



CLIMATE AND ENVIRONMENT

Potential of Various Renewable Energy and its Introduction Policy in Southeast Asia

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Abstract

Renewable energy has gained importance and is changing the face of energy business. Introduction of community-based off-grid renewable electricity in developing countries is desirable from the viewpoint of fostering inclusive growth. Southeast Asia provides an ideal ground for demonstration, since the region is endowed with abundant renewable resources as well as a significant need for off-grid electricity. Identified impediments include inadequacies in accumulation of relevant data, management skills, financing and harmonization. Assistance by governments and international institutions such as development banks, coupled with utilizing private sector skills on energy management and novel financing methods are the keys to overcoming them.



Challenge

Challenge 1. Climate Change: Limiting temperature increase to below 2 degrees above pre-industrial levels, as stated in the Paris Agreement, necessitates a halving of greenhouse gas emissions by mid-century. Decarbonizing energy, mainly through decarbonization of electricity and electrification of energy consumption is the centerpiece of substantial greenhouse gas reduction¹. Renewable energy has become the preferred choice, since it is infinite, scalable and cost competitive².

Challenge 2. Energy Transition in Southeast Asia: Southeast Asia is the one region where, in the absence of aggressive mitigation policy, GHG emission can rise rapidly due to rising energy demand³; It is also a region which is endowed with considerable renewable potential, and which can benefit greatly from community-based renewable energy projects since a significant proportion of its citizens live in islands or off-grid areas.

Challenge 3. The need to harness inclusive growth: The world has seen significant progress in reduction of poverty. However, income disparity appears to remain high⁴. This suggests that the next step is to foster “inclusive growth”, i.e. to ensure that the entire community is provided of means to enhance productivity⁵. Stable supply of electricity is one of the key measures,

¹ According to IEA’s World Energy Outlook (WEO) ’s New Policy Scenario, electricity comprises about 24% of total final consumption (TFC) of energy. In its Sustainable Development Scenario (SDS) which aims to comply with the goal of the Paris Agreement, the figure rises to 28% even though electricity generation itself is reduced by about 6% due to substantial improvements in energy efficiency.

² For an in-depth discussion of the benefits of renewable energy, refer to Komiyama, Yamada, 2018, *New Vision 2050: A Platinum Society*, Springer.

³ According to IEA’s WEO2018, CO2 emission in Southeast Asia can more than double current levels by 2040 under its Current Policies Scenario, whereas the increase in emission for the whole world is expected to be about 30%.

⁴ PovcalNet by the World Bank

(<http://iresearch.worldbank.org/PovcalNet/povDuplicateWB.aspx> accessed 26 March, 2019) shows that the proportion of people in low income countries below USD1.9/day poverty line has declined from 40.69% in 1993 to 13.02% in 2013 (using 2011 purchasing power parity).

⁵ See e.g. Hedrick-Wong, Thomas, 2019, *Enabling models of inclusive growth: Addressing the need for financial and social inclusion* (EFMD Global Focus Issue 3, Vol.12).



and renewable energy is ideal in the sense that income is not drained on expensive fuel.

In view of the above challenges, the authors are of the view that Southeast Asia provides an ideal test case for community-based renewable projects to take place. Major impediments identified are as follows.

- **Lack of relevant data to assess the potential for renewable energy:** For some renewables, notably hydropower, geothermal and wind power, it is crucial that the project developers are assured of adequate renewable resources. However, gathering data on resource availability takes time and effort, and identifying societal issues can be complicated.
- **Lack of skills to properly manage electricity business:** Provision of electricity needs considerable entrepreneurial skills which are not likely to be developed locally.
- **Lack of adequate financing to cater for off-grid communities:** Provision of adequate financing remains the key aspect due to the nature of project and characteristics of off-grid communities.
- **Inadequate policy harmonization at the regional level:** Harmonization of policies on promoting community-based renewable energy projects in the region can be further pursued.

Proposal

Proposal 1: Governments and development banks should step up efforts to accumulate data on renewable energy potential to facilitate siting.

Rationale

- Southeast Asian countries comprise about 8.6% of the world's population, though its proportion in terms of economic indicators such



as GDP and electricity generation are 3.4% and 3.8%, respectively⁶. Southeast Asia is the one region where, in the absence of aggressive mitigation policy, GHG emission can rise rapidly due to rising energy demand; according to IEA's World Energy Outlook 2018, CO₂ emission in Southeast Asia can more than double current levels by 2040 under its Current Policies Scenario, whereas the increase in emission for the whole world is expected to be about 30%⁷. Southeast Asia is also a region which stands to benefit greatly from the declining cost of renewables and storage since a significant proportion of its citizens live in islands⁸ or off-grid areas⁹, which can be said as being suited for renewables-based electricity generation at the community level.

- It should be noted that Southeast Asia has abundant potential in renewables, and the region has a long history of exploiting it. Indonesia and Philippines together comprise about a quarter of world's geothermal generation, and nearly 10% of Thailand's electricity generation is derived from biomass. However, the region trails the rest of the world in terms of solar and wind, the two renewables whose growth has been dynamic. Solar generation in Southeast Asia is 0.5% of the total electricity generation of the region, significantly below the figure for the world (1.3%). This is despite the photovoltaic potential of the region being roughly comparable to that of central to southern Europe with much higher presence of photovoltaic generation¹⁰. Wind resources in the region are hardly exploited; the region's electricity generation from wind is just 0.2% of the region's electricity

⁶ Figures refer to the ten countries comprising ASEAN. Data taken for the year 2016 from IEA, 2018, CO₂ Emission from Fossil Fuel Combustion (except Lao PDR), CIA World Factbook (for Lao PDR)

⁷ IEA, World Energy Outlook 2018

⁸ Indonesia has 6,000 inhabited islands and more than 30 million live in islands other than the largest five (Java, Sumatra, Sulawesi, Kalimantan, Irian Jaya). Philippines has 2,000 inhabited islands and about 15 million live in islands other than the largest two (Luzon and Mindanao)

⁹ The electrification rates of Cambodia and Myanmar are reported to be 50% and 57%, respectively (<https://data.worldbank.org/indicator/EG.ELC.ACCS.ZS>, accessed 5 March. 2019).

¹⁰ See e.g. Global Solar Atlas (<https://globalsolaratlas.info/downloads/world>, accessed 5 March. 2019)



generation¹¹.

- Use of hydropower in the region is mixed. Large hydropower (above 10MW) comprise about 14% of the region's electricity generation, which is roughly on a par with the whole world. However, Small hydropower comprises only 0.2% of the region's electricity generation, much lower than the figure for the whole world (2.3%). The conspicuous absence of small-scale hydropower is rather unfortunate since the region is endowed with hydropower resources¹².
- Such a variety of renewables is highly desired, since they can complement each other. Hydropower can provide baseload, and biomass can adjust to fluctuations brought by solar. In much of Southeast Asia, precipitation shows a strong seasonal pattern. Here, solar and hydropower can complement each other.
- For some renewables, notably hydropower, geothermal and windpower, it is crucial that the project developers are assured of adequate resources. However, gathering such data takes time and effort. River flow can vary, especially in small rivers with seasonal rainfall pattern. Tapping geothermal resources need careful study as well as test wells to ensure that resource availability is stable. There are socioeconomic aspects as well since some resources (notably hydropower and biomass) may compete with other uses.
- To facilitate community-based renewable projects, it is essential that a concerted effort be taken to accumulate data on renewable resources, especially with respect to hydropower as fluvial water resources available for hydropower (seasonal fluctuation, head) are not well known, which makes small hydropower development in small communities on islands difficult. Information on other renewables, in

¹¹ Data on renewables taken from International Renewable Energy Agency (IRENA), Renewable Energy Statistics 2018.

¹² FAO Aquastat indicates that renewable water resources per inhabitant in much of Southeast Asia is equal to or more than 5,000m³/year (http://www.fao.org/nr/water/aquastat/maps/World-Map.TRWR.cap_eng.htm, accessed 5 March. 2019).



particular geothermal, wind and biomass resources also require a considerable time and effort to accumulate reliable information which can facilitate siting of renewable energy.

Suggestions on means to implement

- Such accumulation of data needs to be coordinated by national governments as well as development banks with a proven track record on power development in the region. In order to sustain the efforts, it is desirable that such data accumulation is carried out taking into consideration capacity building of existing government infrastructure on data collection.
- It is also desirable that such studies also cover societal aspects since they play a large role in determining the possibility of realizing the potential. Examples include water use characteristics and water rights (in the case of hydropower), competing uses for agricultural residues such as mulching and soil cover (in the case of biomass).

Proposal 2: Concerted efforts need to be taken with respect to capacity building, since provision of electricity needs considerable entrepreneurial skills.

Rationale

- Capacity building is also a key factor to disseminate business and management skills crucial to community-based renewable projects. Acquisition of land and water rights (in case of hydropower) may require dispute settlement; reaching agreement with customers / users need business acumen. In addition, there is a need for day-to-day management of matching demand with supply, as well as ensuring that equipments are properly kept and power outage is minimized. Such entrepreneurial skills are not likely to be developed by off-grid communities themselves, and require the expertise of multiple persons. Capacity building on these issues is also desirable from the viewpoint of inclusive growth, since it helps



enhance business skills of local communities.

Suggestions on means to implement

- Coexistence with large-scale power companies / transmission companies needs to be taken advantage, since community-based renewable generation can be beneficial to both grid / central electricity company as well as off-grid electricity providers, in that expanding to off-grid locations can be costly and cumbersome to large-scale power companies.
- Large power companies and microgrid technology firms can dispatch engineers (possibly retired persons) for capacity-building and even on-site management, in cooperation with the local community.
- Applications such as role-playing games are also being developed by innovative software engineers. Such games enable simulation of day-to-day management of electricity generation and provision, matching supply and demand¹³.

Proposal 3: It is desirable to explore novel ways of financing enabled by recent innovation of communication technology, in order to reach out to previously untapped customers.

Rationale

- Perhaps more so than many other projects, provision of adequate financing remains the key aspect of community-based renewable projects. While such projects do not have the risks due to sheer scale which hamper development of large power development projects, off-grid communities are not always equipped with banking infrastructure, and the intended customers of power often do not have a reliable credit history. Due to such characteristics, financial institutions tend to be cautious with investment in

¹³ An example of such role playing game is the Minigrid game (<https://www.enactpartners.org/the-minigrid-game>, accessed 5 March, 2019)



community-based renewable projects.

Suggestions on means to implement

- With the advancement of technology, various innovative methods of financing are being realized. Crowdfunding is beginning to be applied in renewable energy projects taking place in developing countries, not only as charity but as a means of investment¹⁴. Another notable trend is the use of mobile payment. This has taken root in Africa, where mobile telecommunication technology has rapidly developed, skipping landline phones in remote regions. There are examples of companies developing a proprietary platform of mobile payments for asset financing¹⁵. Advances in information and communications technology (ICT) enables investors reach out to previously untapped customers.
- While such novel financing methods preferred solar, which is modular and easily portable, they can be expanded to other forms of renewable energy or storage. It has to be said that legal framework on business conventions vary considerably across countries. It is therefore important to address the need for pioneering the innovative business models within the legislative frameworks of the different countries, where possible.

Proposal 4: Further efforts should be taken to harmonize policies to integrate renewable energy resources

Rationale

- Southeast Asia shows a unique form of regional cooperation despite differences in economies, cultures and languages. Harnessing renewable

¹⁴ Companies undertaking such projects are: Trine (<https://www.jointrine.com/>), The Sun Exchange (<https://thesunexchange.com/>), and Bettervest (<https://www.bettervest.com/en/>) (all accessed 5 March, 2019).

¹⁵ M-Kopa Solar (<http://www.m-kopa.com/>) is a pioneer of such efforts (accessed 5 March, 2019)



energy to meet multiple goals has been a target aimed by several countries in the region. It is expected that deployment of renewable energy to meet the Sustainable Development Goals (SDGs), set by the United Nations, notably SDG7 (energy), helps not only in terms of transformation towards a sustainable society, but also helps countries meet other key goals, including the SDGs on poverty alleviation, health, water, nutrition, cities and climate, through improvement in energy access and energy security.

Suggestions on means to implement

- As several projects and programs in the region have demonstrated, decentralized renewable energy solutions such as small hydropower, biogas and solar plants, when supported by local entrepreneurship and strong community participation, can greatly improve access to modern energy services, and enhance energy security provisions. Such solutions in turn bring about substantial economic, social, health and environmental benefits, which contribute to several of the SDGs.
- As the economy of the region grows, it is expected that there will be an increase in cross-border flow in business activities and human resources. Therefore, further harmonization of policies and standards in the Southeast Asian region is a key step to further accommodate renewable energy resources, and enhance efficient diffusion of equipment, technologies and business skills.

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