

## Electricity from the ocean: a path to secure energy in Southeast Asia?

Mary Ann Joy Quirapas<sup>\*</sup>, Srikanth Narasimalu, Michael Abundo, Htet Lin

*Wind and Marine Renewables, Energy Research Institute, Nanyang Technological University, Singapore*

### **Abstract:**

*This paper studies the significance of renewable energy in the light of finding alternative sources of energy for the Southeast Asia region. Specifically, it looks at the feasibility of a relatively niche renewable energy technology in the region which is the ocean renewable or marine renewable energy. This study looks at how much can ocean renewable contribute in securing energy (i.e. electricity) in the region.*

**Keywords:** *ocean renewable energy; energy security; Southeast Asian region; ocean renewable energy policies*

*\*Corresponding author. Tel.: +65 9759 1236, Fax: +65 6316 3195*

*E-mail address: mquirapas@ntu.edu.sg*

### **1. Introduction**

Southeast Asian region is faced with three main energy challenges or what they call as energy “trilemma” (Low, 2012) - a country needs 1) to provide energy security, 2) to have sustainable economic growth and 3) to take into consideration the environmental impact of development. Although the region is still highly depended to fossil fuels as energy source, it is realising the potential and advantages of using renewable energy as an alternative source of energy. Countries like the Philippines, Thailand, Indonesia and Malaysia have set out their long-term renewable energy targets which are reflected in their national energy plans while Singapore is determined to be a research and development centre for renewable energy in the region (Ipsos Consulting, 2012).

In terms of ocean renewable energy, there is a potential for it to be harnessed and utilised as an alternative source of energy. Most of the Southeast Asian countries are on different levels in terms of ocean renewable R&D, resources assessment and turbine development. However, similar to the other type of renewable energy, there are different economic and non-economic challenges that each country still has to face to fully take advantage of the opportunities that ocean renewable energy could provide.

This paper makes use of both preliminary and secondary data which are collated from the past and recent studies about ocean renewable energy in the region. The former are from personal interviews and discussions with the identified ocean renewable energy experts in Southeast Asia. The summary of the resource assessment of ocean renewables are from the previous works of the Energy Research Institute at NTU (ERI@N), Wind and Renewables team (reference cited in the bibliography).

### **2. Overview of Renewable Energy**

The medium-term outlook for renewables remains to be positive. According to IEA Report they could see the following trends for the renewable energy in the global market (van der Hoeven, 2013):

- Electricity generated from hydropower, wind, solar and other renewable sources is projected to scale up by 40% in the next five years
- The share of electricity from renewable will account for a quarter of the global power mix by 2018. This is a 20% increase from 2011.
- By 2016, global renewable electricity generation will overtake that of gas and be twice of that of nuclear. This makes renewable energy the second most important source of electricity after coal.

There are two main drivers according to the Mid-term Renewable Energy Report 2013 for the positive outlook for renewable energy in recent years – the use of renewable energy is “spreading out everywhere” (van der Hoeven, 2013) and renewable energy is being cost competitive in the market. In developed countries, the purpose for deploying renewables is energy security, climate mitigation and economic development; for developing countries like those in Southeast Asia, the main driver is the electrification target especially for rural areas. Renewable energy such as wind, hydro and solar PV energy could serve as off-grid solutions to rural communities thus providing basic rural energy needs (Olz and Beerepoot, 2010). For example, biomass is one main source of electricity for cooking (World Energy Outlook Report, 2013).

Although seen to have been positives trends, the renewable energy still faces challenges that it continuously tries to overcome – 1) that development of renewable energy is a lot lesser compared to what has been usually reported. In reality, “only 8 percent of global energy comes from renewable energy” (Byun n.d.). 2) There is also a difference between what has been pressed on as the overall category of renewable energy often projected to be used by countries – solar farms, wind turbines and other “aesthetically politically correct imagery” of renewables (Byun n.d., 151), versus what most of the countries, especially on developing ones, e.g. hydro and biomass which are considered to be the “backward burning of traditional biowastes and small dams or water mills” (Byun n.d., 151). 3) Renewable technologies to be a viable alternative investment still need to have specific subsidy policy for the feed-in-tariff or other policy instruments that would be helpful in encouraging investments. 4) There is still a debate on the real or perceived costs of economic incentives of renewable energy in the context of stagnating economic growth and energy demand in Europe. For some countries with a share of renewables in their grid, integration problems of wind and solar PV are also present and need to be addressed.

### **3. Case Study: Ocean Renewable Energy in Southeast Asia**

In the case of Southeast Asia, there are a number of on-going studies and activities that suggest the potential for utilization of ocean renewable energy (Quirapas et al., 2015). Indonesia, Malaysia, Philippines, Singapore and Vietnam have the most number of studies on ocean renewable energy resource availability. In terms of tidal energy, Indonesia has of 4.8 GW potential in practice, wave energy is 1.2 GW and OTEC is 43 GW (Ocean Energy Potential, 2012). Similarly, Malaysia is also looking at OTEC as one primary source of ocean renewable energy. The Universiti Teknologi Malaysia (UTM) has recently launched their OTEC Research Centre in KL and they are looking at Sabah as a potential site for OTEC studies (Yaakob, 2013). Philippines, on the other hand, is looking at tidal energy potential of 35 TWh/yr which is around 40 GW to 60 GW power potential (Buhali et al., 2012). In terms of wave energy, the pacific side has 33 kW/m/yr ocean renewable energy potential and from South China Sea side is 35 kW/m/yr (World Bank, Philippine Coastal and Marine Resources: An Introduction n.d.). Singapore has a positive indication of ocean renewable energy as well, in theory– around 250 MW extractable tidal energy has been studied and assessed on the Southern islands of the country (Abundo, 2012). For Vietnam, there is potential for tidal energy around 1,753 GWh/yr (barrage) (Pham, 2013).

For other countries in the region, studies are mainly in the theoretical potential of ocean renewable energy and yet to be applied in practice. For example, Brunei Darussalam has a 335 kW tidal energy potential in theory while 0.66 GW theoretical potential in wave (Malik, 2011). Cambodia, Myanmar and Thailand’s information on ocean renewable energy are quite minimal at the moment and are only focusing more on tidal height and range and not specific on energy potential; although there are dedicated institutions which continue to study the viability of ocean renewable energy in their countries (Port of Yangon, 2013; Bird, 2010) (Department of Alternative Energy Development and Efficiency n.d.). Laos is a land-locked country therefore no available data has been found about its

ocean energy potential.

### **3.1 Policy Opportunities and Challenges for Ocean Renewable Energy in Southeast Asia**

Around the globe, the policy tools that have been used in driving ocean renewables are regulation and standard policies, quantity instruments (specifically RPS and RECs) and price instruments (mainly fiscal incentives, public financing and feed-in-tariff) (Quirapas et al., 2015). In the case of Southeast Asia, the Philippines, Thailand and Indonesia have made ocean renewable energy either part of their energy mix or renewable energy roadmap. The Philippines has targeted to develop its first ocean energy facility by 2030. To achieve this, Philippine Council for Industry and Energy Research Development (PCIERD) had included ocean renewables in its renewable energy roadmap. Thailand, on the other hand, has a 2 MW target from wave and tidal energy. Ocean renewable energy has been part of Indonesia's energy mix through an amendment made on their National Energy Policy (i.e. Act No. 30 of 2007, Amendment of Presidential Decree No. 5). This paved way to the creation of Indonesian Ocean Energy Association (INOCEAN) which will be responsible in coordinating the tripartite efforts of the government, academia and industry in driving ocean renewables in Indonesia. Malaysia, like Indonesia, had set-up the National Oceanography Directorate (NOD) which will be the main body that will pursue all oceanographic and marine-related activities in the country. Present in Malaysia are different universities which are doing research and development, and prototyping of marine turbines. Together with these academic institutes, NOD is tasked to initiate the ocean renewable energy technology roadmap for the country (Quirapas et al., 2015).

Brunei, Cambodia, Myanmar Vietnam and Lao PDR have yet to formulate specific policy tools for the uptake of ocean renewable energy in their countries. These countries, however, have already mapped out their national renewable energy plans. Even in oil rich countries like Brunei, the government defines the "Brunei Vision 2035" which looks at energy efficiency, conservation and preservation of energy sources. Cambodia, on the other hand, has the Power Sector Strategy which encompasses the use of renewable energy for rural electrification among others. Similarly, Myanmar sets up its National Energy Policy of Myanmar which make use of renewable energy sources for the country's goal of energy independence. Vietnam Master Plan no. 6 for national energy development targets the share of renewable energy in the energy mix to be increased to 5% in 2020 and 11% in 2050. Lao PDR, although has yet to develop its comprehensive renewable energy policy, aims to increase the share of renewables to 30%, of which 10% of it is from biofuels for the transportation sector (Quirapas et al., 2015).

One of the main challenges in driving the ocean renewable energy in the region still lies on effective resource assessment. This can be observed with the differing levels of development in the ocean renewable energy research and development of each Southeast Asian country. The presence of institutes, universities and agencies specifically dealing with marine studies or ocean renewables makes a positive effect on the maturity of research work done in Indonesia, Malaysia, and Singapore. Brunei has been starting its efforts to look into marine renewables as a possible alternative (or complementary) to wind renewable energy. Thailand, on the other hand, specializes in ocean energy modeling and data collected are yet to be transformed into useful information for turbine development to be used in ocean renewable resource assessment. For some countries, the lack of expertise can also be a result of lack on information or means to be trained in such field. Substantial funding and financial support are needed to support local R&D for these countries and to be able to produce and further develop the expertise of ocean renewables in the region.

Another challenge is the existence of effective policy tool to push for ocean renewable energy. This dilemma is similar with other forms of renewable energy in the region (Quirapas et al., 2015). The

Indonesia, Malaysia and the Philippines have the most developed and concrete plan for ocean renewable energy however are still impeded by non-economic barriers like political stability, administrative hurdles in applying for feed-in-tariff, “inappropriate application of subsidies for certain types of energy” and maintenance of a stable socio-political environment which encourages more renewable or ocean renewable energy investors to come (Ipsos Consulting, 2012). The existence of high targets for renewable energy is a good start but its applicability should be accompanied by a detailed sound policy, guidelines and support from the government. For the rest of the countries, specific ocean renewable energy policy has yet to be developed.

With regard to technology development, most of the Southeast Asian countries are on its development stage (Quirapas et al., 2015). Prototypes and small-scale turbines are being developed and tested in the waters (Indonesia, Malaysia and Singapore). For some, various locations are being identified to be potential sites for resource assessment (Thailand and Myanmar).

#### **4. Conclusion**

There are opportunities and challenges for ocean renewable energy in Southeast Asian region just like the forms of renewable energy. There are ongoing activities, research works and even conferences and workshops that discuss the possibility of getting energy from the ocean. Some countries even have existing policy tools that could be helpful in driving the uptake of ocean renewables to secure the energy needs of the region. However, all of these efforts should be able to into consideration some of the crucial points that might impede in the development of ocean renewable technology in Southeast Asia (i.e. lack of information, expertise, facilities and funding), as well as the non-economic barriers.

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