

Investigation on the Opportunities of Solar Rooftop Development in Green Technology and Its Application to Industrial Sector

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Abstract

Environmentally friendly technology has been the focus of many parties at this time. Concerns about the rapid exhaustion of fossil energy sources and a huge potential in renewable energy sources have made researchers and industries develop green technologies. One that was developed is the solar panel on the roof of the house (solar rooftop) that can be used to generate electricity using solar energy. The importance of solar energy is that it can reduce the load of electrical energy from companies producing electricity that are currently using fossil fuels. Solar Rooftop development is still limited to certain countries, where several prototypes have been produced for use by the community, especially in areas where electrical energy is less accessible or difficult to obtain. The price of solar panels is still high and the installation of the panels and ancillary equipment requires technical expertise so that this technology has still not been readily accepted.

Increased electricity sales tariffs and more convenient arrangements to install solar cells on the roof of houses are expected to increase the demand for solar cells. This can stimulate industry to develop and manufacture better and more efficient solar cells. In the early stages, government support is indispensable for the development and use of green energy, and this is particularly true for solar rooftop. In which case the technology can be considered economic, developer's production cost, delivery cost and implementation issues of technology can be assessed. Thus, we can expect the use of solar rooftop on a large scale and it can assist better and cheaper access to electrical energy for the common man.

Introduction

Renewable energy (RE) development involvement has increased globally. In the last decade, more than 40% of world power generations utilize renewable energy resources. The fact has convinced that renewable energy is the most cost-effective solution to provide today's world energy demand.

Indonesia has enormous potential to become the world energy leader in renewable energy by utilizing more than 200 GW of renewable energy resources. To realize the goal, government has set an ambitious target (Fig. 1). According to Presidential Regulation No. 5/2006 (National Energy Policy), government expects to realize optimum primary energy mix by 2025, in which 17% comes from renewable energy. It sets a national target for optimal energy mix at that time to be less than 20% from oil, more than 30% from gas and more than 33% from coal.

Development and utilization of renewable energy is considered an urgent strategy by many countries to rule out energy crisis in the future. It is depicted as benchmarking on national energy management.

USA has considerably developed in the utilization of renewable energy, by communities, corporations and large industries.

2025 Target Presidential Regulation No. 5 / 2006

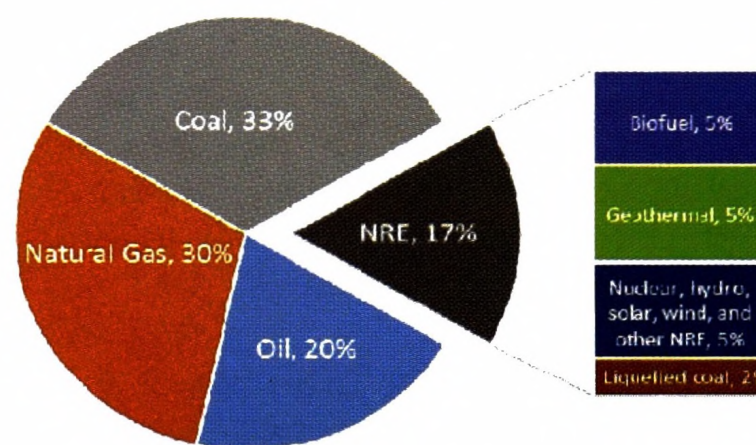


Fig. 1. National Primary Energy Mix Target

Solar energy has recently become an important energy sources. Much effort has gone into achieving better efficiency, without entailing large costs, e.g. through research to develop better materials for solar panels. Solar panels consist of photovoltaic cells installed on a single panel. They are part of a photovoltaic system which generates electricity utilizing sunlight energy. Electricity produced by solar panels is environmentally

friendly, since it does not use fossil fuel which pollutes and emits carbon gases. Solar energy harvesting in residential housing can reduce electricity bill substantially. Solar panels can be installed over the roof, the building, ground top or standalone. Installation on the roof is preferred in urban areas which have limited space.

Japan and Australia have been eager to adopt and expand the application of solar rooftop photovoltaic technology. Malaysia is promoting community usage of solar panels on roofs of residential houses and office buildings. Indonesia has followed the trend by setting feed-in tariffs for solar rooftop photovoltaic.

A Feed-in Tariff (FiT) is a common economic instrument used to stimulate investment in renewable energy technologies. FiT drives market growth by providing developers long-term purchase agreements for sale of electricity from RE sources. These agreements, which aim to be both effective and cost-efficient, typically offer a specified price for every kilowatt-hour (kWh) of electricity produced and are structured with contracts ranging from 10-25 years.

Energy source	Feed-in tariff	Conditions	MEMR legislation
Geo-thermal	US\$ 0.01-0.19/kWh	Location and whether plant is connected to high or medium voltage network	No. 22 of 2012
Mini/Micro hydro	Rp 656-1,506/kWh	<10 MW, dependent on location and whether connected to low or medium voltage network	No. 4 of 2012
Biomass	Rp 975-1,722.5/kWh		
MSW (non-biogas)	Rp 1,050-1,398/kWh		
MSW (landfill gas)	Rp 850-1,198/kWh		
Solar Photo-voltaic	Price ceiling US\$ 0.2 - 0.30/kWh	Purchase by tender. 40% local materials required	No. 17 of 2013

MEMR = Ministry of Energy and Mineral Resources of Indonesia ; MSW-Municipal Solid Waste

Table 1. FiTs for renewable energy sources in Indonesia

The Indonesian government uses FiTs to accelerate deployment of renewable energy, in particular for small and medium projects up to 10 MW (Table 1).

FiTs provide private investors with known, guaranteed and consistent revenue that can help them make a viable business case for renewable energy projects, which may have higher generation costs.

Approximately 85% of Indonesia's installed power capacity is owned and operated by the state-owned electric utility PT Perusahaan Listrik Negara (PLN), which is also the sole operator of transmission and distribution services. However in recent years approximately half of new capacity has come from the private sector through independent power producers (IPPs). The Government of Indonesia has taken steps in recent years to reform the energy sector, placing emphasis on partial liberalization of the energy market, decentralized energy planning and increased transparency.

The rates for the Indonesian FiTs are understood to be based on PLN's 'electricity base price', which is the marginal production cost that would be incurred by PLN to produce electricity at the location of the renewable energy project. The calculated electricity base price is also supplemented with a stipulated return for investors, set by the regulators.

Methodology

This paper is based on a qualitative method using literature study, in-depth interview and focus group discussions based on descriptive data analysis. Desk study involved searching for referenced material through paper based sources e.g. books, journals, articles and also official websites of government and organizations. In-depth interview and discussion was used to gain information about the research topic related to the research objective from experts. The next step was to refine the data and information obtained and to analyze them descriptively to determine opportunities for utilizing solar rooftop photovoltaic and its application to industry.

Result and Discussion

Renewable energy has gained a place in world economic policy. More and more countries have policies that support the development of renewable energy including solar energy. A drawback of solar energy that it requires enough area to obtain large energy capacity can be addressed by placing solar panels on the roof of the building (rooftop PHOTOVOLTAIC systems). Rooftop systems can be mounted on roofs of offices or even homes.

Advances in technology make solar power increasingly easy and cheap to produce. The cost of

solar power has dropped about 90% over the past decade. Solar rooftop is being used in several regions in Indonesia especially in areas where electrical energy is less accessible or difficult to obtain.

Although the government has targeted the fulfillment of energy generation capacity of electricity from solar power of 8 GW by 2019 through a total of 35 GW mega projects, there is no legal framework governing the application of solar photovoltaic, since the cancellation of Ministry of Energy and Mineral Resources No.17/2013 by the Supreme Court. The issuance of Presidential Regulation No. 4/2016 (development of electricity infrastructure, especially new and renewable energy), which regulates the formation of specialized business entities purchasing electricity from renewable energy as well as the allocation of subsidies on renewable energy, has not been followed by technical regulations that provide certainty to stakeholders for implementation in the field. An agency with the special purpose of buying electricity generated from renewable energy was planned but has not been established. Industry and users welcome implementation of these strategies.

In terms of purchase from independent power providers (IPP), the government must ensure PLN can buy but not provide guarantees to IPP. All state owned enterprises can be off-takers, with agreements to buy electricity from IPPs at a price higher than PLN, so that there is a project but actually is not. Support for this program was provided by community observers RE, which by itself has implemented electricity generation from renewable energy, especially solar photovoltaic at their own expense. However, once again there must be an assured quota scheme, FiT and metering policy are clear and provide good benefits to the user community and PLN as the state organization responsible for the fulfillment of the national electricity demand.

Market demand is still low relying only on government projects

Currently there are 8 solar module assembly plants in Indonesia, but only 6 companies are members of the Indonesian Solar Module Manufacture Association (APAMSI), namely PT. LEN Industri (Persero), PT. Surya Putra Utama, PT. Swadaya Prima Utama, PT. Adyawinsa Electrical & Power, PT. Azet Surya Lestari and PT. Wijaya Karya Intrade Energi. Industry is still limited to assembly because when viewed from the feasibility aspect of

investment, a photovoltaic module industry should be producing at a capacity of 1 GW per year just to reach break-even point (BEP). A requirement of 8 GW can be regarded as sufficient capacity if demand is guaranteed continuously for 4-6 years.

A scheme to drive the growth of the solar photovoltaic industry is being studied at this time so that the government can allocate incentives to APAMSI as an industry investment cost to expand electricity generation from renewable energy. However, this scheme is not supported by the cross-sectoral coordination ministries involved. There are fears that the product developed by this industry (which certainly has a higher domestic component level, DCL) will not be absorbed by government and retail markets.

Manufacturing solar panels is the solar energy industry with the smallest risk compared with the solar cell industry, wafer industry and so on. The risk is related to the cost of investment required, while industrial demand in the country is still low. On average the production of APAMSI members is only 16% of total production capacity because it still relies on government projects. As a result, factories work only from August to December each year.

Encouraging solar module industry in Indonesia

The government was actually trying to make a bigger market through the auction quota of 140 MW of solar energy in 82 locations by implementing MEMR 17/2013 on Power Purchase by PT-PLN from Photovoltaic Solar Power Plants (PSPP), which was eventually cancelled by the Supreme Court because of indications that the auction practice was unhealthy under the pretext of DCL.

Indeed, with a target capacity of 140 MW for Indonesia, it is well worth establishing a solar cell industry in the country. If the target increases to 500 MW it is worth building silica wafer plants in the country. Furthermore, if the target rises to 1 GW, it will be worth for industry to use minerals like nickel as raw materials in the manufacture of solar panels.

Recommendations

1. Prohibition of imports of solar power forcing manufacturers to open a factory in the country can be useful similar to Malaysia's ban. Standards regulations do not affect Chinese imports because Chinese solar panels already meet international standards as they are

supplied all over the world. The government has already banned the import of solar panels for state use but still allows their purchase if there is at least 40% local content requirement.

2. Prohibition of export of minerals: Manufacturers smelter and then export ingot (pure material as feedstock) is produced in the country. After that, the government needs to remove the ban on export of ingots.
3. Require manufacturers to produce wafers in the country. Glass solar panels can actually be in production in the country (for example, by ASAHI Corp.) but may lead to oversupply. APAMSI considers market to be too small i.e. 1 x glass production volume equivalent to the volume of sales APAMSI for 3 years.
4. The use of crystalline technology that is labor-intensive using abundant raw materials though cannot be produced domestically. Thin film technology does have cheaper production costs but have a low efficiency. In addition, the thin film industry is a capital intensive industry with an investment of approximately \$ 55 million / machine for a capacity of 50 MW / year. At the moment there is thin film technology with better efficiency, the industry must replace the entire equipment for system production.
5. It should encourage the development of micro inverter and charge-discharge control for solar power, thereby increasing the level of local content contributed by industry supporting components such as panels, transformers, PCBs and batteries that already exist in the country. DCL of artificial batteries manufactured by Nipress Ltd. also has reached 48%.

Conclusion

Rooftop solar power for electricity generation is used in homes or offices in some parts of Indonesia. The target energy mix of 2025 which

emphasizes increased use of renewable energy, including solar energy has encouraged solar module manufacturers to make solar panels at a more competitive price. Oversupply of electricity generated from solar photovoltaic can also be sold to PLN at a predetermined FiT. Government support is still necessary for actors in the solar photovoltaic field in the country to develop economical technology with lower solar photovoltaic production and delivery costs and to solve implementation issues of technology. The proposed recommendations should be examined by the relevant stakeholders to expand the use of rooftop solar PHOTOVOLTAIC to meet the expectations of people for access to cheaper electricity.

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