Other potential emerging offshore wind markets in Asia-Pacific

2019

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Executive summary

Markets with potential for offshore wind development in Asia-Pacific and not covered separately in our emerging markets offshore wind report series include Bangladesh, Malaysia, Singapore, and Thailand. None have concrete offshore wind plans, but intentions have been made known in the public domain. An interesting consideration for Singapore and Thailand is that companies from the two countries are already involved in other offshore wind markets in Asia-Pacific as well as Europe. Such companies, including Malaysian companies, are expected to lead the diversification into offshore wind in the emerging regional markets before their governments come up with concrete offshore wind plans for their respective home markets.

Private image by Thomas Poulsen

This *Other potential emerging offshore wind markets in Asia-Pacific* (the Report) is part of a series of reports on the global emerging offshore wind markets. The reports have been crafted by the Panticon team during the months of October through May, 2019 to mark the new name of the management consulting company. Panticon is particularly strong in the Offshore Wind and Logistics sectors within the three core disciplines of Strategic Management Advisory, Mergers & Acquisitions, and Market Research & Analysis.

The Report has been created using an extensive library of data sources (see Reference section). The main data sources used as the basis for the Report were made up of 500+ pages and mainly consisted of various publications by government related organisations, academic journal articles, offshore wind industry articles, and press releases by firms across the offshore wind market supply side as well as demand side.

The Report contains forward-looking statements, which by their very nature, address matters that are, to different degrees, uncertain as they pertain to the future. These, or any other uncertainties, may cause the actual future results to be materially different than those expressed in the forward-looking statements as contained within this Report. At Panticon, we do not undertake to update our forward-looking statements, nor do we assume any liability for actions or dispositions made by firms, organisations, and/or individuals based on information contained in this Report.

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Image: Map from Google Maps/cropped

Table of contents

Executive summary 3

List of abbreviations 7

1. Singapore 8

Executive summary. 8

1.1. Introduction 8

1.2. Project owners and developers 9

1.2.1 Development and consent lifecycle phase 9

1.3. Local offshore wind supply chain 10

1.3.1. Sub-sea and other structures 10

1.3.2. Construction of installation vessels 11

1.3.3. Installation activities 11

1.3.4. Construction of wind farm support vessels 12

1.3.5. Wind farm support activities 12

1.3.6. Other 13

1.4. Conclusion 13

2. Thailand 14

Executive summary 14

2.1. Introduction 14

2.2. Project owners and developers 14

2.3. Local offshore wind supply chain 15

2.4. Conclusion 15

3. Bangladesh 16

4. Malaysia 16

5. Conclusion 17

References 18

List of abbreviations

ASEAN	Association of South East Asian Nations
CTVs	Crew transfer vessels
GW	Giga-Watts
JV	Joint-venture
MW	megawatts
MoU	Memorandum of Understanding
NTU	Nanyang Technological University
O&G	Oil and gas
OWF	Offshore wind farm
REIDS	Renewable Energy Integration Demonstrator – Singapore
WFSVs	Wind farm support vessels

1. Singapore

Executive summary

Located near the equator and with limited land available, solar energy is the most commercially viable renewable energy form for Singapore. However, the government has announced plans for Singaporean companies to be active in offshore wind as well as plans for Singapore to embrace offshore wind domestically. Several government-owned companies with links to the sovereign wealth fund, **Temasek**, are in the forefront of diversifying into the offshore wind industry. In addition, other local companies are getting involved in offshore wind across Asia-Pacific as well as in Europe. Such companies also include conglomerates from other countries listed on the Singapore exchange. As at end of April 2019, no concrete plans or targets for offshore wind diffusion exist in Singapore.

1.1. Introduction

Singapore has limited renewable energy options. It lacks hydro resources while geothermal energy is not economically viable. Solar energy remains the most commercially viable renewable energy option. Singapore lacks land for onshore wind development and accordingly, it has been looking to the sea for power generation, including wave, tidal and offshore wind energy, although its wind speeds and mean tidal range are low. In recent years, Singapore has indicated intentions to embrace offshore wind.

- In October 2014, Japan's classification society **ClassNK** announced the launch of a new feasibility study for a new marine renewable energy testing facility to be built in Singapore, the world's first marine renewable energy testing facility to be located in the tropics. In February 2015, **ClassNK** and Singapore's **Maritime and Port Authority** signed a Memorandum of Understanding (MOU) to promote research and development and innovation in the maritime industry including marine renewable energy. Two months later, **ClassNK** established the **Global Research and Innovation Centre** in Singapore which focuses on maritime technologies and marine renewable energy.
- In December 2014, France's **Alstom** (**GE Renewable Energy** since November 2015) and Singapore's **Nanyang Technological University** (**NTU Singapore**) announced a collaboration to design, develop and deploy MicroGrid Power Mix Management solution in the context of the Renewable Energy Integration Demonstrator – Singapore (REIDS) initiative. The REIDS initiative includes the construction of a microgrid to manage and integrate electricity generated from multiple sources including solar, wind, tidal, diesel, as well as energy storage and power-to-gas solutions.
- In February 2018, four Singapore organisations partnered with China's **Envision** to develop an innovation ecosystem to facilitate digitalisation of the energy infrastructure.
    - **NTU Singapore**: collaboration to explore innovative and sustainable energy solutions (building load forecasting, battery management system, and integrating **Envision**'s EnOS™ platform into NTU's Eco Campus plans)

- **Ascendas-Singbridge**: collaboration to develop smart building solutions with **Envision**'s EnOS™ IoT Platform and ecosystem
- **Sunseap Group**: collaboration to develop an IoT platform to optimise **Sunseap**'s existing and future portfolio of solar PV rooftop, ground-mounted and floating projects vin Singapore and Asia-Pacific
- **Solar Energy Research Institute of Singapore**: collaboration to improve **Envision**'s EnOSTM platform with a focus on weather predictions as well as other potential R&D activities

- In February 2018, Singapore's **Ministry for Trade and Industry** reiterated the country's intentions to maintain its role as a major player in the global marine and offshore engineering industry by diversifying into new growth areas including offshore renewables in the Marine & Offshore Engineering Industry Transformation Map.

Meanwhile, Singapore's companies are increasingly involved in offshore wind abroad – both in Europe and in Asia. The involvement was initially in vessel construction and has now expanded into offshore wind farm (OWF) development and ownership.

1.2. Project owners and developers

In October 2016, Singapore-based upstream energy company **Enterprize Energy**, via wholly-owned subsidiary **Yushan Energy**, and Canada's **Northland Power Inc.** launched an inaugural OWF project in the Taiwan Strait, the Hai Long OWF project, with respective shares of 40 per cent (%) and 60%. Taiwan's **Bureau of Energy** has awarded 1044 megawatts (MW) of the project in the April 2018 and June 2018 rounds. In June 2018, **Enterprize Energy** sold half of its 40% stake in the Hai Long OWF project to Japan's **Mitsui & Co**.

Enterprize Energy is already looking beyond Taiwan. In January 2018, **Enterprize Energy** and compatriot **Renewable Energy Global Solutions**, Vietnam's **PetroVietnam** consortium comprising **Petroleum Equipment Assembly & Metal Structure** and **VietSovPetro**, Danish-Japanese offshore turbine maker **MHI Vestas Offshore Wind** and Norway's **DNV GL**, formed an alliance to develop multi-phased, utility-scale wind projects offshore Southern Vietnam.

1.2.1. Development and consent lifecycle phase

Offshore marine and engineering consultancy **Aqualis Offshore**'s Singapore office performed work for **Petrofac** on the BorWin gamma topside off the German coast in the North Sea. The scope included preparation of technical specifications for the supply of the leg mating units and deck support units, technical support during the procurement process, review of engineering documents from suppliers, and monitoring of the various stages of the fabrication process.

In June 2017, Orkney-**based** marine energy consultancies, **Orcades Marine Management Consultants Limited**, and **Aquatera** formed a Singapore-based partnership with local company **OceanPixel** to provide marine operations planning, management and verification services. The primary focus of the new company, **Orcades Marine Asia Pte Limited**, is to provide operational management of marine

renewable energy installations, including tidal, wave, floating solar and offshore wind.

Meanwhile, **Maersk Training**, an independent **A.P. Moller-Maersk** company (Denmark) that specialises in courses for the offshore sector, including the offshore wind industry, has a training centre in Singapore.

1.3. Local offshore wind supply chain

Singaporean companies are mostly active in the installation and commissioning lifecycle phase of an offshore wind farm.

1.3.1. Sub-sea and other structures

Singapore's shipbuilding industry offers potential for sub-sea structure manufacturing. The country is already involved in sub-sea structure manufacturing.

- In January 2012, **Keppel Corporation Limited**, via wholly-owned subsidiary **KV Ventus B.V.**, entered into a share purchase and subscription agreement and shareholders' agreement to acquire a 49.9% stake in Norway's offshore wind turbine foundation designer **OWEC Tower AS. Temasek Holdings** (**Temasek**), a Singapore sovereign wealth fund, has 20% shares in **Keppel Corporation Limited**.
- In September 2012, **Sembcorp Marine** acquired UK marine fabricator **SLP Engineering** (**SLP**) to form **Sembmarine SLP**. **Sembmarine SLP**, now 100% owned by Sembcorp Marine, is primarily engaged in the design and construction of offshore substations for OWFs. In October 2014, it was awarded a contract to deliver the offshore transformer station (OTS) for the UK's 402MW Dudgeon OWF. **Temasek** is the ultimate holding company of **Sembcorp Marine.**
- Anchors for the Kitakyushu floating offshore wind demonstration project in Japan were fabricated at **Mooreast**'s facility in Singapore.
- In December 2016, Norway's **Imenco AS** launched a new division, **Imenco Corrosion Technology**, to provide anode systems to the offshore renewable energy sector and to late life assets in the oil and gas (O&G) industry from its offices in Norway, UK, USA and Singapore (anode equipment for protection of subsea structures).
- In March 2017, **Dounreay Tri Limited** (went into administration in July 2017) identified the **Keppel Shipyard** in Singapore as location for manufacture of columns for a planned 10MW Dounreay Tri floating offshore wind project off Scotland.
- In October 2018, Danish developer **Ørsted**, via subsidiary **Optimus Wind Ltd**, contracted **Sembcorp Marine** for engineering, procurement, construction, hook-up and commissioning works on two topsides for the 1.4GW Hornsea 2 OWF project off the UK.
- In May 2019, **Keppel FELS**, in a consortium with Norway's **Aibel AS**, secured a contract from **TenneT Offshore GmbH** for the design, engineering, procurement, construction, installation and commissioning of a 900MW offshore HVDC (High Voltage Direct Current) converter station and an onshore converter station. **Keppel FELS** will execute steel construction for the platform from its

shipyard in Singapore.

- In May 2019, **Keppel FELS** secured a contract from **Ørsted** to provide detailed engineering, procurement, construction, testing and commissioning for two offshore wind farm 600MW substations in Taiwan.

1.3.2. Construction of installation vessels

Singapore's shipbuilding industry has established a track record, albeit limited, in construction of OWF installation vessels.

- In March 2010, **Keppel Verolme BV** and consortium partner **AREVA** (integrated into **Siemens Gamesa** since July 2017) of France, secured a contract from **Wetfeet Offshore** to build a mobile offshore application barge for the Global 400 MW Tech I OWF project in the North Sea.
- In July 2010, Holland's **Seafox Group** chose Singapore's **Keppel FELS**'s multi-purpose self-elevating platform design for its wind turbine installation vessel. In 2012, **Seafox Group** and **Keppel FELS** built *Seafox 5*, the first offshore wind turbine installation vessel built by a shipyard in Singapore. In April 2011, the **Aarsleff Bilfinger Berger Joint Venture** chartered *Seafox 5* to install offshore wind foundations at the 288MW DanTysk OWF in the North Sea. In December 2018, Norway's **Fred**. **Olsen Windcarrier** agreed with **Seafox International Group** to acquire 51% ownership in *Seafox 5*. The vessel is now under commercial, technical and administrative management. **Keppel FELS** indirectly owns 49%. In February 2019, **Fred**. **Olsen Windcarrier** renamed *Seafox 5* to *Blue Tern* in keeping with the company's tradition of naming vessels with first letter "B".
- In March 2015, Dutch **Heerema Marine Contractors** contracted Singapore's **Sembcorp Marine** to build the world's largest heavy-lift and deepwater construction vessel from the latter's Jurong Shipyard in Singapore. The semi-submersible crane vessel , named *Sleipni*, will be equipped with two 10,000 metric tonne cranes and is scheduled for deployment in May 2019. It is designed for installation of larger platforms, new types of seabed processing equipment, and decommissioning of heavier topsides and jackets.
- In July 2016, Italian subsea cable manufacturer **Prysmian Group**'s acquired flat top barge was converted to a cable laying vessel, *Ulisses*, at the **PaxOcean** shipyard in Singapore.
- In June 2017, Singapore-based **Keppel Shipyard** secured a contract from **Royal Boskalis Westminster N.V** for the conversion of a semi-submersible heavy lift vessel *Finesse* to a 5000-tonne lifting crane vessel, *Bokalift 1*, capable of transporting and installing offshore wind turbine foundations.

1.3.3. Installation activities

Singaporean companies are active in OWF installation activities in Europe and Asia through acquisitions as well as directly.

- In February 2010, Singapore's **Swire Pacific** acquired Denmark-based **Blue Ocean Ships** and renamed it **Swire Blue Ocean**. Swire Blue Ocean is a foundation and wind turbine installation company with two WTIVs in its portfolio. Its recent jobs include installation of turbines at the UK's

588MW Beatrice OWF which commenced in July 2018.

- In April 2017, Singapore's **NauticAWT** carried out its first offshore windfarm substation installation and grouting operation for **State Power Investment Corporation**'s Binhai North Phase 2 OWF in China.
- In November 2017, Singapore-based **G8 Subsea** was awarded a contract by **Korea Ocean Engineering & Consultants Co**. for the burial of inter-array cables at the 60MW test phase of Korea's Southwestern OWF project.

1.3.4. Construction of wind farm support vessels

Singaporean companies have taken part in construction of wind farm support vessels for the European and Chinese markets.

- **Damen Shipyards** has supplied crew transfer vessels (CTVs) from its shipyard in Singapore to companies serving the offshore wind market in Europe. Clients include Germany's **Windea Offshore, Sure Wind, Rix Sea Shuttle**, Dutch company **Offshore Wind Services , SeaZip Offshore Services** and German **Opus Marine**.
- Australian shipbuilder Strategic Marine has also supplied CTVs as well as outfitting and delivery of other wind farm support vessels (WFSVs) from its Singapore shipyard. Clients include **Njord Offshore Limited** and **EMS Maritime Offshore**.
- In April 2016, Singapore-based ship designer and shipbuilder **Triyards Holdings Limited** won contracts to build three WFSVs for three different European clients for deployment in the European offshore wind market.
- In January 2017, Hong Kong-based **Everbright International Offshore** (has design offices in Singapore) awarded a contract to Singapore-listed **COSCO (Nantong) Shipyard** to build a multi-purpose WFSVs.

1.3.5. Construction of installation vessels

Singaporean companies have participated in OWF support activities in Europe and Asia through mergers and acquisitions as well as directly.

- In February 2012, Singapore's **Swire Pacific** acquired Norway's **Seabed AS** and renamed it Swire Seabed AS. Swire Seabed AS provides offshore construction support, ROV (Remotely Operated Vehicle) and survey services to the O&G as well as the renewable energy industries including offshore wind energy.
- In December 2015, Singapore-based provider of liftboats and service rigs **Ezion Holdings Limited** entered into a strategic cooperation agreement with state-owned **China Huadian Corporation** to support OWF projects in China. In January 2016, **Ezion Holdings Limited** secured an agreement with another Chinese state-owned enterprise (name not disclosed) to jointly market two service rigs for OWF installation projects. In February 2016, **Ezion Holdings Limited** entered into a joint venture (JV) agreement with state-owned **China Huadian Corporation** for the deployment of service rigs to support the OWF market in China. **Ezion's** responsibility covers the technical, operational management and commercial aspects of the service rigs chartered by the JV.

- In June 2016, **Ezion Holdings Limited** and **Sinotrans & CSC Holdings** established a 49%-51% JV, Sinomarine & Teras (Tianjin) Offshore Co., Limited, dedicated to the offshore wind industry in China. The same month, **Sinomarine & Teras (Tianjin) Offshore Co., Limited** signed a strategic cooperation agreement with **China Huadian Corporation** to support OWF installation projects in China and expected to operate two service rigs for an OWF installation project by end of 2016.
- In September 2017, **PSA Marine**, a subsidiary of Singapore global terminal operator PSA International, acquired shares in the UK's **Njord Offshore Limited**. This followed a nearly two-year partnership between the two companies for CTV services to serve the European offshore wind market that started in December 2015. In October 2018, **Njord Offshore Limited** secured a contract to manage a new purpose-built service accommodation and transfer vessel for turbine manufacturer **Siemens Gamesa** at the Formosa 1 OWF in Taiwan. **Temasek** wholly owns **PSA International Pte Ltd**.
- In January 2018, Singapore-based offshore O&G vessel operator **Pacific Radiance** revealed intentions to diversify into offshore wind.
- In July 2018, Singapore's offshore marine services provider **PACC Offshore Services Holdings Limited** (POSH) and Taiwan's logistics firm **Kerry TJ Logistics** formalised a JV company, **POSH Kerry Renewables**, to provide integrated supply chain and marine solutions to the offshore wind industry in Taiwan. The JV has since signed an MoU with **Rolls-Royce** to explore suitable designs for walk-to-work and service operations vessels. The same month, **POSH Kerry Renewables** secured its first contract to provide anchor handling, supply and standby support to an international geotechnical services operator during the site survey, installation and construction of an OWF.

1.3.6. Other

In August 2014, Denmark's **MacArtney** opened a dedicated slip ring service facility in Singapore in response to demand from Singapore based Moog Focal slip ring users within subsea, survey, ROV and seismic sectors, as well as plans to serve the wider Asia-Pacific region.

1.4. Conclusion

The offshore wind industry continues to draw the attention of other Singaporean companies. Sovereign wealth fund **Temasek**, whose portfolio companies are already involved in offshore wind, is expected to play a key driving role. In April 2019, Singapore's **DBS Group Holdings** (28.9% owned by **Temasek**) and **Oversea-Chinese Banking Corp.**, Southeast Asia's two largest lenders, separately announced they will cease financing new coal power projects and instead focus on renewable energy projects. Sooner than later, such momentum is expected help the government follow up on its "*Marine & Offshore Engineering Industry Transformation Map"* with concrete offshore wind plans.

2. Thailand

Executive summary

Thailand's energy needs and current energy mix warrant a shift towards offshore wind. However, beyond general renewables targets for 2021 and 2036 respectively, no tangible plans or targets have been made yet. An academic study has devised potential of up to 7 GW of offshore wind with a large portion situated in the Bay of Bangkok. Thai companies are slowly starting to get involved in the wind energy industry both domestically - with offshore wind fabrication for the Taiwanese market - as well as outward investments - onshore wind in Laos and Australia and nearshore offshore wind in Vietnam.

2.1. Introduction

Thailand's "*Alternative Energy Development Plan*" of 2015 targets a 25% share of renewables in the country's energy mix by 2021 and 40% by 2036.

Several factors are working **in favour** of offshore wind development in Thailand. They include:

- Growing electricity demand: Thailand has the second highest primary energy demand in the Association of South East Asian Nations (ASEAN) region. In January 2016, energy consumption was forecasted to grow by 75% up to 2035 thanks to economic growth and a growing middle class.
- Offshore wind resources: In April 2015, Thailand's **Thaksin University** and Canada's **Université de Moncton** published a paper showing the Gulf of Thailand to have potential for 7 GW offshore wind, including 3 GW in the Bay of Bangkok.
- Energy independence: Rapidly depleting gas reserves in the Gulf of Thailand and increasing fossil fuel imports.
- Air pollution: Growing need for cleaner air

The main **factors hindering** offshore wind development in Thailand are:

- Government control and rising competition that have constrained domestic growth of renewable energy development.
- Lack of offshore wind policy support framework
- Preference for other power generation sources, e.g. liquefied natural gas imports or coal

Thai companies are not yet as involved in offshore wind as, for example Singaporean companies. However, they have the potential to transition and the interest in the offshore wind industry is growing.

2.2. Project owners and developers

Thai companies are increasingly seeking growth opportunities in ASEAN and other Asia-Pacific countries with growing power demand and favourable renewable energy support schemes. Examples

include Ratchaburi Electricity Generating Holding Co., Thailand's biggest private power company, which owns a 144 MW onshore wind farm in Australia, and Impact Electrons Siam, which is developing a 600 MW onshore wind farm, ASEAN's largest, in Laos due to start operations by 2021.

For offshore wind, Thailand's solar energy company, Superblock Public Company, announced plans in February 2018 to invest up to 56 billion baht to construct 700 MW of wind capacity in Vietnam. The first phase of the investment will consist of three nearshore wind farms in southern Vietnam - a 142 MW project in Bac Lieu province, a 98 MW project in Soc Trang province, and a 100 MW in Ca Mau province with completion set for 2020.

2.3. Local offshore wind supply chain

In May 2018, Thailand's O&G company **CUEL** signed its first offshore wind contract with Belgian contractor **Jan De Nul Group** to fabricate and supply 20 transition pieces for the Formosa 1 Phase 2 OWF in Taiwan. **CUEL** has since fabricated the transition pieces from its Laem Chabang yard on the Eastern coast of the Gulf of Thailand which were shipped to Taiwan in May 2019.

Norway's **Aibel AS**, a supplier of engineering, construction, modifications and maintenance solutions throughout the entire OWF life cycle, operates a shipyard in Laem Chabang.

2.4. Conclusion

Thailand is yet to announce its offshore wind plans. Emerging offshore wind markets in the region and Thai companies diversifying into offshore wind to serve these markets are expected to encourage the government to devise domestic offshore wind plans.

3. Bangladesh

Bangladesh has growing electricity demand. Only two-thirds of its population of roughly 160 million people (at end of 2017 and projected to reach 200 million in 2040) have access to electricity. Annual gross domestic product growth averaged 7% between 2015 and 2017 and is projected to average 6.7% from 2018 to 2020. Its onshore wind resources are limited but Bangladesh has relatively good potential for offshore wind, estimated at between 10 GW and 20GW. Of particular interest are waters East of Chittagong where water depths range between 20-40 metres for distances of up to 110 km from the coast. Bangladesh's "Power Sector Master Plan" of 2016 targets 2.4 GW of renewable energy power generation by 2021, including 1.1 GW wind. Bangladesh does not have a specific offshore wind target included in the Master Plan at this time.

4. Malaysia

Malaysia has no offshore wind plans. However, Malaysian companies are transitioning into renewables including offshore wind. Malaysian Robert Kuok owns stakes in the two companies that in July 2018 formed a JV, **POSH Kerry Renewables**, to provide integrated supply chain and marine solutions to the offshore wind industry in Taiwan. In April 2019, it emerged that Malaysian company **Yinson Holdings** was in the process of acquiring a controlling stake in Singapore's **Ezion Holdings** as part of **Yinson Holdings**' long-term plans to diversify into the renewables energy sector including operations and maintenance of OWFs. Later the same month, state-owned O&G group **Petronas** announced the acquisition of Singapore's distributed solar developer **Amplus Energy**.

5. Conclusion

As more countries in the region adopt offshore wind, more companies from Malaysia, Singapore and Thailand, are expected to diversify into offshore wind. The downturn since 2014 in the O&G industry and the earlier decline in the shipping industry resulted in several company bankruptcies in the region. Regardless of the recovery in oil prices in 2018, companies are aware that the recovery is not sustainable, hence the ongoing diversification into renewables. Winners in the emerging global offshore wind industry are shaping up. Meanwhile, the economic drivers (including job creation), the environmental benefits (deteriorating air quality), and the energy independence that come with offshore wind development are expected to encourage policy makers to craft concrete offshore wind policy frameworks that will support offshore wind development locally.

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Who we are

At Panticon, we are particularly strong in the Offshore Wind and Logistics sectors within our three core disciplines of **Strategic Management Advisory**, **Mergers & Acquisitions**, and **Market Research & Analysis**. We are mainly focusing on the business side to improve our clients' performance, create value in the long-term, and to create sustainable competitive advantages.

How we create value

- Tailor-made strategies
- Support M&A endeavours
- Share knowledge
- Analyse markets
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