

Section 16

Case study – Indonesia

As an archipelago, Indonesia is unlikely to be completely electrified through the main grid. There is therefore the potential for mini-grids to support Indonesians in otherwise hard-to-reach regions. The authors identified 1,061 installed mini-grids in the country. If the private sector is to be involved in further installations, cooperation with the government and the state-owned utility, *Perusahaan Listrik Negara* (PLN) is vital.

16.1 Overview

Indonesia includes more than 17,500 islands, of which around 1,000 are inhabited (NREL, 2016). Over 98 percent of Indonesians had access to electricity at the end of 2018. The rural access rate of 96 percent equates to approximately 4.5 million people without access to electricity in these areas. Generally, islands in the eastern region tend to have lower electricity access rates (ADB, 2016).

Grid extensions are often not feasible in island nations. Rural Indonesians rely almost exclusively on tens of thousands of diesel generators serving villages or hamlets. As of 2013, the state-owned utility PLN operated some 3.1GW of diesel generators and 600 mini-grids (BloombergNEF, 2018). In 2018 alone, the country imported over 23,000 diesel generators. This suggests a huge potential for substituting diesel with renewables.

Indonesia has installed a total of 1,061 mini-grids, mostly led by the national government with support from international donor agencies (Figure 132, Figure 133). Although not reflected in the database, a further 655 mini-grids have been installed by provincial governments. Thanks to their efforts, electricity access has improved steadily in the last several years. However, participating in the mini-grid market is quite difficult for private entities, particularly non-Indonesian companies. Despite the PLN not having exclusive powers over the transmission, distribution and sale of electricity, it still dominates

Figure 132

Indonesia’s installed mini-grids, by project

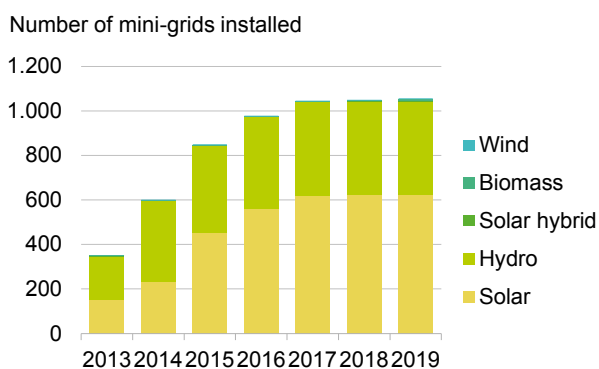
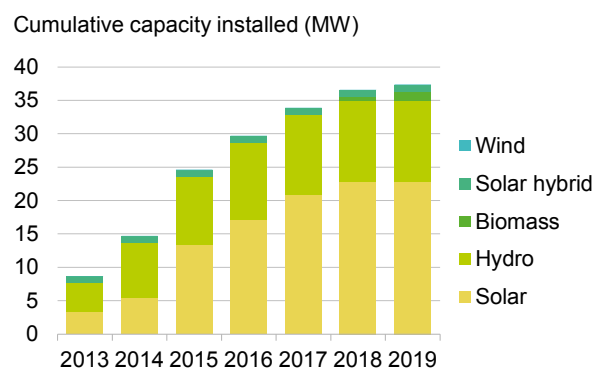


Figure 133

Indonesia’s installed mini-grids, by capacity



Source: BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers. **Note:** Operating projects without a specified commissioning year are not included.

the power market, making it difficult for other entities to obtain business licences. Limits on foreign ownership of businesses operating in the country presents an additional barrier.

16.2 Distributed power market structure

The PLN dominates the power market in Indonesia, covering generation, transmission and retailing. However, it does not cover all areas of the island nation; remote islands, and some concentrated industrial areas in particular, leave some room for other entities to participate in the distributed power market.

Independent Power Producers (IPPs) holding generation licences may build plants up to 50MW and sell power directly to consumers in non-PLN service areas. They may also build mini-grids and sell electricity to the PLN in its service areas, which requires negotiation and close cooperation with the utility.

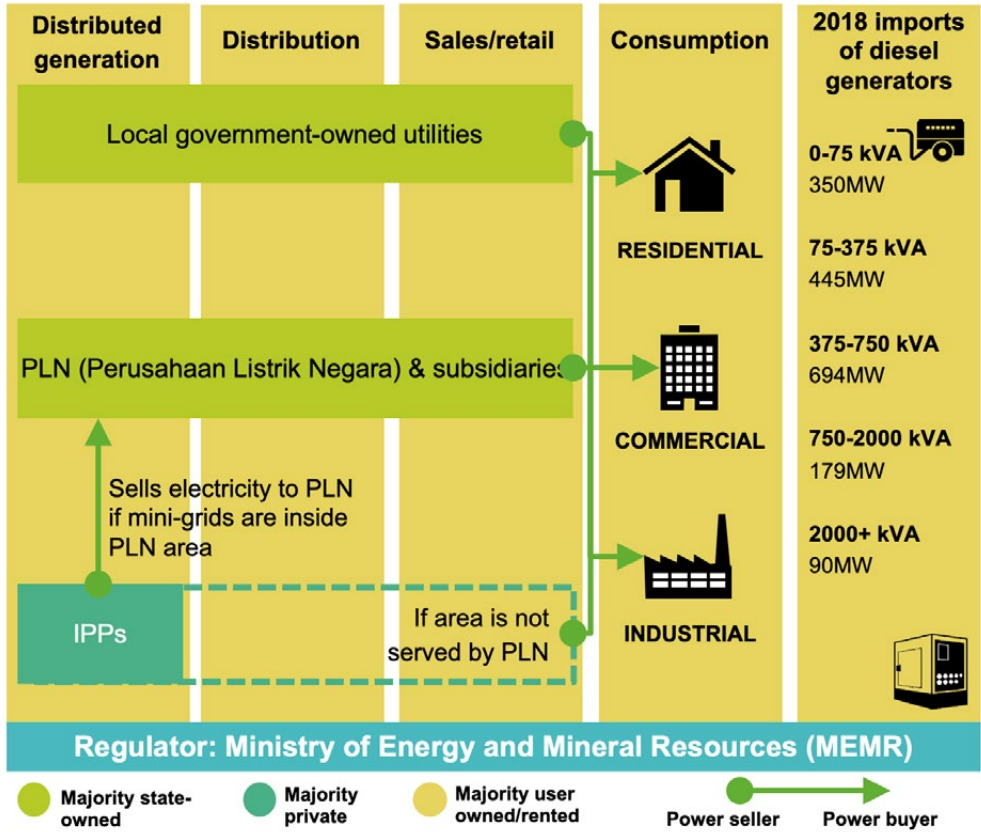
The Ministry of Energy and Mineral Resources (*Kementerian Energi dan Sumber Daya Mineral Republik*, or ESDM) oversees the energy sector. The Directorate General of Electricity creates the national electrification plan, issues generation licences to IPPs and approves tariffs in cooperation with the PLN. The Directorate General of New, Renewable Energy and Energy Conservation (EBTKE) is in charge of planning, regulations and of the mini-grid programme (IRENA, 2018).

15.3 Current market status

The authors identified a total of 1,061 mini-grids installed in Indonesia, including almost 630 solar or solar hybrid, some 422 hydro, and a handful of biomass and wind-based systems. The total generation capacity is 38MW (Figure 135). Since the 1990s, a large number of hydro mini-grids have been developed with support from the government and in-

Figure 134

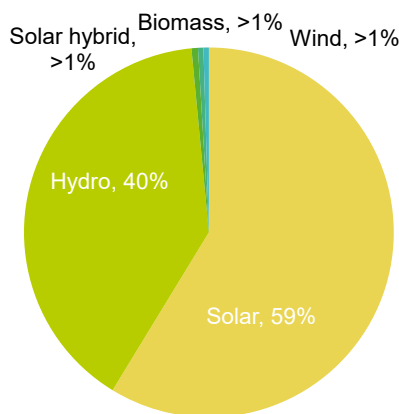
Indonesia’s distributed power market structure



Source: BloombergNEF.

Figure 135

Indonesia's installed mini-grids, by technology



Source: BloombergNEF, GIZ, Carbon Trust, CLUB-ER, surveyed developers.

ternational agencies. GIZ, for example, supported NGOs and local turbine manufacturers to deploy micro-hydro projects.

Most projects were built with direct and indirect technical support from the Energising Development (EnDev) programme, which has promoted access to affordable and sustainable energy since 2005. As many as 72 projects were installed by IBEKA, an Indonesia-based social enterprise that builds mini-

grids for off-grid communities. Various government ministries such as the Ministry of Cooperatives and SMEs and the Ministry of Villages, Development of Disadvantaged Regions and Transmigration, and local governments financed construction of these projects.

Mini-grids are usually handed over to local governments after installation, but three types of entities continue to operate and maintain the mini-grids: co-operatives, village-owned enterprises and communities. The co-operative ownership model used to be common, but the national government is now more supportive of the village-owned enterprise model.

There are very few private entities in the mini-grid sector in Indonesia (Figure 136). Private-sector participation has been in engineering, procurement and construction (EPC). One active developer is Clean Power Indonesia, which has developed biomass mini-grids that use bamboo and other forest-based biomass as feedstock in rural communities in the PLN service areas. Singapore-based developer Canopy Power has not completed any mini-grids for rural electrification but has installed three mini-grids for private resort islands since September 2019. The company not only sells mini-grids but offers *energy-as-a-service* to customers.

Figure 136

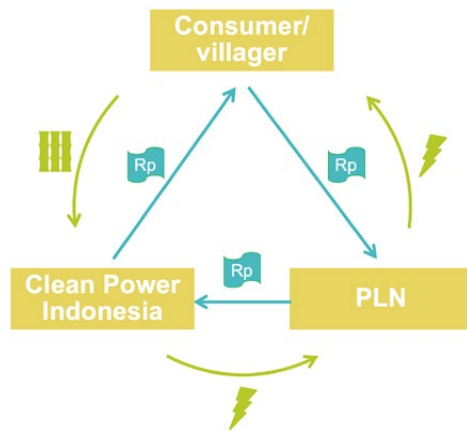
Mini-grid developer landscape in Indonesia



Source: Organizations, BloombergNEF.

Figure 137

Business model of Clean Power Indonesia



Source: BloombergNEF. Adapted from Alliance for Rural Electrification (ARE), 2019.

From 2015 through 2017, corporate interest in the Indonesian mini-grid market appeared to be growing. In 2015, Caterpillar and Fluidic Energy signed an agreement with the PLN to develop 500 mini-grids serving 325,000 households. In 2017, Electric Vine Industries (EVI) and ENGIE announced a commitment to install mini-grids in 3,000 villages in Papua province (EQ International, 2017). In the same year, General Electric and the Ministry of Villages, Disadvantaged Region

Development and Transmigration signed a memorandum of understanding to electrify 13,000 remote villages through various approaches (GE, 2017).

Since then, there have been relatively few updates on these initiatives, suggesting that the market has been more challenging than some developers had initially anticipated.

16.4 Policy and regulations

Indonesian law allows only one entity to distribute and sell electricity in any area. The PLN has the right of first refusal before the government may offer the opportunity to other entities. Permits can be granted if the area is not already covered by an Electricity Supply Business permit holder or if a permit holder is not able to provide reliable electricity access.

To obtain the rights to a business area, IPPs need to make a request to the Ministry of Energy and Mineral Resources (ESDM) through the Directorate General of Electricity (DGE). The application must be supported by an analysis of the electricity needs and business plans for the requested business area

Box 15

Private sector collaboration with PLN & local communities

Clean Power Indonesia has a 700kW biomass mini-grid to provide electricity to 1,250 homes in three villages in Mentawai, Indonesia. Ankur Scientific, the technology provider, has signed an agreement with the PLN and is responsible for the maintenance of the 6x100kW and 2x50kW biomass gasifiers, supported by the local villagers. The PLN owns the mini-grid, and has signed a 20-year power purchase agreement (PPA) with Clean Power Indonesia to procure all electricity generated at a rate of USD 0.15/kWh and charge consumers at the National Electricity Rate of approximately USD 0.03/kWh. Bamboo is purchased from villagers as the main feedstock under a 20-year supply agreement for a linked price equal to 20 percent of the PLN electricity tariff paid to the project.

The project's total capital investment is USD 12.5 million, and operating expenses (including feedstock) are USD 0.12/kWh. As much as 96 percent of the investment was funded by a grant from the US Millennium Challenge Corporation, with the remaining investment coming from Clean Power Indonesia and its local government partner.

By including the PLN in the business model (Figure 137), the project developers are protected against the risk of grid arrival and can maintain financial sustainability with a tariff that is affordable for consumers (Alliance for Rural Electrification 2019).

and a recommendation from the governor or other official from the provincial government. The DGE will assign a technical team to assess the feasibility of the request to determine whether the requested permit in the business area will be granted.

Organizations the authors spoke with highlighted the fact that the licensing procedure is complicated. To date, no non-PLN entity has obtained a licence to sell electricity to end-users in a PLN business area.

Outside the PLN areas

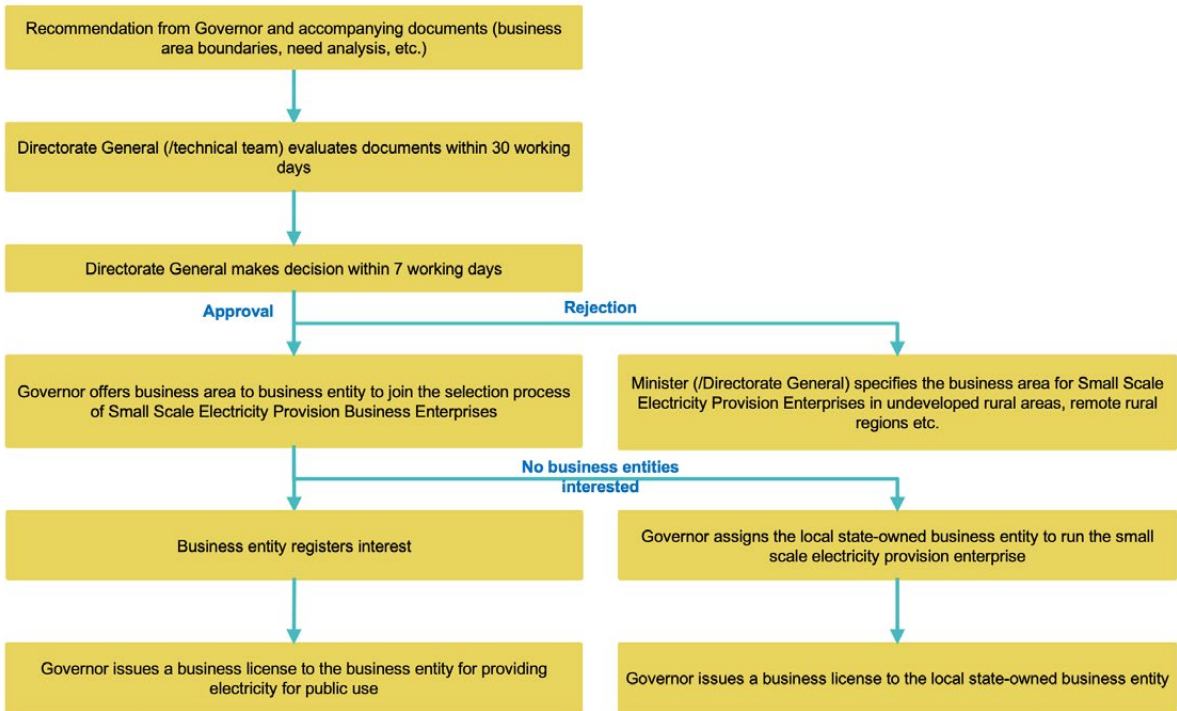
In 2016, the ESDM issued a regulation that sought to accelerate electrification in rural areas (Minister of Energy and Mineral Resources, 2016). The minister determines a business area, consisting of multiple villages not served by the PLN. Developers can apply to serve the area. If successful, they may generate up to 50MW and sell electricity directly. If no private companies register an interest in serving the business area defined by the local government, then the local state-owned business is assigned to run the service (Figure 138).

Foreign company ownership

The Indonesian government limits foreign ownership of businesses that build or operate generation plants of any size (Table 28). Power plants up to 1MW in size must be owned by domestic investors while power plants 1–10MW are open to foreign investment of up to 49 percent. Projects larger than 10MW may have foreign investment of up to 95 percent (or 100 percent under a public-private partnership arrangement). This bars any direct foreign ownership in mini-grids, which would typically have a capacity of less than 1MW.

There are also local content requirements that may further deter investors, even though it is unclear how the share of locally-manufactured content is measured or how effectively this will stop developers from importing foreign materials. The regulations are especially unclear for hybrid-generation projects such as solar-diesel, as there are different local content requirements for each generation source.

Figure 138
Indonesia’s business licence application procedure



Source: The Ministry of Energy and Mineral Resources, 2016.

Table 28

Foreign company ownership allowed in the Indonesian power sector

Asset	Ownership rules
Power plant (<1MW)	Domestic ownership only
Small-scale power plant (1-10MW)	Maximum 49% foreign ownership
Power plant (>10MW)	Maximum 95% foreign ownership (100% for public-private partnerships during concession period)
Power transmission	Maximum 95% foreign ownership (100% for public-private partnerships during concession period)
Power distribution	Maximum 95% foreign ownership (100% for public-private partnerships during concession period)
Electric power installation operation and maintenance	Maximum 95% foreign ownership

Source: BloombergNEF, PR No. 44/2016.

Mini-grid tariffs

Grid connected mini-grids

In PLN areas, developers are required to charge a regulated tariff. For developers receiving a subsidy from the national government, the PLN’s subsidized tariff of USD 0.03/kWh must be charged to residential consumers and a subsidy (that considers operational expenditure, losses, generation cost and expansion plans) is provided. If developers don’t receive a subsidy, the minister or governor decides the tariff. However, it is unlikely that rural consumers would be willing or able to pay a cost-reflective tariff.

Off-grid mini-grids

Where the PLN is not present, tariffs are unregulated. The most common tariff structure is a flat rate, the level of which is agreed between the villagers and developer, typically ranging from IDR 10,000–55,000 (USD 0.73–3.91) per kWh. This wide range likely reflects the operation and maintenance, and transmission and distribution costs associated with complex geographies on remote islands. This might include the cost of transporting equipment to these remote locations that can take several weeks.

Arrival of the main grid

The PLN is obliged to purchase electricity generated from an IPP’s mini-grid if the main grid arrives at the site, through a 20-year PPA. The PLN must purchase power in Indonesian rupiah, and can pay in US dollars only if an exemption is obtained from Bank Indonesia (Allen & Overy, 2017). The mini-grid is transferred to the PLN once the 20-year term is over.

The PLN is required to purchase electricity from renewable energy power plants of less than 10MW, which include renewable mini-grids. The tariff is set under two different scenarios:

- 85 percent of the regional cost of electricity generation if the regional cost of power exceeds the national average
- A negotiated rate if the regional cost is equal to or less than the national average.

As of 2018, there were no solar, solar hybrid or wind mini-grids connected to the main grid. However, there have been a number of outcomes since the main grid arrived at the 199 hydro-based mini-grids (Table 29).

Table 29**Outcomes of mini-grids in Indonesia upon arrival of the main grid**

Outcome	Reason(s)	Number of projects
Mini-grid abandoned	Tariff higher than that of PLN Poor management of the system	140
Mini-grid operating in parallel to the main grid	Tariff cheaper than that of PLN Better quality service	50
All electricity sold to PLN		5
Excess electricity sold to PLN		4

Source: BloombergNEF, World Bank. **Note:** Green highlights favourable outcome.

Only nine (5 percent) of the 199 mini-grids were connected to the main grid successfully. Prior to May 2017, government-funded infrastructure could not generate private income. In addition to this, the feed-in tariffs were deemed too low in some cases.