options. Commonwealth of Australia, Canberra

Climate Policy Initiative (2014) Indonesia launches new budget-tracking system to better target climate finance. https://climatepolicyinitiative.org/press-release/indonesia-launches-new-budget-tracking-system-better-target-climate-finance/. Accessed 27 Dec 2017

Climate Policy Initiative and Ministry of Finance (2014) The landscape of public climate finance in Indonesia. An Indonesian Ministry of Finance and CPI Report, Jakarta

Cornot-Gandolphe S (2017) Indonesia's electricity demand and the coal sector: export or meet domestic demand? Oxford Institute for Energy Studies, Oxford. https://www.oxfordenergy.org/wpcms/wp-content/uploads/2017/03/Indonesias-Electricity-Demand-and-the-Coal-Sector-Export-or-meet-domestic-demand-CL-5.pdf. Accessed 27 Dec 2017

Dutu R (2016) Challenges and policies in Indonesia's energy sector. Energy Policy 98:513–519

GlobalEdge Indonesia Risk Assessment (2018) https://globaledge.msu.edu/countries/indonesia/risk . Accessed 19 Aug 2018

Government of Indonesia (2014) Peraturan pemerintah Republik Indonesia Nomor 79 Tahun 2014, Tentang Kebijakan Energi Nasional. Available at http://peraturan.go.id/pp/nomor-79-tahun-2014.html. Accessed 13 Jan 2018

Government of Indonesia (2016) First nationally determined contribution, Republic of Indonesia. United Nations Framework Convention on Climate Change. http://www4.unfccc.int/ndcregistry/PublishedDocuments/Indonesia%20First/First%20NDC%20Indonesia_submitted%20to%20UNFCCC%20Set_November%20%202016.pdf. Accessed 26 Oct 2017

Government of Indonesia (2017) Regulation of financial services authority No.51/POJK.03/2017 on application of sustainable finance to Financial Services Institution, Issuer and Publicly Listed Companies. https://www.ifc.org/wps/wcm/connect/f73fb38f-d33a-4afc-a352-4cb685d3b986/Indonesia+OJK+Sustainable+Finance+Regulation_English.pdf?MOD=AJPERES. Accessed 19 Aug 2018

Government of Indonesia and Global Green Growth Institute (2013) Green growth program. Prioritizing investments: delivering green growth. October 2012

Horn M, Sidharta A (2017) New Indonesian feed-in tariffs: will renewables benefit? DLA Piper. https://www.dlapiper.com/en/newzealand/insights/publications/2017/03/new-indonesian-feed-in-tariffs/. Accessed 16 Aug 2018

International Climate Initiative (2017) Enabling project finance in Indonesia. https://www.international-climate-initiative.com/en/news/article/enabling_project_finance_in_indonesia/. Accessed 4 Jan 2018

International Energy Agency (2016a) Fossil fuel subsidy reform in Mexico and Indonesia. https://www.iea.org/publications/freepublications/publication/PartnerCountrySeriesFossil_Fuel_Subsidy_Reform_Mexico_Indonesia_2016_WEB.pdf. Accessed 11 Dec 2017

International Energy Agency (2016b) World energy outlook. https://www.iea.org/newsroom/news/2016/november/world-energy-outlook-2016.html. Accessed 27 Dec 2017

International Energy Agency (2017a) Key world energy statistics. https://www.iea.org/publications/freepublications/publication/KeyWorld2017.pdf. Accessed 27 Dec 2017
International Energy Agency (2017b) Energy efficiency 2017. http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf. Accessed 20 Dec 2017
International Energy Agency (2017c) South East Asia energy outlook 2017. https://www.iea.org/publications/freepublications/publication/WEO2017SpecialReport_SoutheastAsiaEnergyOutlook.pdf. Accessed 13 Jan 2018
IRENA (2016) Renewable energy outlook for ASEAN. International Renewable Energy Agency. http://www.irena.org/DocumentDownloads/Publications/IRENA_REmap_ASEAN_2016_report.pdf. Accessed 8 Jan 2018
IRENA (2017) Renewable energy prospects: Indonesia. International Renewable Energy Agency. Available at http://www.irena.org/publications/2017/Mar/Renewable-Energy-Prospects-Indonesia. Accessed 27 Dec 2017
Listiyorini E, Singgih V (2018) Indonesia to expand biofuel mandate to railways, power plants, Bloomberg. Available at https://www.bloomberg.com/news/articles/2018-08-01/indonesia-to-expand-biofuel-mandate-to-railways-power-plants. Accessed 14 Aug 2018
Maulidia M, Halimanjaya A (2014) The coordination of climate finance in Indonesia. ODI Centre for Policy Research, Jakarta
McKenzie B (2017) Indonesian government puts the squeeze on renewable energy tariffs. http://www.bakermckenzie.com/-/media/files/insight/publications/2017/02/indonesia-govt-renewable-energy-tariffs/al_indonesia_govtrenewableenergytariffs_feb2017.pdf?la=en. Accessed 19 Dec 2017
Ministry of Energy and Mineral Resources (2017). Decree number 1404 K/20/MEM/2017. http://jdih.esdm.go.id/peraturan/Kepmen-esdm-1404-Th2017.pdf. Accessed 20 Aug 2018
Ministry of Energy and Minerals of the Republic of Indonesia (2018) Power supply business plan (RUPTL) 2018 to 2027
Ministry of Finance (2015) Green planning and budgeting strategy for Indonesia's sustainable development, 2015–2020. Available at https://www.kemenkeu.go.id/sites/default/files/gpb-strategy.pdf. Accessed 2 Jan 2018
Ministry of Finance (n.d.) The role of MoF in climate financing. http://www.fiskal.kemenkeu.go.id/pkppim/en/site/index/role-of-mof-in-climate-financing. Accessed 2 Jan 2018
National Energy Council (2016) Indonesia energy outlook 2016. Secretariat General of National Energy Council. http://www.ea-energianalyse.dk/reports/1635_ieo_2016.pdf. Accessed 4 Jan 2018
PLN (2017) Annual report. http://www.pln.co.id/statics/uploads/2018/07/AR-PLN-2017-4Jun18.pdf. Accessed 19 Aug 2018.
PWC (2016) Power in Indonesia: investment and taxation guide. https://www.pwc.com/id/en/energy-utilities-mining/assets/power/power-guide-2016.pdf. Accessed 19 Dec 2017
Siagian UW, Dewi RG, Boer R, Handrawan I, Yuwono BB, Ginting GE (2015) Pathways to deep decarbonization in Indonesia. SDSN – IDDRI. http://deepdecarbonization.org/wp-content/uploads/2017/02/DDPP_AFOLU_ID.pdf. Accessed 11 Dec 2017
Sriyanto N (2017) Players in the energy management sector in Indonesia: roles and interests. In: Foreign policy and energy security issues in Indonesia. Springer, Singapore
Sugiawan Y, Managi S (2016) The environmental Kuznets curve in Indonesia: exploring the potential of renewable energy. Energy Policy 98(Issue C):187–198
Tänzler D, Maulidia M (2013) Status of climate finance in Indonesia: country assessment report. GIZ and Adelphi
Ucok WRS, Dewi RG, Boer R, Hendrawan I, Yuwono BB, Ginting GE (2015) Pathways to deep decarbonization in Indonesia. SDSN – IDDRI
UNDP (2018a) Development of greenhouse gas emissions profile from Indonesia's power sector. United Nations Development Programme (UNDP), Indonesia
UNDP (2018b). Indonesia tackles climate change through the issuance of Green Sukuk (Islamic Bond). 3rd April 2018. http://www.id.undp.org/content/indonesia/en/home/presscenter/

pressreleases/2018/4/indonesia-tackles-climate-change-through-the-issuance-of-green-s.html?cq_ck=1522745732024. Accessed 16 Aug 2018

UNEP (2015) Towards a sustainable financial system in Indonesia. The UNEP inquiry into the design of a sustainable financial system. http://documents.worldbank.org/curated/en/819461487145062821/pdf/112817-WP-Indonesia-Towards-a-Sustainable-Financial-System-PUBLIC.pdf. Accessed 2 Jan 2017

Volz U, Böhnke J, Eidt V, Knierim L, Richert K, Roeber GM (2015) The green transformation in Indonesia. In: Financing the green transformation. Palgrave Macmillan, London

Wijaya A, Chrysolite H, Mengpin G, Wibowo CK, Pradana A (2017) How can Indonesia achieve its climate change mitigation goal? An analysis of potential emissions reductions from energy and land-use policies. World Resources Institute. https://www.wri.org/publication/how-can-indonesia-achieve-its-climate-goal. Accessed 26 Oct 2017

World Bank (2009) New environmental analysis for a sustainable Indonesia. http://www.worldbank.org/en/news/press-release/2009/11/18/new-environmental-analysis-sustainable-indonesia. Accessed 7 Jan 2018

World Energy Council, Wyman O (2017) World energy trilemma index 2017. https://www.worldenergy.org/wpcontent/uploads/2017/11/Energy_Trilemma_Index_2017_Full_report_WEB2.pdf. Accessed 25 Oct 2017

Yoshino N, Taghizadeh-Hesary F (2015) Analysis of credit risk for small and medium-sized enterprises: evidence from Asia. Asian Dev Rev 32(2):18–37, MIT Press