

Bringing Renewable Energy into Life in Indonesia: Solar and Beyond

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The cost of solar modules was originally very high back in the 1970s (US\$76/W-peak), but it has become much more affordable quite recently (below US\$0.50/W-peak in 2015) thanks to several decades of research and development. While upfront cost tends to be relatively high for a solar system, the levelized cost of electricity of utility-scale solar power plants (US\$0.13/kWh by 2020) is rapidly approaching that of conventional coal power plants (US\$0.10/kWh according to the US Energy Information Administration). Granted, in many parts of the world solar power is still not as competitive as coal, especially when the scale of the solar project is small. However, the cost is actually low enough to allow for solar farms to be built in remote areas with little or no coverage from the traditional electric power grid infrastructure. In this context, solar power is considered a technically suitable method for delivering electricity services to such areas due to its ability to form microgrids. Unlike coal power plants, which need frequent refueling (high operational cost for remote areas), a solar plant can be operated in isolation without much need for resupply. This capability would be especially beneficial for regions with as yet underdeveloped infrastructures, by realizing the prospect of energy independence for better living standards. The question now is: how does Indonesia fit into all this?

Indonesia, on average, has a significant amount of cloud cover and therefore is not too attractive for nationwide wholesale solar power. This is quite understandable, since Indonesia is an archipelago on the equator that is covered by an extensive stretch of tropical rainforest. However, certain regions do have relatively little cloud coverage and higher level of long-term solar irradiance. These regions, which include East Nusa Tenggara, would make excellent sites for scalable solar power plants. Although, in practice, it is prudent to start small and scale up gradually — as costs are anticipated to decrease over time.

The recent completion of the 5 MW-peak solar power plant in Kupang is an encouraging first step toward the development of solar power in Indonesia. The scale of the project itself,

5 MW-peak, is small compared to the scale of standard solar power plants (a typical utility-scale project is in the order of tens to hundreds of MW-peaks). As a result, the Kupang plant might have a higher cost than an average utility-scale solar, since it has not fully utilized the economies of scale. Nevertheless, a crucial milestone has been accomplished.

The completion of the Kupang plant is also a critical juncture for Indonesia's ambition toward the "500 Island" renewable energy project. In collaboration with Caterpillar Inc., Indonesia (represented by the national electricity company PLN) has signed a memorandum of understanding to build hybrid and photovoltaic + energy storage (microgrid) projects in 500 remote islands in Indonesia. Included in the project are the utilization of more than 35 MW-peak photovoltaic panels and 250 MWh of energy storage capacity. Energy storage (battery) is a particularly important element for the formation of microgrids, which would enable the plant to store unused solar energy during the day and discharge the stored energy at night when the sun is not shining. This is especially so when the remote islands are not serviced by PLN due to infrastructure constraints. As solar power and other forms of renewable energy grow into a more significant fraction of the country's energy mix, the existence of robust energy storage will be crucial to balance the supply and demand of electricity and maintain the stability of the electrical grid.

The abovementioned collaboration between PLN and Caterpillar Inc. also has an added benefit of boosting local manufacturing. The energy storage solution for this project is being provided by Fluidic Energy, an Arizona (US)-based company with zinc-air battery technology. While Fluidic Energy is a foreign company, it has opened a manufacturing facility in Bogor, Indonesia to take advantage of Indonesia's abundance of high-quality zinc. It is encouraging to see the steps taken by the government to ensure that solar manufacturing creates local jobs and contributes to Indonesia's renewable energy development. In addition to supporting the local economy, this also encourages Indonesian workforce to learn advanced technology and improves the overall quality of Indonesia's human resources.

With the threat posed by global climate change, and despite all the political challenges, the world is anticipated to shift much of its energy portfolio toward one with a reasonably low carbon emission. As laid out in the MIT Energy Initiative (MITEI) reports, the energy portfolio in this envisioned low-carbon future will be dominated by a mix of various renewable energy options — supported by nuclear power and grid-scale energy storage to offset the intermittency of some renewables such as wind or solar energy. John Holdren, science and technology advisor for the Obama administration, had also stated that there is no silver bullet for the world energy crisis. Consequently, all range of options will have to be considered and Indonesia must be ready.