WHITE PAPER

Leader Associates

Renewable Energy Market in Indonesia

Solar Energy
Wind Energy
Microgrid

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Contact details – Leader Associates team

Leader Associates

Molly Huang

Project Producer

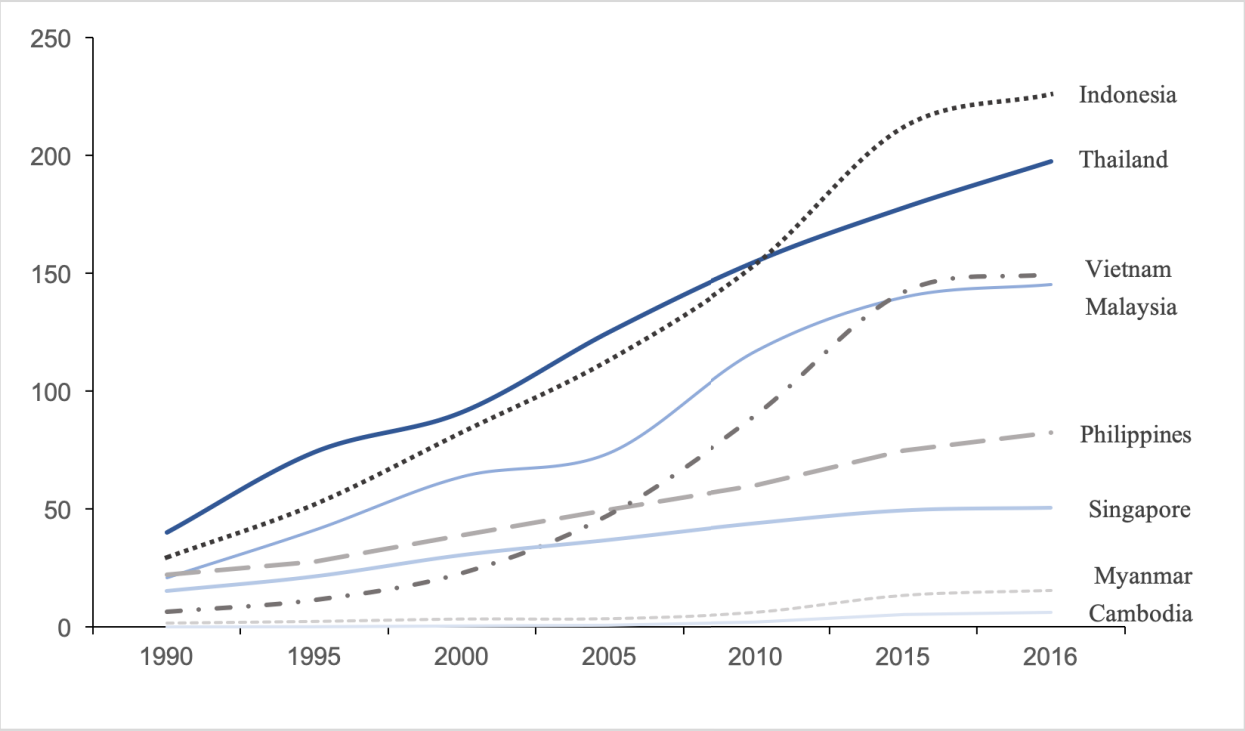
molly@leader–associates.com

+ 86 156 0177 4853

1. Overviews

Renewable energy markets in Southeast Asia have been attracting international investors in recent years. That is because Southeast Asia is in a boom era, so there will be a massive demand for electricity in the future. Because of its unique geographical environment, Southeast Asia has abundant solar power and wind energy resources. Thus, the development of renewable energy will be an essential approach to fill the power gap. Indonesia, in particular, is the world's fourth most populous country, with a population of 267.66 million in 2018. Besides, Indonesian total electricity consumption in 2017 was 235TWh, far higher than Thailand's 198TWh, which ranked second. According to a forecast of IEA, total electricity consumption in Southeast Asia will be double by 2040, with a compound growth rate of 4%, which is twice as fast as in the rest of the world [2]. Furthermore, according to the 2019 RUPTL, the annual growth rate of power consumption in Indonesia is about 6.4% from 2019 to 2028 [3]. It will also mean that renewable energy has great potential in Southeast Asian countries.

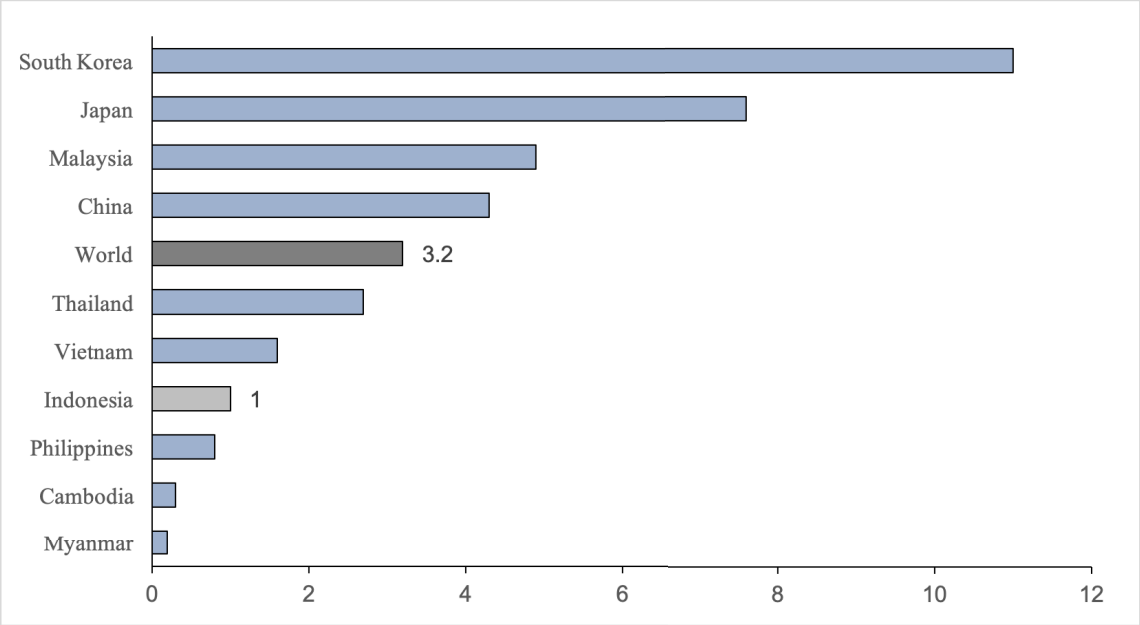
Figure 1: Total electricity consumption by country in Southeast Asia, 1995–2016 (TWh)



Source: IEA [1]

Although total electricity consumption in Indonesia is most in the ASEAN, its annual electricity consumption per capita is far below the world average. The average yearly per capita consumption of electricity in Indonesia (1MWh) was only about 31% of the world's standard (3.2MWh) in 2017. Moreover, annual electricity consumption per capita in Malaysia and Thailand is much higher than that in Indonesia, at 4.9 and 2.7MWh per year, respectively. Additionally, Vietnam's per capita electricity consumption is slightly higher at 1.6MWh per year. Per capita electricity consumption only in the Philippines, Cambodia, and Myanmar are lower than in Indonesia. That means there is still plenty of room for growth in the Indonesian electricity market.

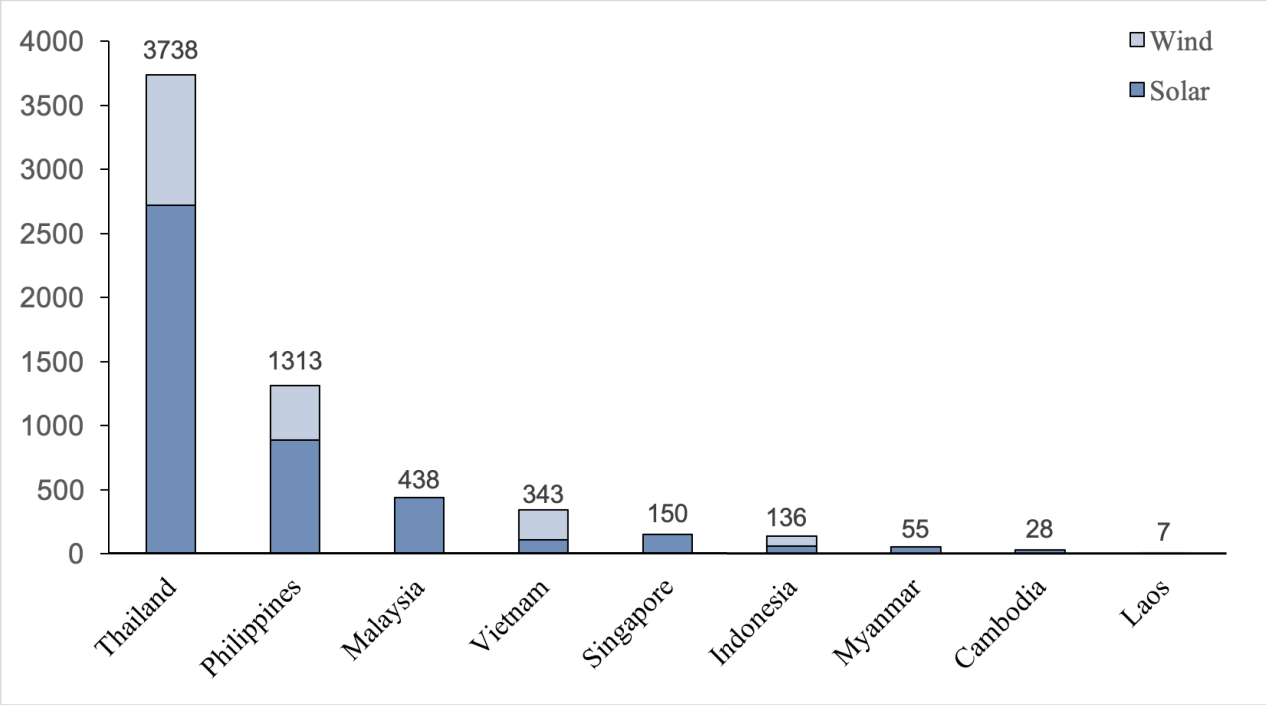
Figure 1. Lithium-ion battery price in history and forest via BNEF [3]



Source: CEEW [4]

However, the development of renewable energy in Indonesia has stalled in recent years, especially wind and solar PV power. By the end of 2018, cumulative installed solar and wind capacity in Indonesia just reached 136MW, which is at a relatively low level compared with other Southeast Asian countries. It is a recognized fact that 2019 was the year of Vietnam's renewable energy explosion, with a new solar installed capacity of about 5GW. Besides, Thailand also has installed 3788MW of wind and solar power by the end of 2018. The Philippines, which is similar to Indonesia, has deployed 1313MW of total capacity for wind and solar energy. The stagnation of Indonesia's renewable energy growth is due to many factors, but the government will release a series of favorable policies for renewables. Therefore, the renewable energy market in Indonesia will maybe usher in explosive development in 2020.

Figure 3: Cumulative Installed Solar and Wind Capacity in ASEAN by the end of 2018 (MW)



Source: IRENA [5]

This paper mainly focuses on Indonesian solar PV power, wind energy, and small hydropower. Firstly, this report will talk about the reasons for the slow development of the renewable energy market in Indonesia in the past few years. Then the status of the country's renewable energy will be further discussed. Afterward, this paper will share deep insights into policies and future outlook on renewable energy. Last but not least, this report will provide an investment recommendation for the current situation of Indonesian renewables.

2. The reasons for the stagnation of renewable energy growth in Indonesia

Indonesia has introduced the FiT scheme in 2011 and ended it in 2017. However, Indonesia only deployed 42MW of solar capacity and 0kW of wind capacity during this period. Undoubtedly, the Indonesian government has utterly failed to develop renewable energy through the FiT program. The Philippines, which is similar to Indonesia in many ways, has introduced the FiT scheme in 2012. During 2012 and 2017, the Philippines has installed 885MW of solar capacity and 383MW of wind capacity. There are several reasons why these two countries have a significant difference in expanding renewable energy [6].

Firstly, Indonesia has copious coal and natural gas reserves, and it is also a net exporter of coal. Hence, this country relies heavily on fossil fuels to generate electricity. In 2017, 87.3% of total power came from fossil fuels, with coal accounting for 58% and natural gas accounting for 21.7%. Because of abundant reserves of fossil fuels and lower price of coal in PLN (Perusahaan Listrik Negara), fossil fuel companies have entrenched interests in trying to halt the growth of renewable energy and maintain their market share.

The second factor is that the state-owned utility company PLN has a monopoly on energy transmission and distribution in Indonesia. PLN operates 68.7% of the total installed capacity for power stations in 2018, with a capacity of 43.2GW. Besides, PLN is not only paying IPP (Independent power producer) for obtaining electricity from renewable energy sources, and it is also competing with them for overall market share. That is because IPPs do not have permission to sell electricity to private consumers, and they need to sell it to PLN first. Therefore, there is a reason to doubt that PLN is willing to develop Indonesian renewable energy through the FiT scheme.

Figure 3: Cumulative Installed Solar and Wind Capacity in ASEAN by the end of 2018 (MW)

	PLN	IPPs	PPUs	IO Non-BBM	Total
Installed capacity (GW)	43.2	14.9	2.4	2.4	62.9
Share of installed capacity	68.7%	23.7%	3.8%	3.8%	100.0%

Note: 1. IPP-Independent power producer
2. PPUs-Private power utilities
3. IO Non-BBM-Holders of non-fossil fuel operating licenses

Source: CEEW [4]

To provide cheap electricity to the citizen, the Indonesian government stipulates PLN to bear the costs of electricity generation and transmission. Additionally, the retail price of electricity is also set by the government rather than by the market. Therefore, these political considerations have limited PLN's ability to raise revenue, and it has had to seek cuts elsewhere. On the other hand, Indonesia has subsidies for coal power generation, with the financial support of USD 2.3 billion in 2016, and the trend is increasing year by year [7]. As a result, the LCOE of coal in Indonesia is much lower than the LCOE of renewable energy, such as solar power and wind energy. Accordingly, for the Indonesian state-owned power and mining companies, maintaining the status quo—and the supremacy of fossil fuels and the rents derived therefrom—may be the preferred objective.

Furthermore, since the government replaced the FiT scheme with the BPP (local average generation cost) program in 2017, the price of solar and wind power has been capped at 85% of the local BPP. This price makes renewable energy completely uncompetitive in Indonesia. As a result, no new PPAs have been signed since the program came into force. That is because the majority of developers do not see the price as attractive for them to recoup their investment and make a reasonable profit. Developers are also concerned that the new pricing system does not provide any recognition of the environmental benefits of renewable energy, in which the program favors fossil fuels indeed [8].

The last reason is financing problems. Indonesia needs about USD 154 billion of investment to realize its target of 23% renewable energy by 2025. Nevertheless, the state cannot offer a tremendous amount of money, which means private financing is necessary. However, regulatory uncertainty and conflicting policies make potential investors and lenders reluctant to involve in the Indonesian renewable energy market [9].

For the reasons mentioned above, the Indonesian renewable energy development is stagnant for many years. Thus, aligning the interests of all stakeholders is the key to developing renewable energy, which also means anyone embraces renewable energy. Moreover, Indonesia needs a reform of the energy market to break down the current barriers and give renewable energy a new lease of life.

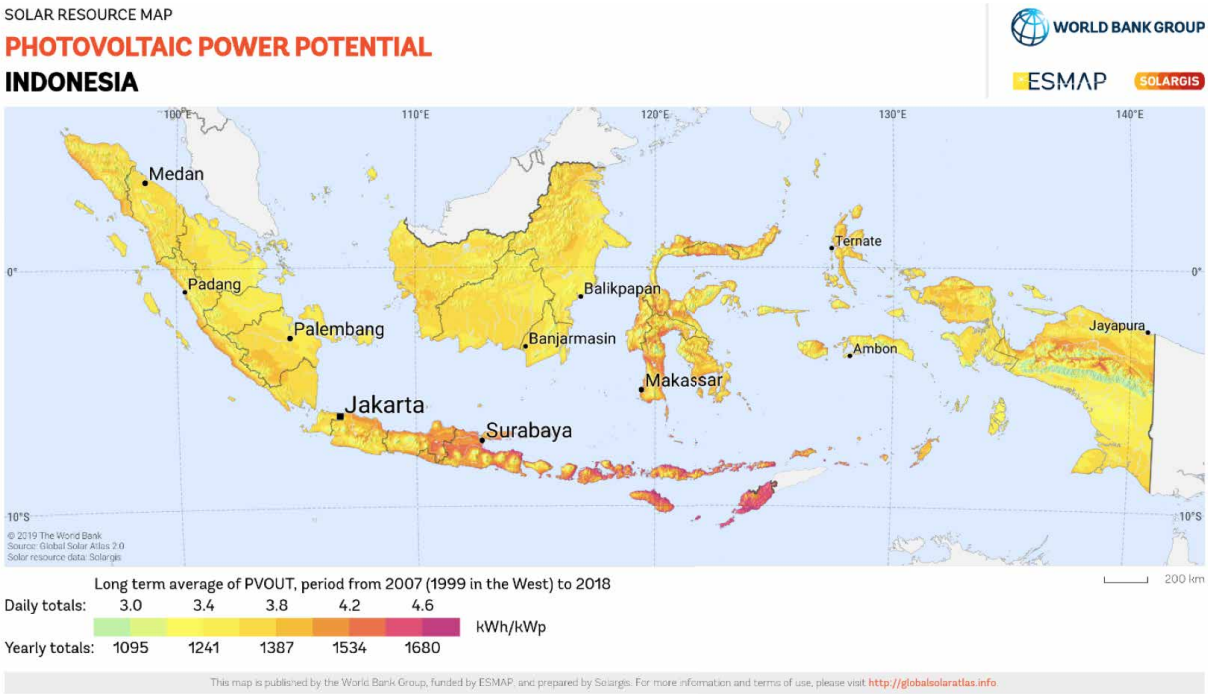
3. Current Renewable Energy Landscape and Challenges

3.1. Tepigraphy and Climate

Indonesia is a populous country with a unique geographic location: it includes more than 17500 islands, of which 6000 islands are inhabited, and 1000 islands are permanently settled. The geographical features of Indonesia are scattered, mountainous, and seismically active, which are obstacles to developing a cost–effective grid–connected power system. Therefore, a distributed energy system is the best approach to increase electrification rates and give islanders access to reliable and cheap electricity.

On average, areas with high solar radiation intensity are in southern Indonesia, while regions with low to moderate solar radiation intensity are in western Indo–nesia. The minimum photovoltaic power potential is 4.2 kWh/m2 per day, and the maximum is 7.2 kWh/m2 per day. The truth of the matter is that solar power is the most promising compared to other renewable energy sources in Indonesia, with a technical potential of 500GW.

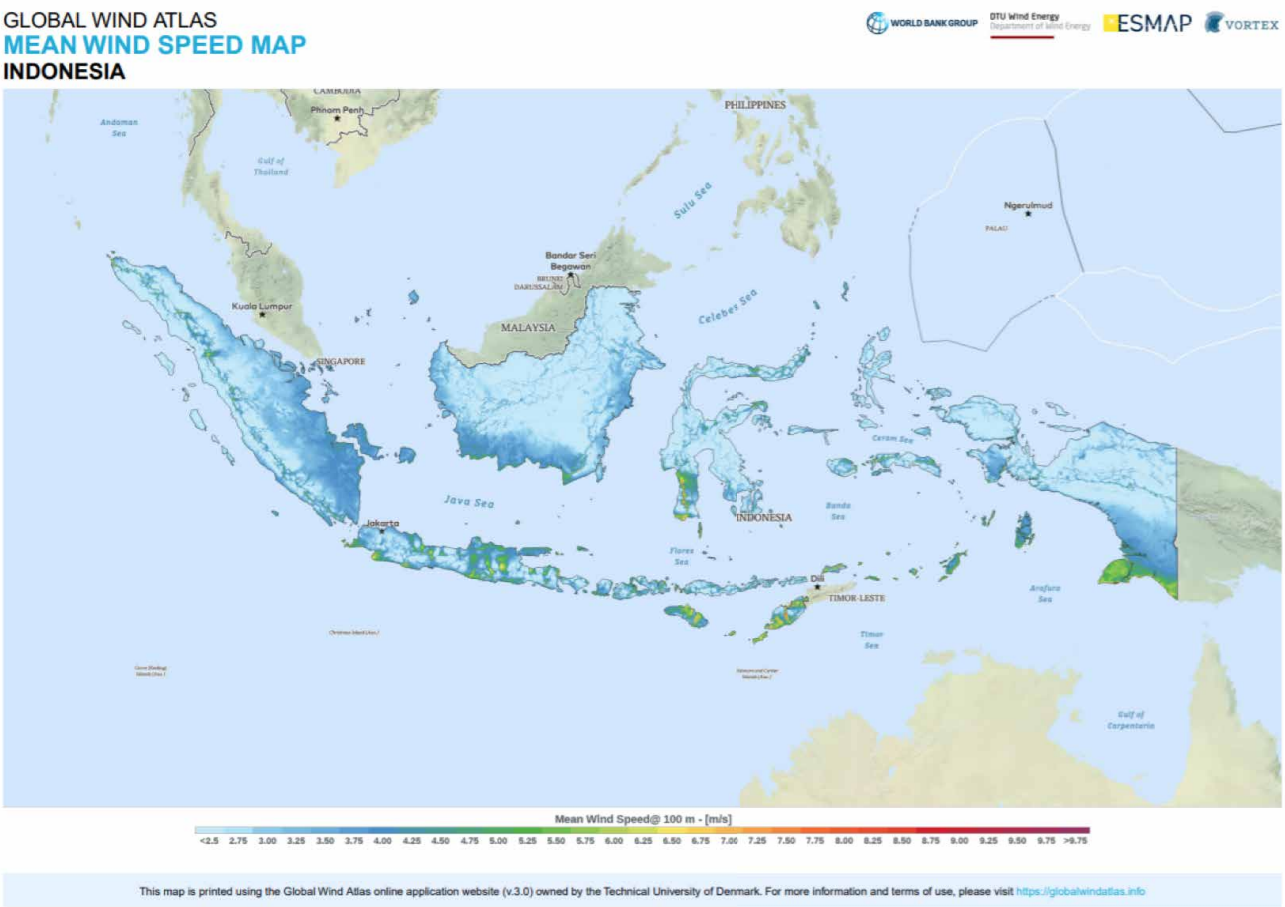
Figure 4: Photovoltaic Power Potential in Indonesia



Source: SOLARGIS [10]

Although Indonesia is an archipelagic country, its characteristic of wind speed is typically slower, with speeds ranging from 3m/s to 6m/s. The main wind energy potential areas are located in East and West Nusa Tenggara (the eastern and western portion of the Lesser Sunda Islands, central south and east south of Indonesia), which have average wind speeds of more than 5 m /s. Besides, the technical potential for wind power in Indonesia is much less than that for solar energy, with a total capacity of 9.5GW [11].

Figure 5: Mean Wind Speed in Indonesia

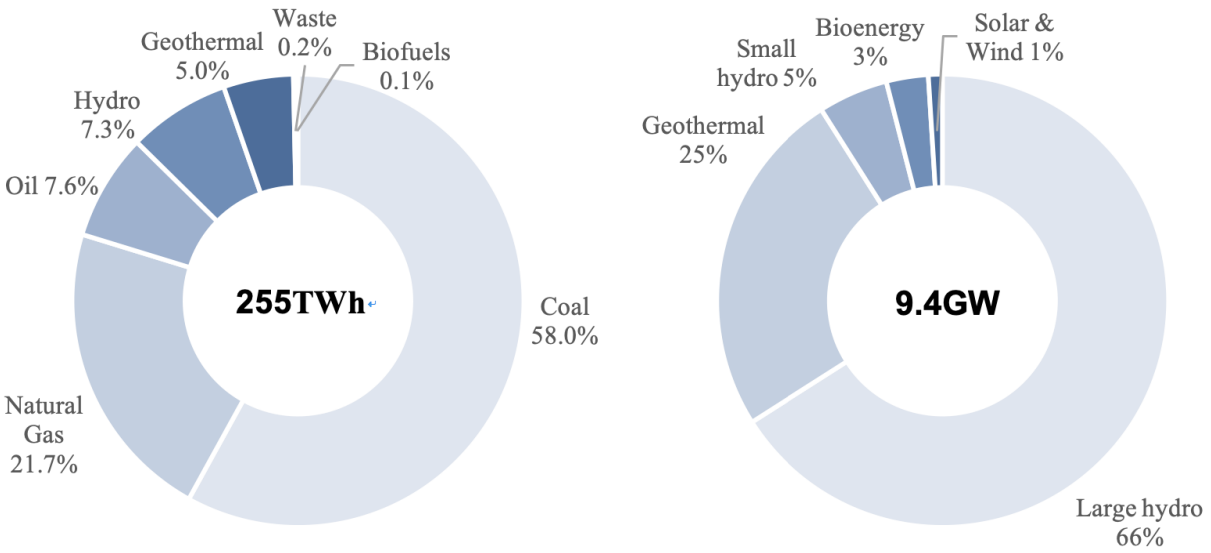


Source: World Bank Group [12]

3.2 Electricity Generation Mix

By the end of 2017, the total electricity generation in Indonesia was 255TWh. It is not difficult to find that coal and natural gas are the most significant ways of power generation in Indonesia, accounting for 58% and 21.7% of total electricity production, respectively. In terms of renewable energy, Indonesia mainly relies on hydropower and geothermal, accounting for 7.3% and 5% of entire power generation, respectively. That is because the country has abundant hydroelectric resources and 40% of global geothermal resources, with a technical potential of 75GW for hydropower and about 28GW for geothermal energy. By the end of 2018, Indonesia has installed 9.4GW of renewable energy capacity. The large-scale hydropower is still absolutely dominant in the whole Indonesian renewable energy market, with a proportion of 66%. Then geothermal energy has a quarter of total renewables installed capacity, followed by small hydropower and bioenergy. Despite sufficient solar and wind resources in Indonesia, these two types of renewables only account for 1% of the total installed capacity of renewable energy.

Figure 6: Indonesian Electricity Generation in 2017 (Left) and Share of Renewable Energy (Right)

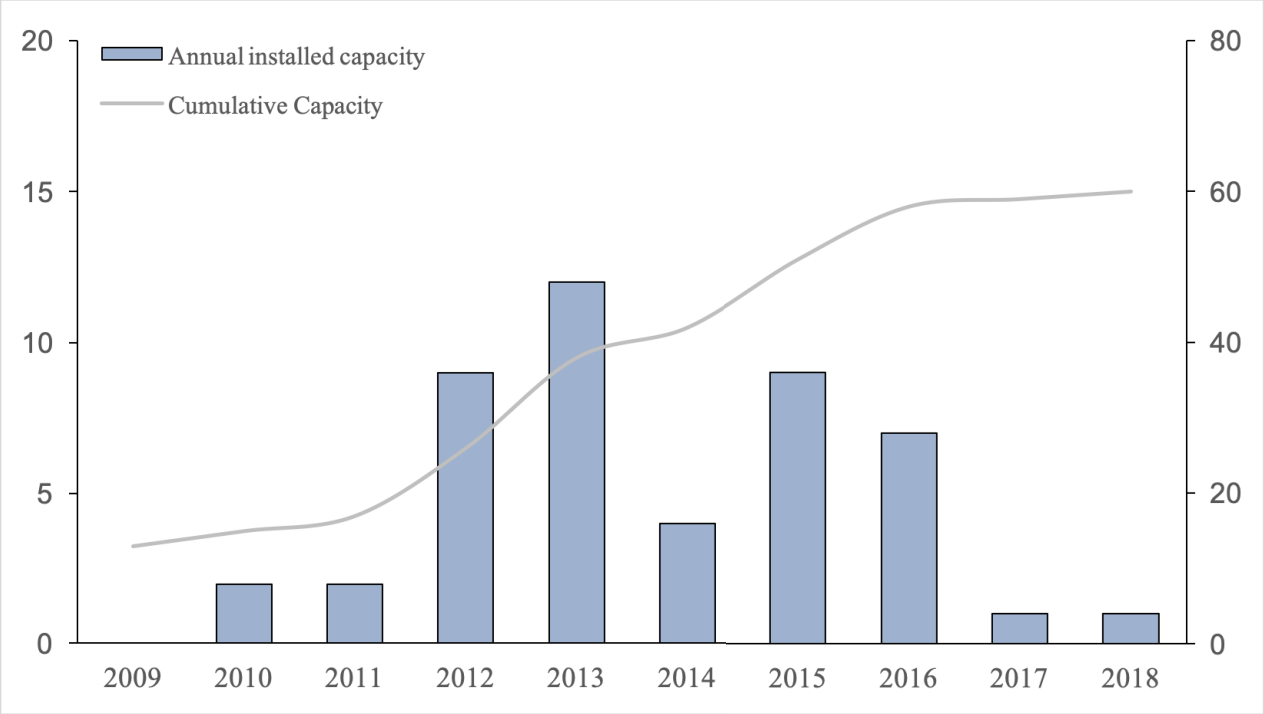


Source: IEA [1]

3.3 Solar Energy

By the end of 2018, cumulative installed solar PV capacity in Indonesia was only 60MW, in which about 80% of total capacity is dominated by isolated off-grid systems located in remote areas, and just 20% is connected to the grid. It is worth noting that the off-grid system is mostly funded by subsidies or grants from governments and donor agencies that have limited ability, so the capacity of solar projects is usually less than 1MWp. Also, photovoltaic grid-connected systems are often utility-scale solar farms, and some rooftop solar systems were installed in recent [14].

Figure 7: Annual Installed and Cumulative Solar PV Capacity in Indonesia (MW)



Source: IRENA [5]

3.3.1 Rooftop PV

In an IESR's (the Institute for Essential Service Reform) research about assessments of Indonesia's rooftop solar potential, the lowest estimate was that 194GW of rooftop capacity could be installed, which would generate almost 276TWh of solar power per year if these capacities were built. It will also mean that just rooftop PV could meet the entire demand for Indonesian electricity. In a more optimistic scenario, potential size could reach from 267GW to 462GW. Moreover, the most optimistic scenario is 655 GW, which would be equal to an astonishing 931TWh of electricity generation [15].

The government has realized the promising future of rooftop PV in several years ago. Hence, the Indonesian government established the One Million Rooftop Solar ((Gerakan Nasional Sejuta Surya Atap, GNSSA)) movement in 2017 for supporting the target of 23% renewable energy by 2025. The goal of this plan is to deploy a 1GW solar rooftop electricity capacity by 2020. However, two years after its launch, this program only has a limited effect. That is because of three reasons, which are licensing procedures, parallel charges for PV in the industrial segment, and net metering for household users [15].

Fortunately, the Indonesian government has adjusted the MEMR Regulation No. 49/2018 net metering legislation. Besides, the government also indicated MEMR Regulation No. 12/2019 had replaced the MEMR Regulation. 29/2012. These policy adjustments in Indonesian rooftop solar are not only exempting the operation license requirement for small power systems but also reducing the minimum operating hours of capacity charge for parallel operation [16]. Therefore, these changes may make the rooftop solar market to break the ice.

3.3.2 Floating PV

Indonesia has more than 1700 islands, 100 reservoirs, and 521 natural lakes, and the government is planning to build 60 floating photovoltaic stations to achieve the target of 23% renewable energy by 2025. Masdar has signed a power purchase agreement with Indonesian state electricity company PLN to develop the country's first floating PV park. The planned 145 MW floating PV station will be erected in a 225-hectare area of the Cirata reservoir in west Java and is expected to be operational in 2022 [17]. It is currently the largest floating PV project in Southeast Asia. It is believed that this project will be a significant milestone in the development of solar energy in Indonesia in the future.

3.3.3 Off-grid System

It is unrealistic and uneconomical to build a large number of modern power grid systems because Indonesia has tens of thousands of islands. There are about 4000 villages still lack electricity so far, and many residents who live in remote areas and islands still use diesel generators, which are costly and unstable. Accordingly, the development of distributed renewable energy is particularly crucial to improve access to electricity. In June 2018, the Indonesian government launched three projects of solar plus storage mini-grids, thus enabling three remote villages to enjoy uninterrupted, off-grid access to electricity for the entire day [18]. The success of these three small projects has proved that distributed renewable energy is feasible in Indonesia.

3.4 Wind Energy

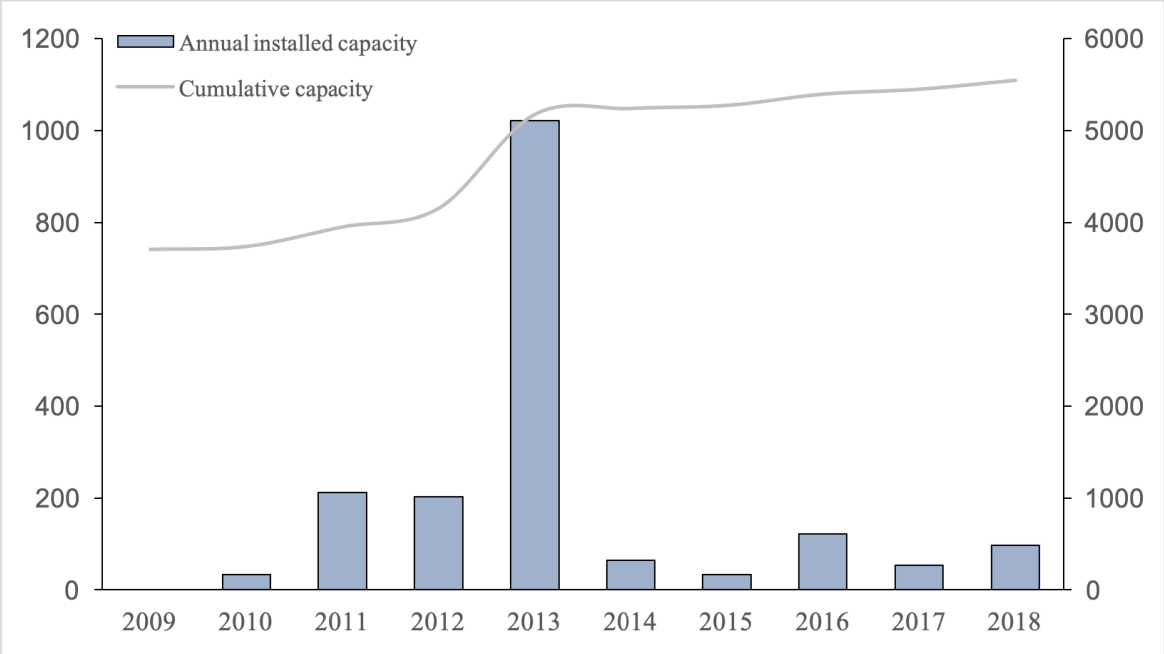
By the end of 2018, cumulative installed wind capacity in Indonesia only was 76MW. However, there is only one large wind farm is currently in operation. The wind farm is located at Sulawesi Selatan, which consists of 30 turbines with a total installed capacity of 75MW. Besides, this wind farm was developed by UPC Renewables and commissioned in April 2018. There is an under-construction wind project, which is also located at Sulawesi Selatan, consists of 20 turbines with a total capacity of 72MW [19]. The capacity of wind farms, which include both operational and under construction turbines, is 148MW, which is far behind Indonesia's potential size of 9.5GW.

3.5 Micro Hydropower

By the end of 2018, the total installed hydropower capacity in Indonesia reached 5548MW. It is not hard to see that annual hydropower capacity installations are less than 100MW over the past several years since new hydropower capacity addition with a considerable increase in 2013. Although Indonesia has abundant hydroelectric resources with a capacity of 75GW, only around 8% form that potential exploited in the type of large-scale power plant and small-scale power plant.

The large-scale hydropower plant is inapposite to be deployed due to funding problems and environmental matters such as the safety of fish and other creatures. Because of numerous islands in Indonesia, small hydro always is the best way that people utilize water resources until pico hydro becomes a mature technology. Furthermore, Indonesia has quite a few rivers to expand small and micro hydropower stations. Generally, people can classify hydropower plants by capacity, which includes the installed capacity of small hydro is under10MW, mini-hydro is under 2MW, micro-hydro is under 500kW, pico hydro is under 10kW. Micro-hydro plants are usually more efficient in the range of 60% to 90%. Besides, the cost of a micro-hydro station is USD 670/kWh, and the payback period often is less than one year [20]. Therefore, Indonesia's micro-hydropower still has excellent development potential.

Figure 8: Annual Installed and Cumulative Hydropower Capacity in Indonesia (MW)



Source: IRENA [5]

4. Future Outlook and Supporting Policies

Indonesia's government has set goals of 23% renewable energy by 2025 and 31% renewable energy by 2050. The current proportion of total electricity generation from renewable energy is about 14%, and the government needs to install 14.9GW of renewable energy capacity to realize the first target [21]. Moreover, the renewable energy target in General National Energy Plan (Rencana Umum Energi Nasional [RUEN]) is 6.5GW of solar power and 1.8GW of wind energy by 2025 [8]. So far, Indonesia has achieved only 0.9% of its solar energy and 4% of its wind power goals, so there is a long way to go to meet targets fully.

In 2019, PLN released the latest Electricity Supply Business Plan 2019–2028 (RUPTL 2019–2028). In this plan, PLN allocated 33.67GW of total power capacity for independent power producers in the period of 2019–2028. Nevertheless, the whole new capacity installation of coal–fired power plants reached 25GW. Among the renewable energy resources, geothermal energy was allocated a capacity of 3060MW, small hydropower was allocated a capacity of 1422MW, and large hydropower was allocated a capacity of 3139MW. However, other types of renewables, including wind energy and solar PV power, were assigned a size of only 1186MW. All of which could easily lead one to the conclusion that PLN still focuses on developing coal power stations.

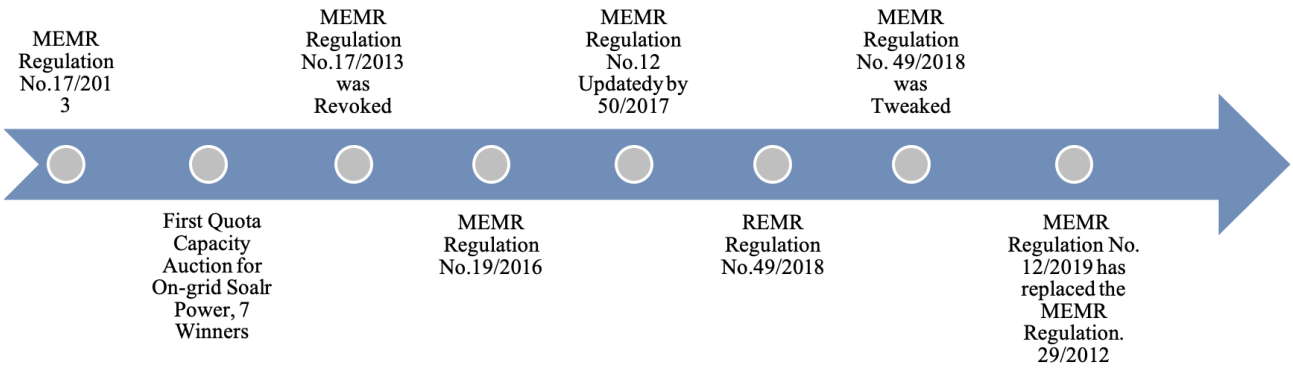
Table 2: Power projects allocated for Independent Power Producers (IPP) pursuant to the 2019–2028 RUPTL

Year / IPP	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	Total
	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW	MW
Coal power plant (PLTU)	514	5,491	2,550	1,224	2,415	2,025	710	-	-	-	14,929
Mine mouth coal power plant (PLTUMT)	-	-	840	1,200	1,550	400	200	200	500	800	5,690
Geothermal power plant (PLTP)	190	151	115	340	235	170	1,759	-	55	45	3,060
Combined cycle, gas and coal power plant (PLTGU)	35	-	275	2,190	1,180	300	-	-	-	300	4,220
Micro hydro power plant (PLTM)	140	229	469	185	147	193	9	20	20	10	1,422
Hydro power plant (PLTA)	154	173	710	-	30	-	1,682	129	62	200	3,139
Other types of renewables power plant (PLT EBT Lain)	57	204	246	347	155	106	14	5	12	40	1,186
Total MW	**1,090**	**6,247**	**5,205**	**5,446**	**5,712**	**3,195**	**4,347**	**354**	**649**	**1,395**	**33,666**

Source: Norton Rose Fulbright [22]

Figure 9 displays a roadmap about Indonesian solar policies in the past few years. Indonesia's government frequently enacted and amended regulations because previous systems did not attract investors to invest in renewable energy. However, recent amendments have progressively simplified the rooftop photovoltaic installation process, and the government has reduced the minimum operating hours of capacity charge for parallel operation applied to industrial customers from 40 hours a month to only five. Thus, decreasing the number of hours is expected to spur solar energy use by industry customers.

Figure 9: Indonesian Solar Policy Roadmap



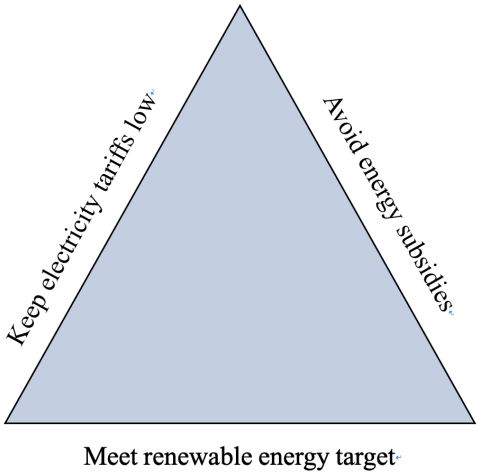
Source: IEEFA [14] & PV magazine [16]

In February 2020, there is good news in the Indonesian renewable energy market, in which the government will issue the feed-in tariffs scheme to boost the renewable energy sector. This program only applies to new contracts with hydro, solar, and wind power plants but not geothermal power plants. Additionally, the FiT scheme will be divided into two phases. The first stage will provide renewable power stations, developers, a fixed electricity price for 12 years. In the second phase, the government will offer a lower fixed price at the 13th year until the end of the contract [23].It will also mean that developers of wind, solar, and hydropower projects can obtain an excellent stable cash inflow to reduce the payback period.

5. Summary

Overall, renewable energy in Indonesia is very promising. Nevertheless, the Indonesian government is caught in a trilemma about the development of renewable energy. They want to meet a renewable energy target while keeping electricity prices low and avoiding energy subsidies. It was not possible in the early stage of renewable energy development. Hence, if the government hopes to get out of this trap, they would have to reform existing energy policies, such as reducing coal subsidies and introducing the FiT scheme or the auction program for renewable energy. Ensuring sufficient profits for renewable energy investors is an essential factor in promoting the country's renewable energy development.

Figure 10: Indonesia's energy trilemma



Source: IISD [8]

However, more and more good news has emerged recently, which could give Indonesia's renewable energy sector a new lease of life. For instance, President Joko Widodo hinted last year that reducing coal would become a national policy and pointed out in public speeches that sustainability is a national goal [24]. Furthermore, the government is trying to adopt the FiT scheme again, and the march regulation may address previous rules that were seen to make clean energy financially unviable. In September, parliament also has an option to advance the country's first unified renewable energy law that would guide policies on clean development. Therefore, investors need to focus on Indonesia, where pent-up demand in renewable energy is set to surge once the policy turns around.

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