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MARINE RENEWABLE ENERGY LEGAL FRAMEWORK IN MALAYSIA: A WAY FORWARD

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Abstract: Being a nation that is surrounded by seas, Malaysia is seen to have the potential to harness energy from the sea. At present, renewable energy is already considered to be an important focus within the country's low emissions strategy particularly through the enforcement of the Renewable Energy Act 2011. However, the scope of this Act is inadequate to include energy from the sea as it is confined only to eligible renewable energy sources under the feed-in tariff scheme. The objective of this paper is to highlight the legal and regulatory requirements governing marine renewable energy development in Malaysia particularly in sustainably capturing tidal and wave potential. As an alternative, this paper explores the viability of ocean energy as another source of renewable energy. The paper adopts a doctrinal approach and suggests some measures within the law and policy which when considered would help towards the development of marine renewable energy. The authors recommend for Malaysia to adopt the Nova Scotia's legal framework. This model could well be applied provided that there is a strong political will and policy drivers to achieve the national objectives in accelerating renewable energy sector, particularly from marine sources.

Keywords: South China Sea, environment, tidal energy, wave energy, and law of the sea.

Introduction

The oil crisis in the United States in 1973 has surely awakened many countries to secure their energy supply. Coupled with the scarcity of fossil fuels, climate change impacts and mounting energy demand for industrialization, several actions were implemented to respond to these issues. A preliminary measure was undertaken by nations to deal with these issues and the international conventions such as the United Nations Framework Convention on Climate Change 1992 (UNFCCC), the Kyoto Protocol to the UNFCCC and the Paris Agreement were adopted. Basically, these legal instruments were intended to promote climate change mitigation and as such, energy and sustainable development strategies were inextricably linked to these aims. One of the important facets of these instruments is renewable energy (hereinafter referred as "RE") generation which is considered to be a key player for mitigating climate change impacts, enhancing energy security, empowering the economic sector, and promoting sustainable development (Dolman & Simmonds, 2010; Ghazali *et al*., 2018).

While Malaysia progressively developed, there is great pressure for this country to pursue alternative energy in order to safeguard its depleting energy supply. Through the Seventh Malaysia Plan (1996-2000), the government has expressed its concern over energy security and has started to improve energy efficiency (EE) and to promote non-conventional sources, such as solar and hybrid systems that support electricity access for rural populations. Malaysia's commitment to developing RE for electricity generation was mainly entrenched by efforts to reduce dependency on fossil fuels, to resolve the increasing pattern of energy demands as well as to reduce greenhouse gas (GHG) emissions.

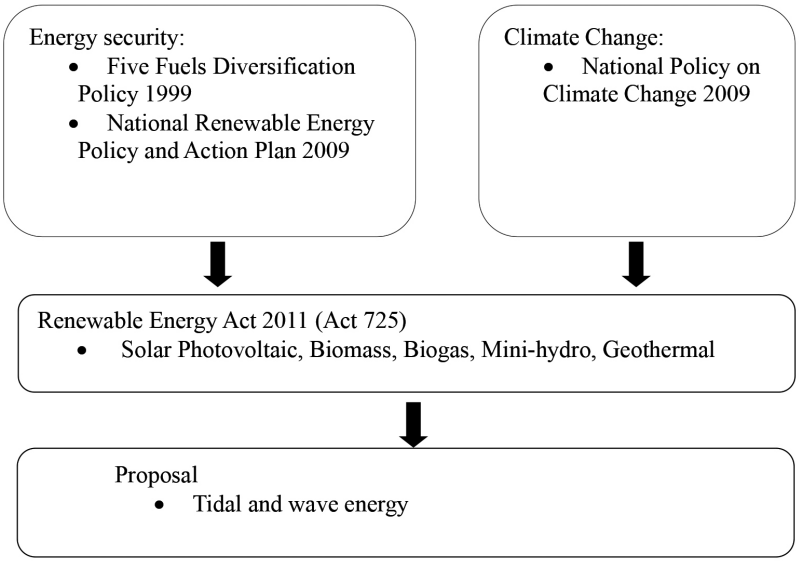

Figure 1: Conceptual Framework for Renewable Development in Malaysia

This is consistent with growing issues regarding climate change and energy security that the world's nations as reflected in Figure 1. The National Policy on Climate Change 2009 Malaysia indicated one measure to combat climate issues, which is through RE deployment especially in the power sector due to the reason that RE sources are environmentally friendly compared to the fossil fuels. This Policy's target is in line with Malaysia's pledges to cut carbon intensity by up to 45 percent by 2030, in accordance with the Paris Agreement.

In the context of Malaysia, achieving the RE targets and carbon reduction through renewables-based electricity generation requires a number of efforts including the need to amend the scope of the current law, the Renewable Energy Act 2011 to enable it to incorporate other eligible sources under the FiT scheme including tidal and wave energies. Malaysia, located near to the Equator and the South China Sea, comprises of two noncontiguous regions which make up the Peninsula and East Malaysia to be almost surrounded by water, except near the border of Thailand in the north and the border of Kalimantan, Indonesia in East Malaysia. Based on these geographical and topographical factors, Malaysia has an abundance of natural resources, both onshore and offshore that can be exploited for electricity generation.

Despite increasing social issues, Malaysia in recent years, has seen the successful development of renewable energy sector, particularly marine renewable energy, and has addressed problems on unemployment and youth migration. For instance, in Scotland, this sector provides the opportunity to explore a new and relatively unexplored area of economy. This breakthrough is expected to lead towards an effective ocean and coastal development and more activities are anticipated in future (Johnson *et al*., 2013). Environmental and energy security are important aspects that need to be considered in developing the marine renewable energy policy. Nevertheless, Allan *et al*. (2014) presented that the impacts on the country's economy are of extra importance in developing marine renewable energy. It appears in their study that the Scottish economy, especially in the coastal regions, has been enriched. Therefore, it is of critical importance to consider relocation and mobility of population and employment (Allan *et al*., 2014).

In an attempt to quantify the effects from energy insecurity and global carbon emissions, more sophisticated technologies have been

developed to maximize marine RE potentials which include from thermal and salinity gradients in the sea and bioenergy from algae. Incorporating advancement into the existing marine RE sector is another direction of research and development to commercialize marine RE sector. Such advancement should soon provide the power to deal with cost, energy storage, material and informatics as well as maritime governance. Much of the potential of the marine RE remains unexplored and warrant ongoing efforts to demand for a cost-effective and reliable techniques to supply human's needs through ocean energy (Borthwick, 2016). This study adopted a doctrinal approach through examination on related legislation and expected to deliver an overview of the prospect as well as challenges pertaining to marine RE development in Malaysia.

Renewable Energy Development in Malaysia

Prior to the enactment of the Renewable Energy Act 2011, Malaysia had a long history of renewables electricity generation programmes. Unfortunately, failure of one of the programmes namely, Small Renewable Energy Project (SREP) prior to 2009, has brought enormous reforms into the country's energy sector (Sovacool & Drupady, 2011). The Energy Commission Act 2001 (Act 610) defines renewable energy as being "energy which is not depleted when used, and includes energy obtained from energy sources such as biomass, hydropower, solar power, geothermal power, wind power, waves, and tides." As such, has abundant sources which were listed by the Energy Commission Act 2001, yet have not been fully exploited. The renewable resources are, "the recurring and non-depleting indigenous resources or technology as set out in the first column of the Schedule" and as defined in the RE Act 2011.

The National Renewable Energy Policy and Action Plan were promulgated in 2009 to resolve the failure of not achieving the target of 5 percent renewable energy within the energy mix. The crucial part of this policy has been to demonstrate the importance of utilizing renewable resources, especially to ensure a better environment in the future. As the policy has indicated several flaws of previous RE programme in Malaysia, the Renewable Energy Act 2011 was subsequently enacted to enable renewable energy generation as accommodated in a feed-in tariff (hereinafter referred as the "FiT") mechanism. As to date, the schedule of the Renewable Energy Act 2011 only provides the quota for FiT for biomass, biogas, mini-hydro, solar photovoltaic and geothermal. Table 1 shows the power generation in Malaysia according to RE sources from 2015 to 2018. Until 2018, there is no power generated from the geothermal energy, though it has been included into the RE Act, as an eligible source for FiT since 2015. Needless to say that all the listed REs in the Renewable Energy Act 2011 are only limited to inland energy sources. Since Malaysia is a maritime nation surrounded by sea, there is the potential to tap energy from the ocean. Nevertheless, Chong and Lam (2013) pointed toward Malaysia's limited effort to promote marine RE in the current RE law and policy.

Potential of Marine Renewable Energy in Malaysia

According to Chong and Lam (2013) there are several types of energy that could possibly be exploited from the ocean sources including the ocean tides, ocean waves, marine current

Table 1: Power Generation (MWh) of Commissioned RE Installations from 2015 to 2018

Year	Biomass	Biogas	Small Hydro	Solar PV
2018	242021.20	229570.50	65377.23	468209.55
2017	215826.50	266846.80	74831.27	432820.44
2016	87629.13	188137.00	49026.53	320051.42
2015	58111.05	210462.30	55406.38	264185.56

temperature gradient and salinity gradient. Tidal and wave energies stand among the potential marine RE sources that can possibly be developed in Malaysia with some modification of to the technologies are required to the local condition (Quirapas *et al*., 2014, Lim *et al*., 2015; Mohd Nasir & Abdul Maulud, 2016). Moreover, Behrouzi *et al.* (2016) indicated that rural areas which near to the ocean, especially in the East Malaysia, could prospectively self-generate electricity from hydrokinetic energy. Furthermore, metropolitan city like Kuala Lumpur could also extract energy from the ocean for the electricity generation through the Straits of Malacca (Chong & Lam, 2013). Besides, Hassan *et al*. (2012) have identified the availability of sources and technology for tidal turbine systems, which will benefit communities in remote and coastal areas as well and in islands.

Sarawak Energy Berhad has embarked on some feasibility studies on the potential of developing tidal energy in Sarawak in which locations include areas off Kuala Igan, off Kuala Rajang, off Tanjung Po, off Kuala Paloh, off Tanjung Sirik, off Kuala Miri, Bintulu Port, and Pulau Triso (Batang Lupar). Results showed that Pulau Triso (Batang Lupar) has a huge potential for harnessing tidal energy, due to the energy's sustainability and predictability. Correspondingly it was identified that in the North West region of the areas offshore of Sarawak, Kuching, and the middle region of Sarawak, including Siu and Mukah bear similar the potential of tidal streams (Sarawak Energy). Likewise, Tawau Sabah has also the potential to harness tidal energy for electricity generation (Samo, 2017).

Mohd Yusoff *et al*. (2015) has conducted a study on the potential of harnessing tidal energy through data obtained by the National Hydrographic Centre Malaysia in which revealed that Selangor has a better prospect to harness tidal energy compared with other locations in Malaysia. Meanwhile, Hassan *et al.* (2012) identified Pulau Jambongan, Kota Belud and Sibu as possessing bright prospect for tidal energy with expected electricity generation approximately 14.5GWh/yr. As in Table 2, Chong and Lam (2013) stipulated that tidal turbine has the greatest potential to be used in Malaysia especially in the Straits of Malacca. Other than that wave energy also possess a good prospect to be exploited, followed by the tidal barrage.

Other the hand, Tan *et al*. (2017) have studied wave energy potential in the Peninsula and Sabah through data obtained from Malaysia Meteorological Department where the data were attained from sea depth about 20m under the sea level and 5km from the shore. Based on their study, the wave-induced forces were formed on January, November and December. While weak waves were identified from May to August and May to October. However, they suggested that greater wave energy could be formed from a greater wavelength of the deep water wave in which is available in the deep water region. In addition, Bonar *et al*. (2018) have recommended the utilization of low-speed tidal turbines to support small-scale and off-grid system since this resource's potential is relatively small. However, their studies only focused on five sites along the Malacca Strait, without considering other coastal sites in Malaysia. Furthermore, according to Hayward *et al*. (2012) though the deployment of wave energy technology is vital in reducing carbon emissions, the technology is still limited and eventually not cost-effective,

Table 2: Potential of Marine Renewable Energy Technology in Malaysia (Chong & Lam, 2013).

Potential Level	Tidal barrage	Tidal turbine	Wave energy	OTEC power	Salinity gradient power
Low				✓	✓
Medium	✓		✓	✓	✓
High		✓	✓		

unlike wind and solar technologies which are commercially used worldwide and have succeed to achieve significant cost reductions.

As noted earlier, RE deployment contributes to several positive impacts on the environment especially in reducing carbon emission and this measure has been embraced by many countries to combat climate change. Similarly, marine RE denotes numbers of prospering returns to the environment and marine biodiversity as a whole. The installation of marine RE based technologies contributes to the habitat enhancement in which fishing and vessels are not permitted in the area, thus, attracting marine living populations to the protected area (Grecian *et al*., 2010). Apart from that, the infrastructure installed at the site will act as artificial reefs in which to enhance fisheries (Inger *et al*., 2009). Besides, Fadaeenejad *et al*. (2014) assure that marine RE, particularly wave energy has a significant impact to the tourism sector. Marine RE could assist in protecting and preserving the environment in the tourism focal points, especially the islands.

However, any interaction and interruption to the ocean would bring some adverse impacts to the marine environment. Nonetheless, there are still uncertainties as to these effects, since marine RE sector is still in the infancy stage. Yet, the development of marine RE sector is significant to mitigate the impacts of climate change, in line with Malaysia's promise to reduce carbon dioxide intensity in the atmosphere as embedded in the Paris Accord. Therefore, it is crucial to underpin science and technology to our legal system especially when related to the environment.

Law and the Interface of Marine Renewable Energy

Unlike the land, the ocean is a vast territory that requires diverse approaches to manage several aspects attached to it, which have been reflected in numerous international conventions. Towards endorsing the legal framework for the development of marine renewable energy in Malaysia, the starting point should be initiated from the international law of the sea. Understanding this will enable the policymakers to determine state jurisdiction over the ocean as well as rights and privileges in exploring and for exploitation and obligations of the ocean. Tracing back to the long history of the law of the sea, two contradictory principles were rooted in regulating human engagement with the ocean which are *Mare Liberium* (freedom of the seas) and sovereignty (Tanaka, 2008). *Mare Liberum* is rooted in the idea that this common resource should not be the subject of certain ownership and that its use should be unfettered. Sovereignty, on the other hand, signifies the extension state jurisdiction and therefore, shall deem to have control over its territory (Tanaka, 2008).

After a long history in ocean governance and tedious international law process taken place, the United Nations Convention on the Law of the Sea (UNCLOS) III was adopted in 1982 in which marks as the modern navigator for the ocean governance. Three aspects UNCLOS that are significant at the national level with the establishment of the Exclusive Economic Zones (EEZ), states responsibilities to protect and preserve the marine environment and common duty to address issues pertaining to marine governance (Wright, 2015). In Article 56 (1) of UNCLOS III, the coastal States are entitled to explore, to exploit as well as manage all forms of natural resources within the EEZ. The scope of such state to induce its sovereignty in such an area is not limited to fishing and marine biodiversity conservation, but also the escalating of another maritime activity such as marine renewable energy development projects.

As Malaysia acceded to UNCLOS III in October 1996, several legal frameworks were enacted to regulate all matters in relation to Malaysian sea water and the territorial sea. The Continental Shelf Act 1966 [Act 83] is the earliest legislation to regulate matters pertaining to the continental shelf and the exploration and the exploitation of its natural resources. Continental shelf was well defined in Section 2 in which "…the surface of which lies at a depth no greater than 200 meters below the surface of

the sea, or, where the depth of the superjacent waters admits of exploitation of the natural resources." Section 3 (1) of the Act also provides the rights to the explore and the exploit natural resources within the continental shelf conferred to the Federal Government.

Meanwhile, the Exclusive Economic Zone Act 1984 (Act 311) was formulated in pursuit of setting out the exclusive economic zone (EEZ) for the territorial sea to the extent of two hundred nautical miles from the baselines. Provisions under this Act vested the power to the government in exercising its sovereign rights to manage all forms of natural resources of the seabed, the subsoil, and the superjacent waters. Section 4 of this Act provides extensive liberties in employing such area for wide-ranging activities including formation of artificial islands and installations, marine research, preservation of the marine biodiversity as well as energy generation from the water, streams, and winds. The law also prohibited any activity within the EEZ or continental shelf including exploration or exploitation of natural resources. Act 311 Malaysia's ratification over UNCLOS and proclamation of the EEZ were well crafted through Act 311, in which empowers Malaysia to exercise sovereign rights over the water territory for resource exploration and exploitation, inter alia, preserve the marine environment. Thus, in the context of marine RE development in Malaysia, the existence of the EEZ could expedite the efforts taken to embark on such projects in the future by abridging the management of the water territory.

Another important legislation pertaining to the development of marine RE in Malaysia is the Baselines of Maritime Zones Act 2006 (Act 660) which was promulgated ten years after ratifying the UNCLOS. This piece of law is vital in determining baselines, as set out in the UNCLOS which imposes the limits of each maritime zone and for delimitation of maritime boundaries between coastal states. On the other hand, the Territorial Sea Act 2012 (Act 750) determines the limits of territorial sea to 12 nautical miles from the breadth of the territorial sea as embedded in Section 3 (1) except for Sabah and Sarawak, in which not exceeding three nautical miles from the low-water line as embossed in Section 3 (3) of the same Act. No provision in these two laws discusses matters directly connected to the development of marine RE yet they are essential in safeguarding any marine activity in the interests of national security. In the absence of a specific Act to explicitly render a specific area of marine RE development in Malaysia, marine spatial planning or ocean zoning shall be deemed important in coordinating the direction of this project without obscuring other activities in the EEZ (Wright, 2014; Yates *et al.*, 2015;).

A Way Forward

The Federal Constitution defines the functions of federal and state governments, as stated in Article 74, and in the ninth schedule of the constitution. Any matter that can be legislated by the federal government comes under the federal list, and any matter legislated by the state government comes under the state list. Under Paragraph 11 (c) there is List I of the Ninth Schedule Federal works and power, which includes electricity, gas and gas works, and other works regarding the production and distribution of power and energy. Meanwhile, matters related to both forms of government fall under the concurrent list. Nevertheless, Sabah and Sarawak have been granted additional power under List IIA, as part of their agreement to enter into the Federation of Malaysia in 1963.

The Renewable Energy Act 2011 is the primary legal regime in supporting RE development in Malaysia by catalysing the feed-in tariff scheme. The schedule to the legislation has listed solar photovoltaic, biomass, biogas, mini-hydro and geothermal as eligible sources under this scheme. The Act is absent from discussing matters related to marine RE therewithal. However, Lim *et al*. (2015) have proposed FiT rate to support marine RE development in Malaysia. He added that the rates are expected to be higher than the current eligible sources under the Act due to the fact that marine RE technologies are more expensive (Lim *et al*., 2015). Nevertheless, the dependency

on a specific RE support scheme may not able to assist in accelerating and increasing renewables-based generation (Ghazali *et al*., 2018). The limited scope of the RE Act 2011 is potentially hampering the development of RE in Malaysia as it only focuses on the implementation of FiT and to support solar PV generation at small scale generation (Ghazali & Ansari, *et al*., 2018).

Beside the RE Act 2011, the Electricity Supply Act 1990 (Act 447) plays a significant role in supporting RE development in Malaysia, as it regulates the electricity supply sector, electricity tariff, and the licensing and monitoring of any electrical installation, plant, and equipment, with respect to matters related to the use of electricity in which subject to Part VI of the Act. Section 10 and Section 11 of the Act stipulate that matters include the licensing and registration of installations, inspection and construction on the land by the authority, as well as establishing, regulating, maintaining, repairing and removing supply lines. This legislation also empowers distribution licensees to determine tariffs for electricity, according to the manner prescribed in Section 26 of the Act, with a written approval from the respective minister. Nevertheless, no provision in this law has indicated licensing requirement, installation and construction for marine-based activities, therefore, marine license provisions should explicitly be incorporated in the Act in order to support marine RE development in Malaysia.

In respect of RE governing bodies in Malaysia, the Energy Commission (hereinafter referred as "EC") has a dynamic function in governing the country's energy sector. This statutory body was incorporated under the Energy Commission Act 2001 (Act 610) which took over the roles of the Department of Electricity and Gas Supply. Act 610 empowers the EC in regulating matters embedded in the Electricity Supply Act 1990 and the Gas Supply Act 1993. Section 14 of the Act extends the functions of the commission to promoting energy efficiency in electricity usage and gas supplies and deploying renewable energy in Malaysia. Section 2 of the same Act has defined waves and tides as among RE sources. Thus, this Commission has a significant role in marine RE development in Malaysia.

Apart from the EC, Sustainable Energy Development Authority (hereinafter referred as "SEDA") is another key regulatory for RE development in Malaysia. SEDA was established through the Sustainable Energy Development Authority Act 2011 (Act 726), in order to promote RE through the implementation of FiT. Section 15 of the SEDA Act indicate the roles of this Authority pertaining to sustainable energy laws in Malaysia, which comprises the functions to advise the related minister, to promote and to implement laws and policies relating to RE. The Act further defines sustainable energy laws as:

"(a) this Act and any subsidiary legislation made under this Act;

(b) the Renewable Energy Act 2011 and any subsidiary legislation made under the Renewable Energy Act 2011; and

(c) any other legislation under which the Authority is to exercise any function, including any subsidiary legislation made under such legislation."

This Authority is also responsible for stimulating RE and EE business and technology, as well as educating and creating awareness of the public on the sustainability and RE as the energy solutions. Apart from that, SEDA has successfully obtained many national and international funds and collaboration to support RE and EE programmes in Malaysia. Nevertheless, the laws stipulated above are absent in discussing matters pertaining to marine RE development. Again, the roles and powers of SEDA as postulated in Section 15 and Section 16 indicate the competency of SEDA in promoting marine RE development in Malaysia as SEDA is empowered with a wide jurisdiction over sustainable energy management of the country, including matters that link climate change and energy. Conversely, a study by Abdul Rani *et al*. (2017) on the ocean thermal energy conversion technology (OTEC) suggested that a specific agency should regulate all matters

connected with OTEC activities. They have made a reference to the roles of PETRONAS in petroleum development in Malaysia. However, this idea is not accurate as PETRONAS was incorporated under the Companies Act 1965, therefore the roles of PETRONAS are different from the EC and SEDA.

However, as already mentioned, one of the main stumbling blocks encountered in developing RE from marine resources is that of the scope of the existing law. Currently, the scope of Renewable Energy Act 2011 is limited as it is confined to the implementation of FiT for the purpose of RE generation. It is suggested that the tidal and wave energy should be eligible under the FiT scheme as in the existing law. Having done so, the country's energy portfolio could be diversified and SEDA will have jurisdictions over the matters. Nevertheless, in the case of no amendment made to include tidal and wave energies into the schedule of the RE Act, an alternative support scheme should be introduced to support marine RE development in Malaysia. For instance, the Net Energy Metering (NEM) and a Large-scale Solar (LSS) Photovoltaic Plant which deploys auctions and regulated by the EC.

Legal and Regulatory Control

Legal and regulatory measures are the prerequisites for the development of marine RE especially in Malaysia. Through these measures, risks which might occur during the commissioning, operation and decommissioning stages of the marine RE projects could be reduced. Similar to the inland RE as stipulated in the RE Act 2011 and the Electricity Supply Act, a distinctive regulatory control should clearly have indicated in related laws to which the effects of these controls are enforceable. It must be noted that, the execution of marine RE projects are multifaceted compared to the inland RE. Marine RE projects will involve both the terrestrial and marine realms, thus, cooperation between state and federal governments are required. Framework related to marine protected areas and EEZ may not adequate. Therefore, marine spatial planning will step in. Notably, to support the development of marine RE, involvement of a wide range of stakeholders including the public, industries especially fisheries and tourism, navigation and conservation entities is needed.

It has been suggested that the RE Act 2011 and the Electricity Supply Act 1990 did not fulfil their potential in respect of permitting marine renewables-based generation in Malaysia since no provision in these two legislations have discussed matters pertaining to marine RE. Unlike inland RE generations, marine RE requires a comprehensive regulatory system as this technology is relatively expensive. But it is entangled with issues pertaining to grid connection. Thus, an amendment to the existing laws is required especially in the selection of the support scheme and as to whether FiT is applicable for marine RE and the licensing requirements including proposed installation's distance from the baseline.

Generally, marine RE development in Asia is in its infancy and somehow limited by technological advancement. Countries with advanced technologies like Japan have itemized marine RE as a part of The Third Basic Plan on Ocean Policy. In 2019, the Japanese government allotted offshore wind power in the Act of Promoting Utilization of Sea Areas in Development of Power Generation Facilities Using Maritime Renewable Energy Resources. While, the Chinese government along with the 2009 Renewable Energy Law of the People's Republic of China and the China 13th Ocean Energy Development Five-Year Plan, have extended strategies for the development of a wide range of marine RE source.

On the other hand, marine RE has been even more technologically advanced in Europe. In recent years, many laws and policies have been developed to expand this sector. The Offshore Renewable Energy Development Plan (OREDP) was initiated to manage Ireland's offshore RE sources in 2014. Whereas Germany has expanded its RE portfolio in the Renewable Energy Sources Act by concentrating on

a market-based approached for electricity, particularly from offshore wind. Other European countries like France, Belgium and Italy have adopted a plethora of measures to exploit marine RE sources despite the absence of a specific law for marine RE.

Of all the legal measures discussed in this section, a good example of marine RE law which Malaysia could possibly learn is from the Canadian Marine Renewable-energy Act (Chapter 32 of the Acts of 2015) (Amendment 2017). This Nova Scotia's legislative framework was enacted to support the marine RE development in Canada, particularly Nova Scotia. This framework provides an advancement of state-of-the-art and a reference to this Act is needed in order to provide a comprehensive reference before embarking onto marine RE projects for the purpose of electricity generation in Malaysia. The establishment of the Act is in line with Canada's target to deployment 100 percent renewables sources by 2050.

Section 2 of the Act outlines the purpose of this Act which is "to provide for the responsible, efficient and effective development of marine renewable-energy resources…". There are several distinctive features of the Act which are the establishment of areas of marine RE priority and its plan (Section 10 and Section 11), marine renewable electricity areas (Section 13), the requirement for a public consultation prior to the establishment of marine renewable-electricity area and its related (Section 18 and Section 19), feed-in tariff (Section 30), and last but not least, renewables power purchase agreement (Section 49A). These provisions are essential to ensure the success of marine RE development in a country where a guaranteed access to the local electricity grid with the renewables power purchase agreement and implementation of FiT encourages the development of marine RE by guaranteeing a rate per kilowatt hour for each unit of energy injected to the grid.

This current algorithm can increase the deployment of marine RE resources including waves, tidal, ocean currents and offshore wind as well as well replacing the conventional ones. Both federal and provincial governments are responsible to manage and monitor marine RE development in Nova Scotia. Then, the Nova Scotia Federal-Provincial One Window Committee on Tidal Energy was set up to play a central and critical role in coordinating every process involved in marine RE activities. Although marine RE projects is regulated by Marine Renewable-energy Act (Chapter 32 of the Acts of 2015) (Amendment 2017), each marine RE project is also subject to other legislation, as follow:

1. Canadian Environmental Assessment Act 2012;
2. Canadian Environmental Protection Act 1999;
3. Fisheries Act;
4. Migratory Birds Convention Act;
5. Navigable Waters Protection Act; and
6. Species at Risk Act.

Unlike land, exploitation of seascape and its resources are governed by both national legislation and international laws. Thus, there has been an increased recognition that marine RE occupation on physical marine space would greatly augment conflicts including rights to fishing and navigation and rights of communities and existing marine users. In Canada, aboriginal rights over marine energy remain equivocal. The resurgence of interest in this arena has led to a study related to tidal energy development and rights of the aborigines on marine resources (Kerr *et al.,* 2015). Notwithstanding such claims, the Nova Scotia Marine Renewable-energy Act has explicitly required the establishment of areas of marine renewable energy priority as in Section 10 and Schedule A is subject to public consultation as per Section 18 of the said Act. Section 19 (3) requires a report on resource potential, socio-economic and environmental factors that are linked to the project to be produced. Kerr *et al.* (2015) suggested that initial, transparent and all-inclusive consultation process is indispensable and may alternatively offer a responsible marine RE development between power producers and communities.

Meanwhile, Todd (2012) has addressed the inadequacy of the establishment of marine RE project sites without taking into account the route for the cables to shore (Todd, 2012). Herein, the Nova Scotia law on marine RE has specifically deliberated on the establishment of both grand and petite passage marine renewable-electricity areas accordance to Section 15 and 16 respectively. Notably government policies to support deployment of marine RE sources and a comprehensive legal framework are crucial to accelerate the development of marine RE. The law makers need to consider that technology is advancing ahead of policy and legislation. Hence, the policy needs to be flexible and warrants the weighing scale between sustainability and exploitation of resources. The authors are of the opinion that this Nova Scotia's law on marine RE is a comprehensive guideline in supporting small-scale and large-scale deployment of marine RE along with effective management of impacts on the environment and conflicts. relating to human use.

Conclusion

The underlying basis of marine RE development is diverse from other inland RE sources. A specific ocean zoning, licensing and installation requirements are vital in determining the direction of marine RE development in Malaysia. In the reflection of the appraisal of the Renewable Energy Act 2011 and the Electricity Supply Act 1990 (Act 447), a substantive reform is required as to ensure the legislation is appropriate for the context of marine RE developments. The application of the Renewable Energy Act 2011 is limited to inland resources and the implementation of FiT to facilitate the deployment of RE for electricity generation. Diversifying RE sources is important in the context of energy security and climate change mitigation, in virtue of the National Renewable Energy Policy and Action Plan 2009 and the National Policy on Climate Change 2009.

The Nova Scotia's Marine Renewable Energy Act 2015 has set a good illustration for Malaysia's reference in promulgation a similar legal framework henceforward. Despite numerous measures have been taken to promote RE for the electricity generation, Malaysia is still hesitated to harness the energy from the ocean predominantly due to the high cost. Nevertheless, it is time to turn the table as this new sector has emerged in recent decades as a promising technology to exploit and commercialize the resources from the ocean. With the emergence of technology, it is possible to cut production costs and will also induce significant investments from large corporations. Therefore, a good overview of existing approaches by successful countries as well as an effective legal framework will facilitate the development and sustainable deployment of marine RE technologies and increase investor confidence in supporting and commercializing the project.

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References

Allan, G. J., Lecca, P., McGregor, P. G., & Swales, J. K. (2014). The economic impacts of marine energy developments: a case study from Scotland. *Marine Policy*, *43*, 122-131.

Annual Power Generation (MWh) of Commissioned RE Installations. (2018). http://seda.gov.my/?omaneg=000101000000010101010001000010000000000000000000&s=161.

Behrouzi, F., Nakisa, M., Maimun, A., & Ahmed, Y. M. (2016). Global renewable energy and its potential in Malaysia: A review of Hydrokinetic turbine technology. *Renewable and Sustainable Energy Reviews, 62*, 1270-1281.

Bonar, P. A., Schnabl, A. M., Lee, W. K., & Adcock, T. A. (2018). Assessment of the Malaysian tidal stream energy resource using an upper bound approach. *Journal of Ocean Engineering and Marine Energy*, *4*(2), 99-109.

Borthwick, A. G. (2016). Marine renewable energy seascape. *Engineering*, *2*(1), 69-78.

Chong, H. Y., & Lam, W. H. (2013). Ocean renewable energy in Malaysia: The potential of the Straits of Malacca. *Renewable and Sustainable Energy Reviews*, *23*, 169-178.

Dolman, S., & Simmonds, M. (2010). Towards best environmental practice for cetacean conservation in developing Scotland's marine renewable energy. *Marine Policy, 34*(5), 1021-1027.

Fadaeenejad, M., Shamsipour, R., Rokni, S. D., & Gomes, C. (2014). New approaches in harnessing wave energy: With special attention to small islands. *Renewable and Sustainable Energy Review*s, *29*, 345-354.

Ghazali, F., & Ansari, A. H. (2018). The Renewable Energy Act 2011: A Study on Renewable Energy Development in Malaysia. *International Journal of Law, Government and Communication*, *3*(7), 143-151.

Ghazali, F., Mustafa, M. & Wan Zahari, W. M. Z. (2018). Tarif galakan bagi pembangunan tenaga boleh baharu di Malaysia: Suatu kajian perundangan tenaga baharu 30 KANUN (2), 313-338.

Grecian, W. J., Inger, R., Attrill, M. J., Bearhop, S., Godley, B. J., Witt, M. J., & Votier, S. C. (2010). Potential impacts of wave-powered marine renewable energy installations on marine birds. *Ibis*, *152*(4), 683-697.

Hassan, H. F., El-Shafie, A., & Karim, O. A. (2012). Tidal current turbines glance at the past and look into future prospects in Malaysia. *Renewable and Sustainable Energy Reviews*, *16*(8), 5707-5717.

Hayward, J., Behrens, S., McGarry, S., & Osman, P. (2012). Economic modelling of the potential of wave energy. *Renewable Energy*, *48,* 238-250.

Inger, R., Attrill, M. J., Bearhop, S., Broderick, A. C., Grecian, W. J., Hodgson, D. J., . . . Godley, B. J. (2009). Marine renewable energy: Potential benefits to biodiversity? An urgent call for research. *Journal of Applied Ecology*.

Johnson, K., Kerr, S., & Side, J. (2013). Marine renewables and coastal communities—Experiences from the offshore oil industry in the 1970s and their relevance to marine renewables in the 2010s. *Marine Policy*, *38*, 491-499.

Kerr, S., Colton, J., Johnson, K., & Wright, G. (2015). Rights and ownership in sea country: implications of marine renewable energy for indigenous and local communities. *Marine Policy*, *52*, 108-115.

Lange, M., Page, G., & Cummins, V. (2018). Governance challenges of marine renewable energy developments in the US–Creating the enabling conditions for successful project development. *Marine Policy*, *90*, 37-46.

Lim, X., & Lam, W. (2014). Public Acceptance of Marine Renewable Energy in Malaysia. *Energy Policy*, *65*, 16-26.

Lim, X., Lam, W., & Hashim, R. (2015). Feasibility of marine renewable energy to the Feed in Tariff system in Malaysia. *Renewable and Sustainable Energy Reviews*, 49, 708-719.

Marine Renewables Canada. (2018). 2018 State of the Sector Report: *Marine Renewable Energy in Canada*. https://tethys.pnnl.gov/sites/default/files/publications/MRC-State-of-the-Sector-2018.pdf

Nasir, N. A., & Maulud, K. N. (2016). Wave power potential in Malaysian territorial waters. *IOP Conference Series: Earth and Environmental Science,37*, 012018.

Quirapas, M. A., Lin, H., Abundo, M. L., Brahim, S., & Santos, D. (2015). Ocean renewable energy in Southeast Asia: A review. *Renewable and Sustainable Energy Reviews, 41*, 799-817.

Rani, M. H., Jaafar, A. B., Yusof, M. F., Mahdzir, A. M., Awang, A. A., Shaukat, S., & Hassan, H. A. A. (2017). Legal considerations on OTEC renewable energy deployment in Malaysia. *Journal of Science, Technology and Innovation Policy*, *3*(1).

Salcedo, E. (2019). Marine Renewable Energy Law and policy in the bay of fundy: The impact of ambiguous domestic boundaries in Canada on nova scotia's regulatory framework. *Ocean and Costal Journal,* 24, 1.

Samo, K. A., Rigit, A. R., & Baharun, A. (2016). Mapping of tidal energy potential based on high and low tides for Sabah and Sarawak. *MATEC Web of Conferences, 87*, 02007.

Sovacool, B. K., & Drupady, I. M. (2011). Examining the small renewable energy power (SREP) Program in Malaysia. *Energy Policy*, *39*(11), 7244-7256.

Tan, W. C, Chan, K. W and Ooi, H. (2017). Study of the potential of wave energy in Malaysia. AIP Conference Proceedings 1865, 080007.

Tanaka, Y., (2008). *A Dual Approach to Ocean Governance: The Cases of Zonal and Integrated Management in International Law of the Sea*, Ashgate Publishing.

Todd, P. (2012). Marine renewable energy and public rights. *Marine Policy*, *36*(3), 667-672.

Wright, G. (2014). Strengthening the role of science in marine governance through environmental impact assessment: A case study of the marine renewable energy industry. *Ocean & Coastal Management, 99*, 23-30.

Wright, G. (2015). Marine governance in an industrialised ocean: A case study of the emerging marine renewable energy industry. *Marine Policy, 52*, 77-84.

Yates, K. L., Schoeman, D. S., & Klein, C. J. (2015). Ocean zoning for conservation, fisheries and marine renewable energy: Assessing trade-offs and co-location opportunities. *Journal of Environmental Management, 152*, 201-209.