Indonesia

SOLAR ENERGY PROFILE

A Nation Rich in Unrealized Solar Energy Potential

SOLAR MAGAZINE

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A Nation Rich in Unrealized Solar Energy Potential

INTERVIEWER: Andrew Burger

INTERVIEWEES:

- **Benny Bernarto**, a Jakarta-based corporate and commercial lawyer with Norton Rose Fulbright and a partner in TNB & Partners
- **Fabby Tumiwa**, Executive Director of Indonesia's IESR (Institute for Essential Services Reform)
- **Marlistya Citraningrum**, Program Manager of IESR's Sustainable Energy Access
- **Ariel Liebman**, Associate Professor of Data Science & AI and Deputy Director of the Monash Energy Materials and Systems Institute (MEMSI)

Solar energy and Indonesia seem almost ideally suited for each other. Indonesia has yet to tap into its abundant solar energy resource potential in any significant way, however.

A member of ASEAN (Association of Southeast Asian Nations), a party to the U.N. Framework Convention on Climate Change (UNFCCC) and Paris Climate Agreement, **the Indonesia government has set a target of renewable energy providing 23% of electricity generation by 2025 and 31% by 2050**. At present, some 13 percent of power generation nationwide comes from renewable energy resources, mainly hydroelectric and some geothermal power production, according to government statistics.

Indonesia is rich in solar power potential, with some 207 gigawatts' (GW) worth, according to the Ministry of Energy and Mineral Resources (MEMR), Benny Bernarto, a Jakarta-based corporate and commercial lawyer with Norton Rose Fulbright and a partner in TNB & Partners, pointed out in an interview.

"The development of renewable energy sources, including solar, is a priority that the Indonesian government is working towards," Bernarto told Solar Magazine. "In terms of renewable energy policy, including solar, the incumbent government made it front and center in his re-election campaign bid that renewable energy is Indonesia's way forward. Investors and developers, however, are seeing mix messages as the regulation does not seem to favor open market business competition vis-à-vis the state utility company PLN (state-owned utility Perusahaan Listrik Negara)."

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Chapter 1:
The outlook for solar and renewable energy in Indonesia

IRENA, the International Renewable Energy Agency, expects Indonesia's installed solar power capacity to grow significantly in scale by 2030, driven by initiatives on the part of the government and PLN.

IRENA identified the potential for Indonesia to deploy **47 GW of solar power capacity by 2030** as part of its 2017 Roadmap for a Renewable Energy Future (REmap) program report. The Abu Dhabi-based agency sees Indonesian solar power capacity growing at the utility-scale, on residential and commercial rooftops, and in off-grid settings to replace costly diesel-fueled generation. That includes plans to enhance energy access significantly by rolling out solar energy systems for nearly 1.1 million households in remote areas that do not have electricity.

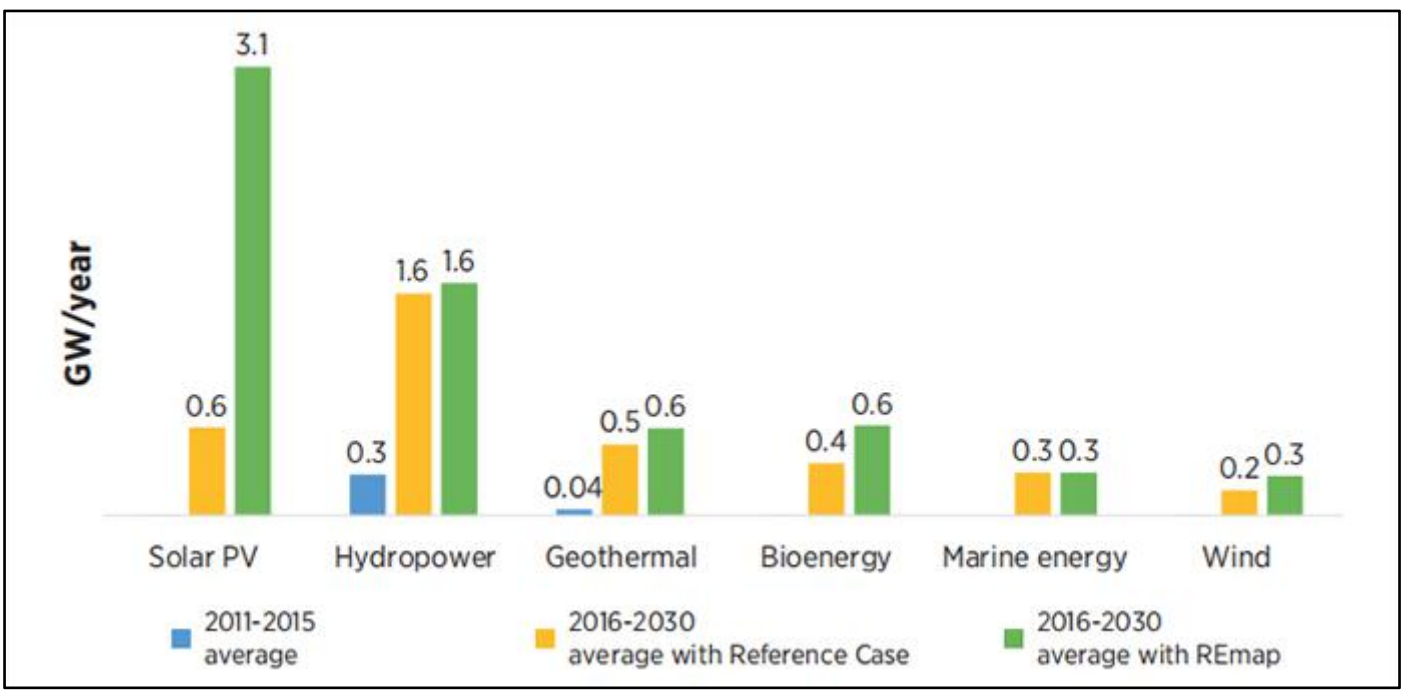

Figure ES3: Annual installations of renewable power in 2011-2015, in the Reference Case for 2030 and with REmap
Source: IRENA Renewable Energy Prospects: Indonesia

IRENA's outlook is looking **overly optimistic**, however. As is generally the case among Southeast Asian nations, opening up the power market to independent power producers and distributors takes a back seat to boosting conventional industrial and economic growth and development, including the use of fossil-fuel power generation.

State-owned utility PLN owns and operates nearly all the nation's generation capacity and has a monopoly on electricity transmission and distribution. It continues to rely primarily on fossil fuels to generate electricity, believing that they are cheaper and more reliable than alternative, renewable energy and clean energy technologies.

The institution of supportive policies and regulatory and market mechanisms to foster renewable energy development under the previous administration of President Joko Widodo were practically non-existent, Mr. Fabby Tumiwa, executive director of Indonesia's IESR (Institute for Essential Services Reform), and Program Manager, Sustainable Energy Access Marlistya Citraningrum told Solar Magazine.

Indonesian Minister of Energy and Mineral Resources Ignasius Jonan, speaking at the Indonesia Clean Energy Forum in Jakarta last November, said Indonesia was unlikely to meet its U.N. Paris Climate Agreement renewable energy and GHG emissions reductions goals, however. Government policy, the terms and conditions of large- and medium-scale project development and institutional market mechanisms that have been created have proved unattractive and largely ineffectual.

Chapter 2:
Realizing Indonesia's renewable energy targets: A pessimistic outlook

"There are a lot of moving parts to Indonesia's energy landscape, and regulations keep changing all the time," Ariel Liebman, associate professor of Data Science & AI and deputy director of the Monash Energy Materials and Systems Institute (MEMSI), told Solar Magazine. Furthermore, "PLN, along with government leaders, want to keep electricity prices low, so they provide massive subsidies for the electricity generation and distribution assets they own," Liebman highlighted.

That said, Bernarto pointed out that Indonesia's Nationally Determined Contribution (NDC) to the UNFCCC and Paris Climate Agreement "put forward a holistic strategy in mitigating the impact of climate change, recognizing that climate change adaptation and mitigation efforts are inherently multi-sectoral in nature."

> *It involves policy that tackles the issue of land use and land-use change (the largest contributor of Indonesia's greenhouse gas emissions) [and] reducing emissions from the energy sector by increasing renewable energy mix, all the while ensuring that economic development in Indonesia continues as projected to lift millions out of poverty.*
>
> —Bernarto said in an interview.

More specifically, issuance of MEMR Decree No. 50/2017 has been deemed unattractive for renewable energy investment. Tariffs, risk allocation, and BOOT (Build, Own, Operate and Transfer) model mandated in the Decree are the main factors making renewable PPAs (Power Purchase Agreements) "unbankable," according to Tumiwa and Citraningrum. MEMR recorded 70 PPAs In 2017, but 32 were yet to reach financial close as of year-end 2018, they noted.

Chapter 3:
Energy in Indonesia

Indonesia is home to some 264 million people, the fourth largest national population worldwide, and its economy is by far the largest among ASEAN's 10 member nations.

Its population is dispersed across an archipelago of thousands of volcanic islands with major cities, towns and villages often separated by forested, mountainous terrain, as well as ocean waters. That makes extension, operation and maintenance of long-distance power grids centered on large-scale coal, fossil-fuel or nuclear power plants difficult and costly.

More energy is consumed in Indonesia than any of the nine other ASEAN member nations. Electricity generation capacity stood at 57.6 gigawatts (GW) as of 2017. Indonesia consumes around 220 terawatt-hours (TWh) of electricity per year. That's marginally more than neighboring Australia's National Electricity Market, yet Indonesia's population is 10 times that of Australia's, the Australia-Indonesia Centre highlights.

Around 80% of nationwide electricity consumption falls within the interconnected Java-Bali and Sumatra systems. The remaining 20% is distributed via thousands of isolated systems that are mostly fueled by diesel generators, **opening up opportunities** to replace them with solar energy generation and energy storage, according to the Australia-Indonesia Centre.

Fossil fuels account for more than 80 percent of Indonesia's energy mix, with coal power plants being the largest source of electricity generation by far. Use of diesel and other fuel oils for power generation is also common across the island nation archipelago.

Panel Discussion: Indonesia Transformation towards low carbon economy. Left to the right: Fabby Tumiwa (IESR), Benhur P.L Tobing (Ministry of Energy and Mineral Resources), Budi Santosa (Indonesia Business Council for Sustainable Development), Dudi Ruliandi (Fiscal Policy Agency/Ministry of Finance), Dida Gardera (Coordinating Ministry for Economic Affairs)
Photo: Climate Transparency

PLN has projected coal use in Indonesia will double from 2017–2025, according to Climate Transparency's 2018 Brown to Green report. Add to that the deforestation, GHG emissions and toxic air pollution produced by its extensive palm oil plantations, and Indonesia probably ranks as one of, if not the largest source of GHG emissions and air pollution in the ASEAN region.

Chapter 4:
King Coal

In addition, coal is big business in Indonesia. It's the world's second largest coal exporter, accounting for just over 16 percent of global exports, some $20.6 billion dollars' worth.

That adds to institutional inertia when it comes to government and PLN support for solar and renewable energy, Liebman pointed out. "They don't believe these new technologies are cheap enough, and they've got all that coal, which they'd rather export than burn internally," he said in an interview. That's "actually a good thing" when it comes to Indonesian GHG emissions, Liebman added.

Furthermore, PLN and the government's long-term 2019–2028 Energy Procurement Plan (RUPTL) calls for building out excess new coal-fired power generation capacity. "The head of the Indonesian coal association a couple of years ago said the country doesn't have enough coal to fuel all the coal-fired power stations the government was planning to build [over the ensuing five-plus years]," Liebman noted.

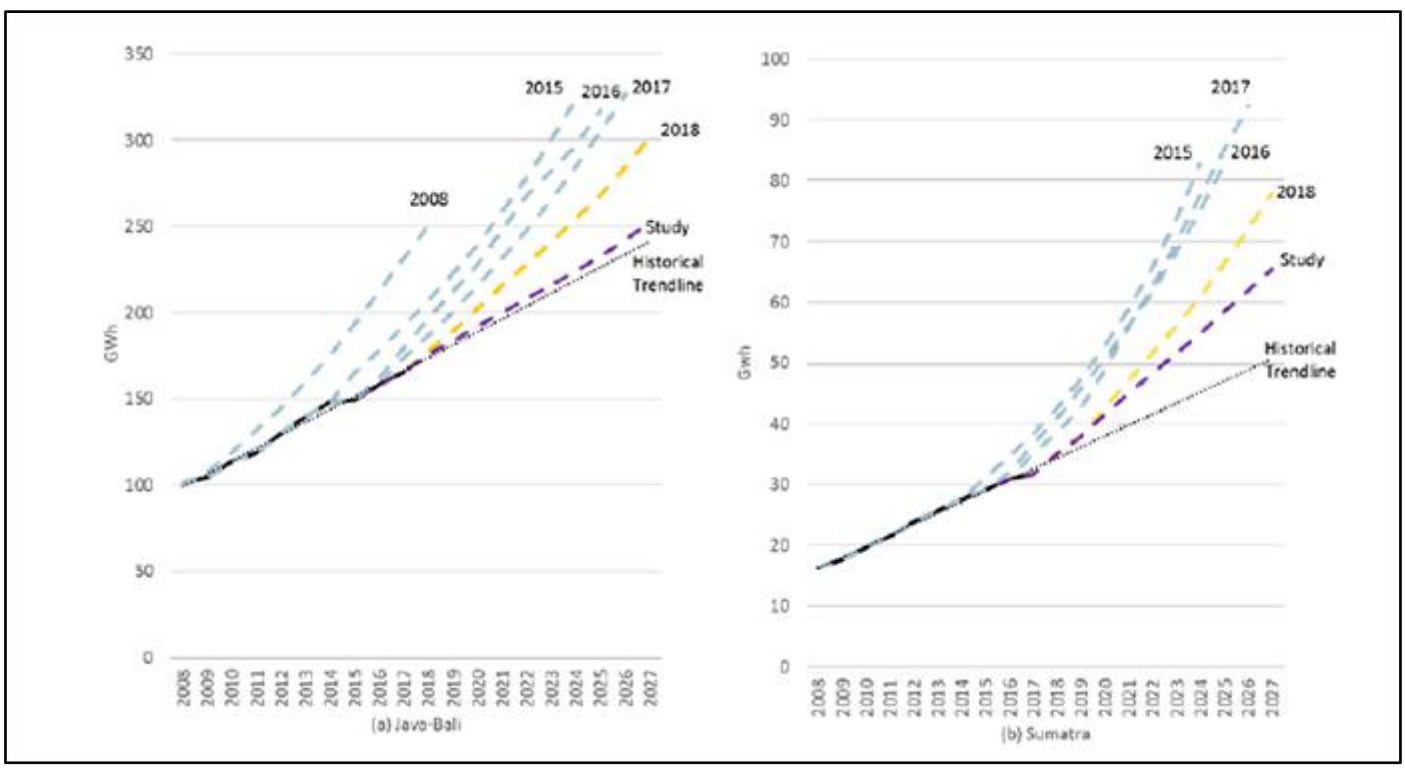

Figure 10: Java Bali and Sumatra RUPTL forecasts versus actuals

Source: A Roadmap for Indonesia's Power Sector: How Renewable Energy Can Power Java-Bali and Sumatra

PLN and the government subsequently dialed that figure down, but it's still far in excess of what's likely to be required in terms of meeting Indonesia's future energy demand, or the most cost-effective or beneficial for consumers, the Indonesian economy and society over the long term, according to a study commissioned by IESR.

Chapter 5:
Indonesia's solar and renewable energy potential

Renewables could supply just 19 percent of Indonesia's power generation capacity by 2027, according to A Roadmap for Indonesia's Power Sector: How Renewable Energy Can Power Java-Bali and Sumatra, a 2019 study commissioned by IESR.

Liebman worked closely with Warwick Forster, managing director of Australia's Apogee Energy an energy consulting company that specializes in renewables and sustainability, to produce the study, which is said to be the first to produce a comprehensive, nationwide analysis of Indonesia's renewable energy development potential.

The research team analyzed model scenarios based on Indonesia's 2019–2028 national energy procurement plan (RUPTL) and initial demand forecasts and details regarding more than 1,050 existing and planned power stations representing some 90% of energy consumption on Java, Bali and Sumatra—about 70 percent of the nation's population all told, Liebman explained.

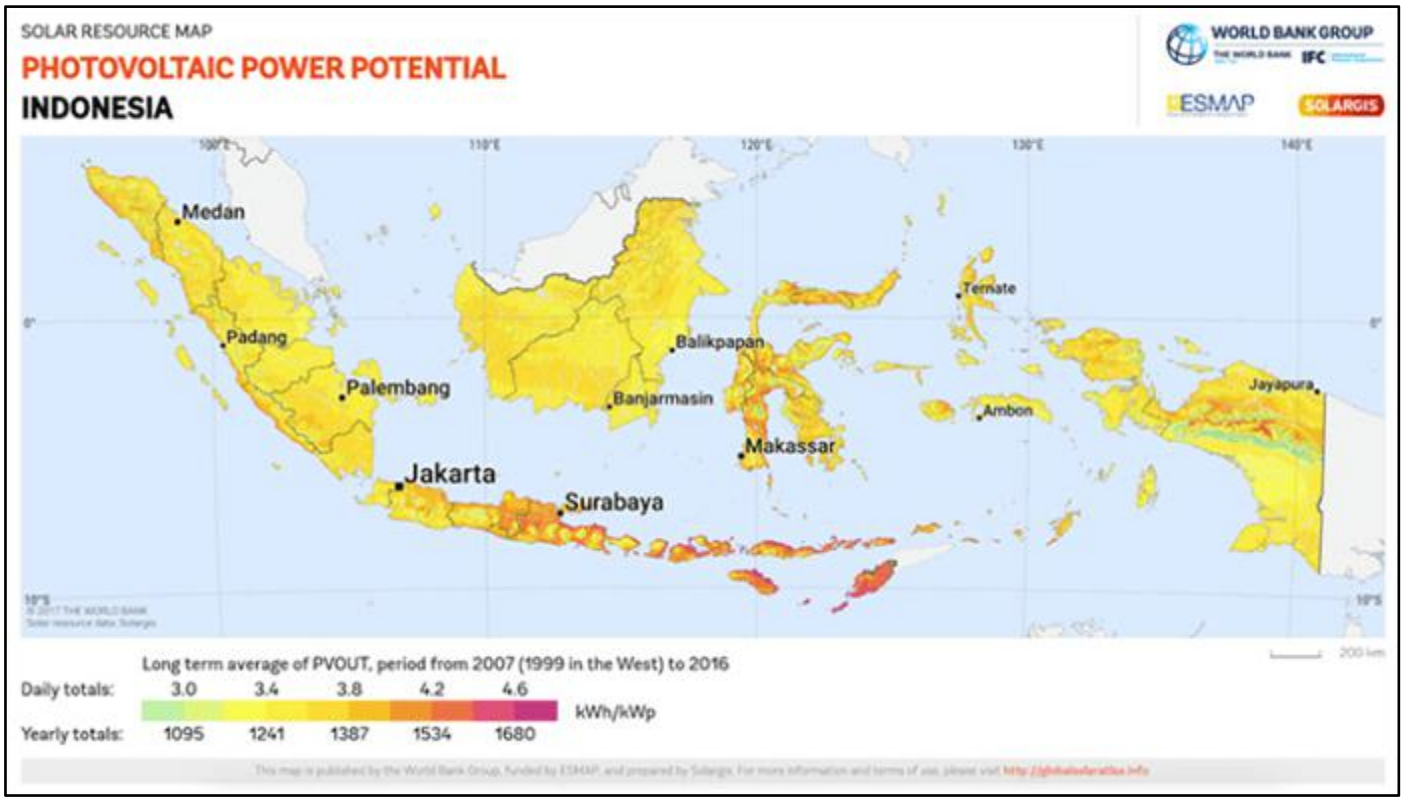

Figure 5: SolarGIS map of Indonesian Solar Resources
Source: A Roadmap for Indonesia's Power Sector report

According to initial modeling and analysis, they concluded "there is likely to be a significant overbuild of generation capacity for both their current forecast energy needs, and a more conservative growth scenario, such as we have modeled," Forster highlighted in a report summary. "Either of these outcomes means an inefficient build of generation, higher system costs to Indonesia and the possibility of stranded generation assets," he pointed out.

Chapter 6:
Business as usual and high renewables penetration scenarios

The researchers ran Liebman's model "under different scenarios where generation was built efficiently at minimal cost whilst still ensuring adequate supply of fast start generation and minimal 'unserved' energy (i.e. when the lights go out)," Forster explained.

What is important is that with these levels of renewables, there is neither significant 'spill' or unused renewable energy, and that the inherent flexibility in the generation fleet is able to manage any issues with the variability in renewable sources.

In addition, scenario analysis results showed reductions in 2027 of between 39–89 million metric tons of CO2-equivalent emissions under the study's Business as Usual and high renewables penetration scenarios.

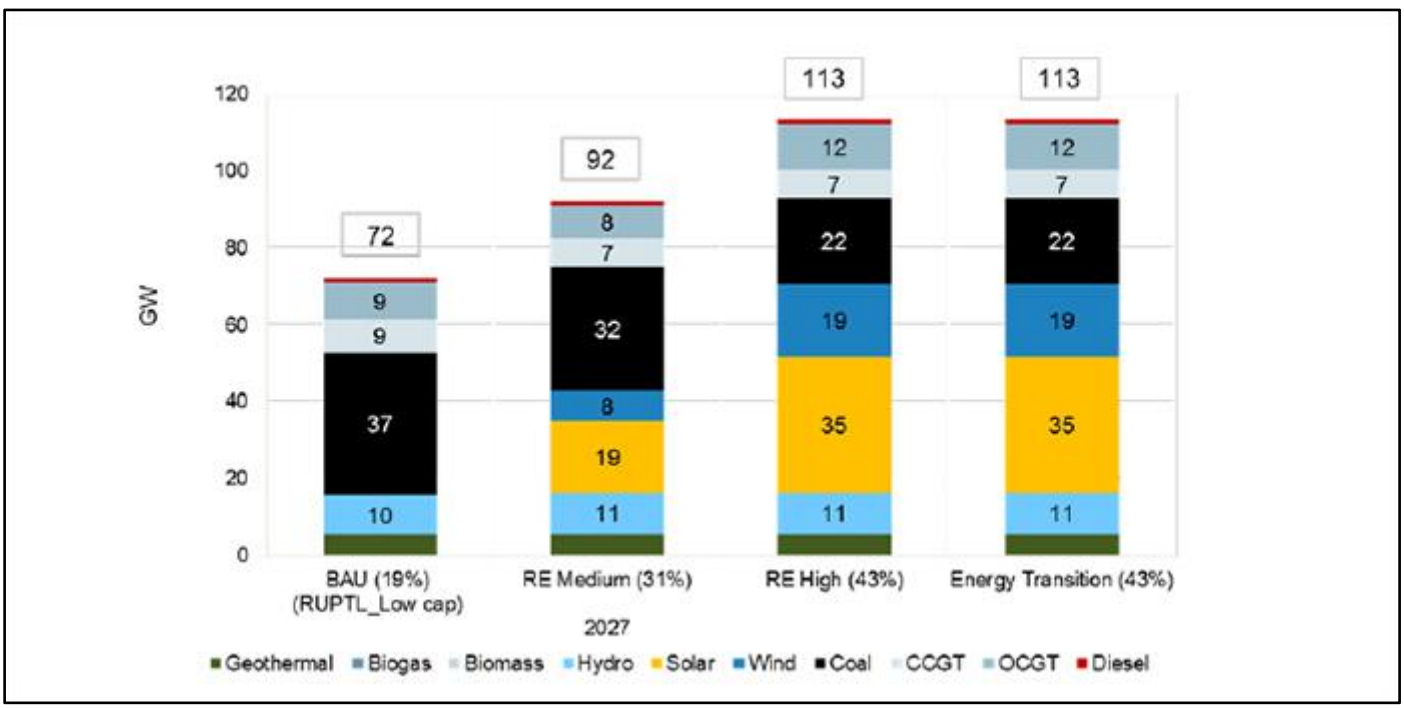

Figure 23: Generation Capacity in 2027 for Renewables
Source: A Roadmap for Indonesia's Power Sector report

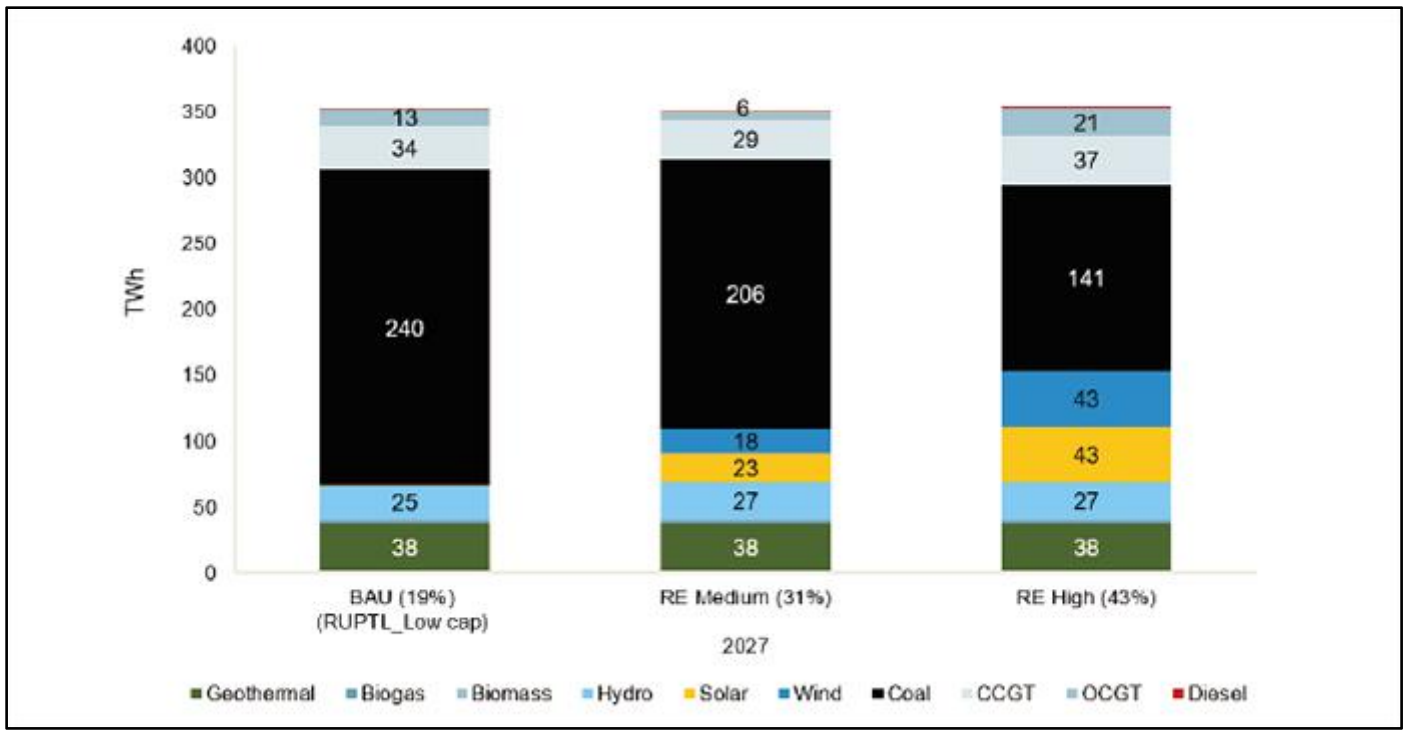

Figure 24: Energy Generation Mix in 2027 by Technology for RE Scenarios
Source: A Roadmap for Indonesia's Power Sector report

Turning to cost assessments, the medium and high-renewables scenarios resulted in 4% and 7% increases in energy costs for the period. An "energy transition" scenario in which less conservative regarding the projected costs of new renewable energy deployment resulted in a 1% reduction as compared to the business-as-usual scenario.

Chapter 7:
Solar energy project development in Indonesia

To date, nearly all solar energy project development in Indonesia has revolved around extending sustainable energy access to remote, off-grid communities by deploying solar home systems (SHS) or solar-plus-storage micro- or mini-grids

Project development by and large is being driven by the government's goal of achieving 100% electrification by 2020. Recently elected to a second term in office, President Joko Widodo signed a Presidential Regulation directing solar PV systems be installed to serve more than 2,500 off-grid villages from 2019–2020, Bernarto highlights in a Norton Rose Fulbright report.

Furthermore, MEMR has supported Indonesia's One Million Rooftop Solar Initiative, which was launched in 2017 with IESR as a founding signatory. Also, it issued MEMR Decree No. 49/2018 with the aim of boosting rooftop solar use by PLN's customers, Tumiwa and Citraningrum pointed out.

"This regulation, in IESR's opinion, has the potential to hamper rooftop solar utilization in Indonesia, however," they said, highlighting three main points:

- The net metering scheme only allows electricity sale for a value of 0.65 to customer's current electricity tariff (a drop from previous regulation which allowed 1:1 ratio),
- Customers need to obtain permission from PLN just to install the panels and only registered business entities are allowed to install solar energy systems, which may increase installation prices and limit accessibility to those in large cities, and
- A contradictory clause for industrial users, Decree No. 49, that exempts industrial users from Decree No. 1/20187 but still stipulates they pay parallel charges and emergency fees.

Chapter 8:
Growing interest in rooftop solar

That said, Indonesian homeowners' interest in rooftop solar has increased during the past six years, more particularly in the wake of the launch of the One Million Rooftop Solar Initiative, according to Tumiwa and Citraningrum.

"The number of homeowners using on-grid rooftop solar has increased by over 100% since the initiative was made public in September 2017," they highlighted. Furthermore, a market survey by GIZ-INFIS and IESR revealed that 13% of households in the Greater Jakarta area with a collective, potential capacity of 368 MW were interested in installing solar PV systems, they added.

> *This growing interest, however, is barely recognized by the government. The newest regulation on rooftop solar does not provide a supportive framework for rooftop solar users. Stakeholders see this regulation as a setback that only aims to prevent PLN from losing revenues.*
>
> —Tumiwa and Citraningrum added.

That belief is unfounded, at least according to an IESR simulation that showed PLN's revenues would decline by just 0.58% if the One Million Rooftop Solar Initiative's target of 1 GW cumulative installed capacity by 2020 is achieved.

When it comes to utility-scale power, project development faces the same obstacles as do other renewables: **the lack of supportive policies**, according to Tumiwa and Citraningrum. "In term of technology costs, Indonesia has comparable LCOE (Levelized Cost of Energy) to neighboring countries at USD0.06–0.11/kWh."

Indonesia was set to implement a long-awaited solar energy feed-in-tariff for solar energy back in 2016 in the wake of the issuance of MEMR Decree No. 19/2016, Tumiwa and Citraningrum pointed out. "But as soon as the new minister took office, this regulation was annulled. The current regulation (MEMR Decree No. 50/2017) sets lower tariffs for renewables, and it affects renewable projects bankability."

Chapter 9:
Barriers to solar and renewable energy growth

The potential for Indonesia to transition to local, emissions-free energy resources is there. The lack of consistent, supportive renewable energy policy and regulations raises project development costs in Indonesia and makes for an unstable, uncertain business environment, however. The resulting lack of solar and renewable energy industrial ecosystems serves as another barrier to market and industry growth, according to IESR and Liebman.

As it stands, aspiring independent solar and other renewable energy power producers need to go through a legal and bureaucratic process that entails obtaining approvals, licenses and permits at both the national and local government levels. They all need to contract with PLN, which has a monopoly on transmission and distribution nationwide, for the sale and purchase of all electricity produced. Furthermore, all project development by independent power producer is based on the BOOT model.

Modernizing the power grid to accommodate renewable energy generation, transmission and distribution poses **another major challenge** for solar and renewable energy growth in Indonesia more generally. PLN has begun addressing this issue, piloting implementation of advanced metering infrastructure (AMI) and smart grid technology. The state-owned utility also continues to implement required load frequency control and automatic generation control for the Java-Bali grid network.

In addition, the lack of a solar and renewable energy industry base and supply chains constrain Indonesia's capacity to realize the nation's renewable energy potential. So does the lack of skilled, experienced people, Liebman highlighted.

Developing a supply chain, developing or acquiring a workforce with right skills, along with difficulties distributing and managing energy resources to centers of demand are **challenges** all industry, governments and communities face when considering how to design and implement a clean, renewable energy transition, Liebman noted.

"Even though we know renewables are cheaper on average, you need to build out supply chains. The next 100 MW [of renewable power generation] is going to be higher than any broad-based average. There's no significant grid-connected, utility-scale solar there, although there are a lot of small, off-grid installations, around 1–2 MW at the most. There's nothing installed at present at the scale we modeled," Liebman said.

Those challenges are the sorts of variable factors that are difficult to model anywhere. They're also challenges that government and multilateral development agencies typically step in to address to build a techno-economic foundation upon which private-sector enterprises and markets can be built upon.

> *We had to assume these challenges were going to be solvable at some point. The [study's renewable energy] development trajectory is probably a little bit optimistic in the first few years. It's hard to hit the ground running without an industrial base, so development would probably be slow in the beginning, but costs should decline as installations increase.*
>
> —Liebman said.

Chapter 10:
Solar energy in Indonesia: A look ahead

Indonesians went to the polls to elect a new president and government leadership in late April. Based on an early quick count of election results from late April, Widodo appeared poised to serve a second, five-year term as Indonesia's president. If Widodo "maintains his current approach and the national energy policy is not translated well into sectoral regulations, renewable energy development in Indonesia will see a stagnant state or best case, very limited progress," according to IESR.

What is the future of renewable energy in Indonesia?

Watch the video at: https://youtu.be/V8wnNIRC_0Q

Widodo's administration did launch initiatives to attract more solar and renewable energy investment to Indonesia in the run-up to the national election, Bernarto pointed out. Among others, these included reducing the number of permits and licenses required to establish businesses, as well as introducing the Online Single Submission System (OSS) for project proposals.

"We see reasonably good interest from investors who are considering Indonesia for renewable energy investment based on the potential resources…The current government is likely to improve the investment climate in general. However, it seems like more effort is needed to convince renewable energy developers, including solar," Bernarto said.

In addition, PLN is developing a national standard for electric vehicle (EV) charging systems. It's also preparing a strategic road map for EV charging stations in support of the government's plan to develop the Indonesian EV industry.

Bernarto cited floating solar power as one prospective solution to land acquisition issues in Indonesia that usually hinder or slow down power projects in Indonesia. In addition, "solar combined with storage microgrids could be the solution to supply energy that is reliable, and cost-effective for those living in remote areas, far from the national transmission lines," he said.

Bernarto believes that the economics of solar energy in Indonesia will become increasingly attractive in coming years. "Renewable energy options that are reliable and affordable would do very well in a developing nation such as Indonesia," he said.

"Solar technologies and hardware are projected to be increasingly affordable overtime for developing nations such as Indonesia given increasing investments in renewable energy projects. There is potential for renewable electricity prices to become competitive against [conventional] alternatives," Bernarto concluded.

Read the Profile at: https://solarmagazine.com/solar-profiles/indonesia/

Appendix

The Story Behind Solar Energy Profiles

The solar energy industry has gained significant development over the past few decades, while making vast and impressive contributions to accelerating the transition to renewable energy, better addressing the climate change and creating a greener living environment for human beings. However, from a global perspective, the solar development is uneven–many regions in the world which have huge solar potential along with many benefits to residents lack a robust ecology comprised of various aspects including strong social awareness, consistent governmental support, mature technology systems, effective policies and regulations, and adequate capital. These regions are mainly in developing areas, like Africa, Asia, and South America, occupying a large proportion of the world's population. In the meanwhile, there are still some 1 billion people across the globe have no electricity access; most of these people are living in rural communities of the areas mentioned above–many practices have proven that solar energy deployment is an ideal means to alleviate energy poverty.

Aiming to make the public to get to know more about and obtain good understandings of the potential, states, and obstacles of the solar energy development in these regions and areas, Solar Magazine launches the Solar Energy Profiles column and will publish profiles for different countries regularly. We will concentrate our efforts on the developing as well as the less developed countries first since they have received less attention. We hope that these profiles composed of official statistics, market analyses and expert insights can catch more attention from international policymakers, development organizations and associations, technology professionals, and investors to form a strong cohesion to accelerate the solar energy deployment and address the energy issues.

More Profiles: https://solarmagazine.com/solar-profiles/

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