

SUMMARY for PUBLICATION

Market opportunity assessment for the Dutch offshore wind industry

With a focus on floating systems

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EXECUTIVE SUMMARY

To achieve its ambition of carbon neutrality by 2050, the Government of Japan has initiated the Green Growth Strategy. Amongst other things, the Government of Japan set a goal to increase offshore wind power generation capacity, including floating offshore wind, to 10 Gigawatt (GW), or 5% of the energy demand in 2030 and 30–45 GW by 2040. Due to these targets, momentum to develop domestic offshore wind has picked up. Because Japan has limited shallow-water sites where bottom founded offshore wind turbines can be installed, there is a strong demand for the development of floating offshore wind turbine projects.

Although Japan has progressed relatively slow on offshore wind, the country was one of the first to be involved in the floating wind industry. First steps were taken to limit the dependency on nuclear energy after the Fukushima accident in 2011. The value and supply chain were fully domestic for these early floating projects and the goal was to make an export product from the Japanese floating wind technology. The demonstrator projects, Kabashima (decommissioned), Sakiyama, Kitakyushu Hibiki Nada and Fukushima (decommissioned) were challenging; although technical feasibility was verified, high capital expenditures were revealed. Japan went back to the drawing board for floating wind technology and public funds opened to continue the development of feasible, scalable and profitable technologies.

Under the Green Growth Strategy, the Green Innovation Fund was launched. This Japanese Yen 2 trillion fund (around EUR 14 billion) has been set up with the New Energy and Industrial Technology Development Organization (NEDO), to provide 10 years of support to private decarbonization initiatives, ranging from R&D and demonstration projects, amongst which projects to develop scalable and economical (floating) offshore wind solutions.

In June 2020, a floating site off Goto City in Nagasaki Prefecture, opened to bidders for a small floating wind zone for projects with a capacity of 16.8MW. The sole bidder, a consortium led by TODA Corporation together with ENEOS Corporation, Osaka Gas, Kansai Electric Power, INPEX and Chubu Electric Power was selected in June 2021.

Due to the immature floating offshore wind market worldwide, limited port availability for floating wind in Japan and limited experience in offshore wind projects at public and private level, most designated offshore wind zones have been selected for bottom founded projects. Further down the line floating offshore wind will be developed and the private market expects the first large scale floating offshore wind projects around 2030.

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Despite this timeline, we see that early involvement in Japan is a valuable opportunity, for example through the current bottom founded offshore wind projects developing. With a strong track record of the Netherlands in offshore engineering, construction and maintenance through the oil & gas and bottom founded offshore wind sectors, there will be opportunities for Dutch companies in the Japanese floating offshore wind industry. The Netherlands Enterprise Agency (RVO) and the Netherlands Embassy in Japan therefore commissioned this market study to support the Dutch floating wind sector to identify opportunities for Dutch companies and research institutes in the Japanese floating offshore wind sector.

We see upcoming opportunities for Dutch Research & Development, knowledge-transfer or training institutes to share the experience and knowledge and to educate Japanese engineers for scalable (floating) offshore wind solutions. In addition, supporting in early-stage project developments and technical feasibility studies are immediate opportunities for Dutch design, supply, transport & installation and supporting companies. Involvement in these studies will make these companies part of the design process and increases the chance of final project involvement. Consequently, on a longer term, for Dutch companies in the design, transport & installation, supply, operations & maintenance or port development fields. Hence, opportunities present itself in various products and services.

Dutch companies, who are interested in floating offshore wind in Japan, should start now in the early stages of the developments of floating offshore wind projects, to enable them to strengthen long term relationships with Japanese organizations and counterparts.

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BACKGROUND INFORMATION

Over the last decade, the global landscape of offshore wind has changed significantly. Offshore wind has seen large growth and has become a serious and mature industry. Where the globally installed capacity was about 5.2 GW in 2012, this was 32.5 GW by the end of 2020 and even 48.2 GW by the end of 2021 [1]. Through these years, the focus has mainly been on bottom founded solutions in Europe, with the monopile foundation as the absolute winner. By the end of 2021, China has made a phenomenal growth to 15.7 GW installed capacity [1]. Technological innovations, such as increasing wind turbines sizes, have led to a virtuous cycle of decreasing costs and hence above-mentioned growth [2].

Driven by the urge to accelerate the energy transition, offshore wind has gained momentum and the number of developments are expected to expand rapidly over the coming decade. The introduction of floating foundations is expected to contribute significantly to this rapid growth, since this technology allows harvesting wind in deep sea areas with higher, more constant wind speeds. The challenges for large scale commercial floating wind farms are expected to be overcome quicker as for bottom founded foundations, due to the maturity of the offshore wind industry and (along with this) the involvement of large players, such as oil & gas companies. There are still challenges to overcome in the floating offshore wind industry, because the market is not developed yet. Floaters and mooring systems, wind turbine integration and O&M processes are yet to be figured out, but also port infrastructure due to the massive structures, is a challenge for the coming years. Reducing steel and improving mooring and anchoring systems will need to be a key area of focus, next to Operations & Maintenance solutions.

Forests cover two-thirds of Japan's land area, and there is little flatland. Therefore, it is essential for the renewable wind energy developments to advance into the ocean. The governmental ambitions are also high with a projected offshore wind capacity of 10 GW in 2030, and 30-45 GW for 2040, which is very unlikely to be achieved without floating foundations [3]. Japan has huge potential to build large-scale offshore wind farms; 128.8 GW for bottom founded and a staggering 425 GW for floating, according to the Japan Wind Power Association. It is expected that Japan will be one of the five floating wind market leaders by the end of this decade [4].

The offshore wind industry is gaining momentum in Japan, albeit progressing slowly compared to other countries (particularly in Europe, the UK and China). At the end of 2021, Japan had an installed offshore wind capacity of only 51.6 MW, comprising of 26 WTGs over 6 different sites [5]. So far, Japan's offshore wind power generation has been more costly than in many other countries. The main reasons for the slow progress can be mainly attributed to geography and climate conditions, the Japanese power grid, and policy issues [6]. Japan's first auction round, just concluded, has a total output of 1.7 GW. Based on the lowest price predominantly, the Mitsubishi led consortium won all three bottom founded offshore wind projects. TODA won the 16.8 MW floating project at Goto City.

2.1 JAPAN'S OFFSHORE WIND MARKET & REGULATORY ENVIRONMENT

The Government of Japan targets Climate Neutrality by 2050. An important part of this will come from offshore wind, targeted to grow to 10 GW in 2030 and 30-45 GW in 2040. Based on its potential and Japanese geology, a significant share will and should be floating offshore wind.

Offshore wind potential

- According to the Japan Wind Power Association (JWPA), BFOW has an estimated potential of 129 GW and FOW has an estimated potential of 425 GW*.
- Japan's wind potential and marine geology favor floating offshore wind; rocky and steep sea beds, with nearly 80% of the offshore wind resources in a water depth >100m

Public-Private Council offshore wind targets [14] [18] [19]

- 10 GW by 2030
- 30-45 GW by 2040, incl. floating under development
- Local content requirements: 60% by 2040
- Cost reduction: Reduce total cost of bottom founded to 8-9 Yen/kWh by 2030-2035 (€ 0.057 - € 0.064)

Installed offshore wind in Japan

- Cumulative installed Bottom Founded Offshore Wind (BFOW) capacity: 51.6 MW (26 units, 6 sites, including semi-offshore)
- Cumulative installed Floating Offshore Wind (FOW) capacity: 5 MW [15]
 - Kabashima 2 MW – SPAR foundation, TODA (decommissioned)
 - Sakiyama 2 MW – SPAR foundation, TODA
 - Fukushima 2 & 7 MW – Semi-submersible, 5 MW – SPAR foundation (decommissioned)
 - Kitakyushu Hibiki Nada 3 MW – barge foundation, BW Ideol/NEDO

Challenges for offshore wind in Japan

- R&D and mass production required to reduce CAPEX
- Environmental conditions; typhoons, earthquakes and tsunami's
- Insufficient power grid capacity and infrastructure
- Local coordination, especially with fishery organizations

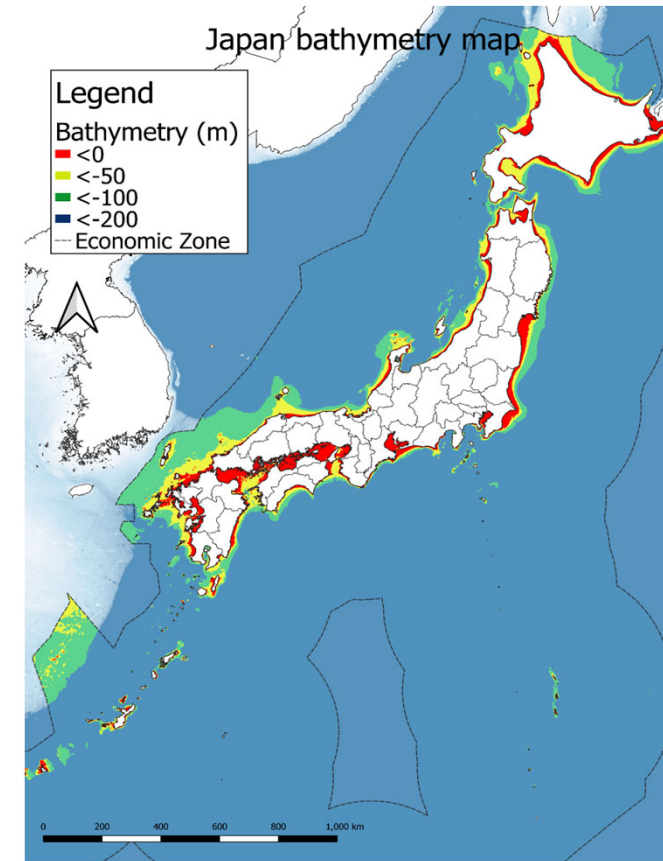


Figure 15: Japan bathymetry map, prepared by BLIX Consultancy based on publicly available data

*taking areas with an annual average wind speed of >7m/s and water depths <300m, assuming BFOW is installed in waters 10-50m at 6 kW/km², FOW is installed in waters 100-300m at 3 kW/km². [20]

2.6 ASSESSMENT ON POLICY AND REGULATORY ENVIRONMENT

Japan's ambitions for offshore wind are to have 10 GW deployed in 2030 and 30-45 GW in 2040, of which a part will be floating offshore wind in development. The targets and development plans are ambitious and point into the right direction that Japan's offshore wind sector will take off now. It is imperative that a legal framework to allow floating offshore wind in the Exclusive Economic Zones, is implemented in the coming years.










Category		Reasoning
Offshore Wind Auction Process		<ul style="list-style-type: none"> Round 1 resulted in three areas won by only one consortium, due to too much emphasis on price (50%) The Ministry of Economy, Trade and Industry currently reconsiders the Auction system, resulting in delay of Round 2
Permitting procedure		<ul style="list-style-type: none"> The Offshore Wind Promotion Act made operation permits possible for 30 instead of 20 years Permitting requires communication with national and local stakeholders. Consensus from local stakeholders, such as fishery organizations, makes up a considerable part of the project feasibility.
National Green Growth Strategy		<ul style="list-style-type: none"> Offshore wind specific targets included in the Governmental Green Growth Strategy: 10 GW in 2030 and 30 – 45 GW offshore wind in 2040 including floating under development The Green Innovation Fund has reserved 119.5 billion Yen for projects focused on “cost reduction of offshore wind power generation”
Grid infrastructure		<ul style="list-style-type: none"> The grid infrastructure is currently insufficient to transport power from high supply to high demand areas. The draft Power Grid Establishment Master-plan has been published in 2021 and will be finalized end 2022. It covers long distance power transmission from high supply to large demand areas by means of HVDC cables, enhancement of regional grid systems and grid connections
Port infrastructure		<ul style="list-style-type: none"> Ports do not meet the requirements for floating offshore wind (deep water, wet storage, commercial scale size, assembly, etc.) Port infrastructure developments are planned to meet the targets by 2030 and 2040
Support schemes		<ul style="list-style-type: none"> The Feed-in tariff (FiT) scheme introduced in 2012, with a relatively high FiT rate of 36 Yen/kWh, has not resulted in a vast increase of offshore wind projects, since other barriers (costs, regulations) prevented offshore wind from taking off quickly in Japan. In 2023, the Ministry of Economy, Trade and Industry decides if the Feed-in premium scheme is incorporated in offshore wind auction process. The FiP scheme allows power producers to sell their electricity freely to the wholesale electricity exchange or through direct negotiations.
Maritime spatial planning		<ul style="list-style-type: none"> Exclusive Economic Zones have no legal framework, which can be a barrier for Floating Offshore Wind since those are the good areas to develop floating. Cabotage laws limit foreign-flag vessels from operating in Japanese seas, up to 12 nautical miles offshore [26]

Table 8: Overview of the drivers and barriers of offshore wind development

 Conditions driving offshore wind development

 Medium barriers for offshore wind development

 High barriers for floating offshore wind development

Floating offshore wind is currently in the early stages in Japan, focus is on investigating the technical feasibility of different solutions and their logistics. The Japanese value and supply chain is interested in knowledge and experience either by feasibility projects, or by education and training.

Main opportunities for Dutch companies:

1. Support developers and EPCI contractors
Since the floating offshore wind market is currently in the technical feasibility stage, Japanese developers and EPCI contractors are interested in the experience from Dutch companies for assistance in full project development.
2. Concept design companies
Japanese companies are open to implement Dutch floater designs. Floaters with small footprints and shallow draft are advantageous due to, amongst others, the limited port infrastructure needed and fishery requirements.
3. Mooring supply companies
For floating offshore wind, moorings are part of the technical feasibility analysis due to their impact on the total system and the logistics during T&I (and possibly O&M). Experience of the Dutch mooring suppliers is already required in this phase.
4. Transport and Installation companies
Different transport and installation methods can be discussed with developers and EPCI contractors. Due to the limited port readiness for floating wind in Japan, T&I methods with limited port infrastructure required will be preferred.
5. Education and training companies
Knowledge and expertise is widely available under Dutch knowledge institutes and Japan is very much interested in this. Education and training of Japanese natives in universities and companies.



Timo Staal
 Project Manager | Consultant
 +31 6 2797 5478
 timo@blixconsultancy.com



Imke Maassen van den Brink
 Manager Strategy | Senior Consultant
 +31 6 5338 2917
 imke@blixconsultancy.com



Remco Doudeyns
 Floating Wind Expert
 +31 6 2027 2156
 remco@blixconsultancy.com



Willemijn van der Werf
 Business Development Director
 BLIX Asia
 +886 966 006 702
 willemijn@blixconsultancy.com



Naohiro Kuji
 Senior Consultant BLIX Japan
 +81 80 3087 5681
 naohirokuji@blixconsultancy.com

About BLIX Consultancy

BLIX is an independent consultancy company in renewable energy with offices in the Netherlands, Taiwan, Japan, South Korea and Poland. Our mission is to be at the forefront of the energy transition. We help our customers develop, realise and optimise renewable energy and grid projects by providing excellent technical, contractual and strategic consulting services. We provide services in all phases of renewable energy and grid related projects with our Project Managers, Technical Advisors, Contracting Specialists, Strategic Consultants and Financial Modelers.

About THE FULL REPORT

To obtain the full report, please visit the website of the Netherlands Enterprise Agency (RVO) and request the full report [here](#).

Alternatively, please send a message to Laisy Deng (laisy.deng@rvo.nl)



BLIX Consultancy
 2e Daalsedijk 6A, 3551 EJ
 Utrecht, The Netherlands
 www.blixconsultancy.com

