

# 10. Indonesia: A Long Way to Low-Carbon Development



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Indonesia is the biggest energy consumer in Southeast Asia and the world's leading coal exporter. Its primary energy mix is dominated by oil and traditional biomass. Almost a third of its population lacks access to modern energy services. In recent years, Indonesia has made promising steps towards a more sustainable energy supply. It has almost completely abolished fossil fuel subsidies and has announced ambitious energy efficiency and renewable energy targets, particularly for geothermal energy. It also aims to reduce greenhouse gas emissions, and engages in related international initiatives. However, policy implementation remains a challenge.

With more than 250 million inhabitants, Indonesia is the fourth most populous nation worldwide. Abundant natural resources and a huge domestic market make the world's largest archipelago a regional economic heavyweight. Accounting for 36 percent of total energy demand in the region, Indonesia is by far the largest energy consumer in Southeast Asia (IEA, 2013). Since 2012, Indonesia has also been the world's top coal exporter. Despite significant potentials for renewables, fossil fuels dominate Indonesia's energy system. The central government has formulated incentives for renewables, encouraged private sector investments and improved energy efficiency, but the country struggles to tap its tremendous renewable energy potential. Political barriers, the abundant availability of coal and substantial subsidies for fossil fuels have long hindered Indonesia's low-carbon development. However, recent developments such as the passage of a comprehensive geothermal law and substantial cuts in fossil fuel subsidies represent promising steps towards more sustainable energy supply.

## **Energy sector dominated by oil, traditional biomass and coal**

Though severely hit by the Asian financial crisis at the end of the 20th century, Indonesia's economy has witnessed stable growth rates over the last 15 years. The

country has become the world's tenth-largest economy in terms of purchasing power parity and national income. Gross national income per capita has increased from USD 560 in 2000 to USD 3 630 in 2014 (World Bank, 2016). In parallel, demand for energy has outgrown domestic production, and Indonesia has become a net importer of oil and natural gas. Total primary energy consumption more than doubled between 2004 and 2014 (IEA, 2016) with energy demand growing by more than 8 percent annually over the past five years. CO<sub>2</sub> emissions have almost doubled between 2000 and 2011. Although Indonesia's average per capita electricity consumption (814 kWh) is still relatively low, energy demand is expected to increase substantially over the next decades (IEA, 2016). The International Energy Agency (2013) estimates that the Indonesian economy will grow by an average of 4.9 percent annually until 2035. The population is expected to grow by 0.9 percent per annum, reaching 301.5 million in 2035.

Indonesia's energy mix is dominated by fossil-based energy sources. For total primary energy supply, crude oil and oil products account for 33 percent, followed by biofuels and waste (26%), mainly due to the use of traditional biomass. Coal and natural gas cover 16 percent each. Geothermal (8%) and hydro (0.6%) play a minor role (IEA, 2016). Due to Indonesia's

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development and industrialisation, energy demand is expected to grow by 2.5 percent annually, reaching 358 million tonnes of oil equivalent (Mtoe) in 2035, compared to 196 Mtoe in 2011 (IEA, 2013). For 2050, total primary energy supply is expected to reach 1 000 Mtoe. Over that period, the share of renewables in the primary energy mix is even predicted to decrease, due to higher overall demand, electrification programmes and decreasing consumption of traditional biomass. The use of traditional biomass and waste for energy is particularly prevalent in remote areas. In 2013, 39 percent of the population (98 million people) relied on firewood, charcoal and other forms of biomass (IEA, 2015). Biomass and waste account for nearly 18 percent of total primary energy consumption (IEA, 2015).

Being one of the world's leading producers of palm oil, Indonesia launched a biofuel development programme in 2006 to reduce the country's dependence on oil imports and support the domestic agricultural sector. For public and private transport, Indonesia aims to replace 30 percent of total diesel consumption with biodiesel by 2025, while bioethanol should reach at least 20 percent in 2025 (Wright & Rahmanulloh, 2016). Although growing domestic demand powers palm oil-derived biodiesel production, the government is well behind its targets. Biofuels accounted for less than 2.4 percent of total energy consumption within the transport sector in 2014 (IEA, 2016).

In 2013, on-grid electricity consumption was approximately 198 TWh. Coal (48% of installed electricity generation capacity) together with oil (12%) and natural gas (22%) cover the largest shares, leaving 18 percent of installed capacity to renewables, comprising hydro (11%), waste heat (5%) and geothermal (2%). For off-grid areas, diesel generators remain the dominant technology, despite the increasing number of widely distributed solar home systems that are mainly provided by the Indonesian Government and international donor agencies. Electricity demand is expected to almost triple between 2011 and 2035, at an average annual growth rate of 4.8 percent. Although the share of renewables in electricity generation is expected to increase slightly, coal-fired generation and natural gas will still dominate the future electricity mix. Whereas coal is expected to increase five-fold between 2011 and 2035, additional capacities from renewables will be much more moderate (IEA, 2013).

Despite Indonesia's rapidly growing energy demand, energy resources remain an important sector for export revenues. In 2012, 20 percent of all merchandise exports came from oil and gas, accounting for 24 percent of total state revenues (EIA, 2015). In 2015, Indonesia exported about 366 million tons of coal, leaving only 87 million tons for the domestic market (Indonesia Investments, 2016). Indonesia has coal reserves totalling approximately 32 billion tonnes, but economically retrievable resources (7.3–8.3 billion tonnes) could be depleted between 2033 and 2036 at current prices (Jensen, 2016). Indonesia also remains the region's largest oil producer, at 890 000 barrels of oil per day (IEA, 2013), but oil imports have already surpassed exports in the former OPEC member state. Indonesia is Southeast Asia's biggest natural gas supplier and exports roughly 45 percent of its production (IEA, 2013).

High fuel subsidies are a major political concern and hinder the development of alternative energy sources. Subsidies accounted for 7–25 percent of annual public expenditure between 2005 and 2013. In 2012 alone, Indonesia spent USD 36.2 billion in fuel subsidies (EIA, 2015), equivalent to around 4.1 percent of annual GDP. At the same time, less than one percent of GDP was invested in infrastructure (Benes et al., 2015). State-owned companies such as Perusahaan Listrik Negara (responsible for electricity generation, distribution and transmission) and Pertamina (in charge of oil and natural gas) control most energy infrastructure but struggle to improve or expand the system. Private sector activities are highly restricted in these state-controlled markets (EIA, 2015).

Reform of fossil fuel subsidies has been on the political agenda since the 1990s. A massive price increase due to subsidy cuts immediately after the Asian financial crisis in 1998 triggered widespread civil unrest that forced former President Haji Mohamed Suharto to step down. Another substantial reform in 2005 was backed by awareness raising campaigns, social spending in infrastructure and education as well as direct payments to the poor, which proved successful in preventing unrest. In 2014, Indonesian President Joko Widodo decided to almost completely abolish fuel subsidies. Since 2015, only minimal subsidies remain on diesel for public transport and underprivileged fishermen (Roberts, 2015). The drop in global oil

prices minimised the impact of the subsidy cut for consumers. Gasoline prices in January 2015 were even slightly lower than the subsidised price. While cutting fuel subsidies, President Widodo aims to foster investment in infrastructure, education and public health. This strategy has so far prevented public resistance. Additional social protection programmes underline the new government's political will to improve social services (Benes et al., 2015). Political leadership, together with a budgetary crisis and the lowest world oil prices since 2009, provided a window of opportunity for the Indonesian Government to remove gasoline subsidies without encountering significant protests. For 2016, energy subsidies are estimated to account for less than USD four billion in the state budget. However, subsidies for electricity and certain petroleum fuels remain in place (ADB, 2015).

Indonesia's energy situation is also shaped by the country's geographical fragmentation. Centres for demand and supply are unevenly distributed across the archipelago. The island of Java accounts for more than half of the country's population and more than 60 percent of national GDP (BPS Indonesia, 2014). Consequently, in terms of energy demand, Java and Bali consume more than 80 percent of the country's electricity. Whereas electricity access on both islands exceeds 80 percent, it is less than 60 percent in provinces like Kalimantan and Sulawesi, and less than 30–40 percent in areas like Nusa Tenggara and Papua (Beranda Inovasi, 2013). While in 2013, about forty-nine million Indonesians (19 percent) still lived without access to modern energy services, the central government seeks to provide modern electricity access to 99 percent of the population by 2020 (IEA, 2013).

### **Clean energy development: ambitious plans but lack of implementation**

Despite Indonesia's abundant fossil-based resources, the government aims to diversify its energy portfolio and exploit new options for meeting growing energy demand and reducing dependency on diminishing oil, coal and natural gas reserves. According to Indonesia's National Energy Plan, "new and renewable energy sources" (which includes nuclear, hydrogen, coal bed methane, liquefied coal and gasified coal) should account for 23 percent of the country's energy mix by 2025. This would require these energy sources to grow more than eleven-fold, the use of gas to more

than double and coal to more than triple by 2025 (IEA, 2015).

Indonesia has significant potential for hydropower (76 GW), solar (4.8 kWh/m<sup>2</sup>/day), biomass (33 GW), and wind (3–6 m/s), and the country holds 40 percent of the world's geothermal reserves (28 GW) (Tharakan, 2015). In addition, supportive policies for biomass and waste (feed-in tariff, 2014), solar (auction programme, 2013) and geothermal (geographically based tariff, 2014) recently came into effect. Indonesia has already established substantial geothermal capacities, particularly after the oil crises of the 1970s, but most potential remains untapped due to social and political constraints. The passage of the 2014 Geothermal Law indicates an important step forward. The law streamlines the formerly fragmented authority of government institutions, facilitates licensing procedures and declassifies geothermal as "mining activity", thereby allowing for development of geothermal projects in protected forest areas. The adoption of this law demonstrates that progress for renewables is possible even in a highly decentralised political system with various competing actors, multiple administrative levels and numerous potential veto players, such as the Ministry of Forestry (World Bank & ADB, 2015). In 2010, a Directorate General of New and Renewable Energy and Energy Conservation was established under the Ministry of Energy and Mineral Resources, to streamline clean energy activities. Government-run investment programmes and private initiatives also contribute to renewable energy deployment. For 2016, at least USD 1.37 billion of renewable energy investment is expected (Mahapatra, 2016).

Numerous donor-driven and government-led renewable energy projects have failed to provide sustainable energy access for Indonesian off-grid areas, but a few successful projects show that cooperation with local partners, private sector involvement, demand-driven solutions, appropriate technologies and awareness among local financing institutions are key to sustainable small-scale renewable energy projects. As an example, donor agencies and private companies have successfully installed more than eleven thousand biogas reactors in nine Indonesian provinces under the Biogas Rumah programme. Farmers were able to implement small-scale biodigesters for electricity, and to substitute kerosene with the help of crediting schemes provided by local banks. Local organisations

are also responsible for maintaining the systems. Implemented by the German donor agency GIZ, the Energising Development initiative is a good example for necessary capacity building. Being part of a global energy access partnership for numerous countries in Africa, Asia and Latin America, the Energising Development Indonesia project supports micro-hydro-power and photovoltaic mini-grid installations that are community operated and administered. Rather than installing these systems, the initiative focuses on monitoring, troubleshooting and capacity building at different levels to improve ownership and establish systems that can be self-sustained without external support. Technical inspections, training for village management teams and a national hotline system are part of the service. As of 2016, Energising Development Indonesia has supported almost three hundred micro-hydropower and more than two hundred photovoltaic mini-grids under different government and non-government programmes.

Given the prospect of declining oil production in the near future, energy efficiency has also become an increasingly important strategic priority for Indonesia. The National Masterplan for Energy Conservation outlines the central government's aim to promote energy efficiency measures and reduce energy intensity by one percent per annum until 2025. The plan sets an energy conservation target of 15 percent for households and the commercial sector, 17 percent for industry and 20 percent for transportation, to be achieved by 2025 (DEN, 2016). Between 2010 and 2012, primary energy intensity has been reduced by five percent annually (IEA & World Bank, 2015).

Despite these ambitious targets for low-carbon development, a number of political and institutional factors have constrained progress. The country's highly decentralised political system, combined with limited local capacity, high levels of corruption and inter-ministerial tensions within the national government impede effective implementation of policies for promoting renewables (Ardiansyah, 2011). Local governments were given the right and responsibility to issue concessions and licenses for renewable energy, but they have very limited capacity for understanding the implications of various energy scenarios. Other obstacles are related to the perceived risks associated with renewable energy investments. Due to the comparatively high up-front costs and weak local capacity for

operation and maintenance, financing institutions consider renewables to be high-risk investments. Consequently, loan interest rates are high. Furthermore, the permit process can be lengthy and unpredictable due to corruption or lack of technical expertise. Additional barriers include land availability issues resulting from potential conflicts with agriculture (especially for hydropower projects) or protected forests (particularly for geothermal sites), and a lack of reliable data on the availability of renewable resources for implementing feasible projects (Marquardt, 2014).

### **High ambitions at the international level**

Providing affordable and reliable energy mainly through fossil fuels is a key priority of Indonesia's medium-term development plan. The country also encourages renewables and low-carbon development through international initiatives, but these efforts largely depend on international support and access to finance. Established with strong support from the International Energy Agency in 2016, the Bali Centre of Excellence for Clean Energy aims to attract international research collaboration for renewable energy and energy efficiency. International events such as the Bali Clean Energy Forum underline the government's commitment to maintain the topic high on the agenda. Indonesia is already a member of the International Renewable Energy Agency and joined the newly created Mission Innovation initiative during COP21 in Paris, to double investments in clean and sustainable energy. In 2015, Indonesia became one of the first associated members of the International Energy Agency. According to its Intended Nationally Determined Contribution, communicated to the United Nations Framework Convention on Climate Change, Indonesia seeks to reduce emissions by 41 percent below business-as-usual projections by 2030 with international support (Government of Indonesia, 2015). In other words, access to foreign assistance and investments is considered a precondition to achieve this target.

Bilateral energy partnerships such as the joint government-to-government cooperation between Indonesia and Denmark should foster knowledge exchange about renewable energy technologies and related policies and regulations (Danish Energy Agency, 2016). Indonesia also supports the ASEAN Plan of Action for Energy Cooperation. The plan aims to increase the

share of renewable energy to 23 percent by 2025 in the ASEAN energy mix, reduce energy intensity by 20 percent in 2020 based on 2005 levels, enhance awareness for renewables, foster research and development networks across the region and increase the commercial utilisation of biofuels (ASEAN Centre for Energy, 2015). Despite these broad visions and declared commitments, the Indonesian Government has yet to demonstrate how it intends to actually implement its ambitious plans.

Subnational authorities remain a critical barrier. However, Indonesia's decentralised political system also allows for local clean energy and climate activities: Jakarta is part of the C40 Cities Network steering committee; Cities such as Medan, Yogyakarta and Surabaya are members of Local Governments for Sustainability (ICLEI); Bogor and Balikpapan have become model cities under the international Urban Low Emissions Development Strategies programme due to energy efficiency principles and waste-to-energy projects.

### **Three promising lessons from Indonesia**

Considering the dominance of fossil-based energy in Indonesia's energy mix, the country cannot be described as a frontrunner in terms of sustainable energy deployment and low-carbon development. Nonetheless, Indonesia provides some promising impulses for a global energy transition towards renewables. In particular, three lessons can be drawn: Firstly, having the largest geothermal potential in the

world, Indonesia could become a global hub for geothermal energy development. Although regulatory obstacles previously prevented stronger exploitation over decades, the 2014 Geothermal Law provides a strong signal of the national government's political will and ability to act in favour of renewables despite a highly complex political system (World Bank & ADB, 2015). Secondly, the national Biogas Rumah programme and its support from various donor organisations has demonstrated that small-scale renewable energy projects for off-grid areas can be sustained successfully at the local level. Technologies adapted to farmers' needs, capacity building for local maintenance and appropriate financing schemes provided by local banks were critical factors for the successful dissemination of small-scale biodigesters. Rather than simply distributing the systems to selected households, the programme created ownership of the facilities and established a niche for local business models that can be sustained beyond the donors' intervention. Identifying these niches is critical for renewable energy projects in developing countries around the world. Finally, Indonesia managed to cut its fossil fuels subsidies despite increasing energy demand and a strong dependency on oil and gas. In 2014, the global oil price drop was instrumental in this step, as the government could remove subsidies without significant impacts on consumer prices. Investments can now be reallocated to energy infrastructure investments and social services, but it remains to be seen how effective and well accepted these reforms will be in the light of increasing fuel prices on the global oil market.

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