Climate Integrate

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Offshore Wind in Japan

Policy Agenda and Prospects

日本の洋上風力

導入拡大に向けた政策課題と展望

Contents

Offshore Wind in Japan: Policy Agenda and Prospects

- Electricity measurements used in this report

  1 megawatt (MW) = 1,000 kilowatts (kW)

  1 gigawatt (GW) = 1,000 MW

- Exchange rates

  1 USD = 150 yen, 1 GBP = 190 yen

Japan's fiscal year starts April 1 and runs through March 31 the following year.

This report was compiled based on information accessible at the end of March 2024.
The websites mentioned in this report were last accessed on March 29, 2024.

Summary

There are growing expectations for offshore wind power generation globally as a source of clean energy. Japan has significant potential for offshore wind, which can play an important role in tackling climate change, providing a stable energy source, and developing an industry. A public and private sector council on offshore wind in 2020 set an offshore wind target of up to 45 gigawatts (GW) by 2040. The Japanese government has been updating policies and introducing new initiatives to expand offshore wind.

However, the installed capacity in Japan is still small compared with that of China and some European countries that are actively promoting offshore wind. Following the construction of pilots and small-scale power projects, the first commercial-scale offshore wind farms in Japan began operating in December 2022 at Noshiro Port in Akita Prefecture. Offshore wind development in the country has just begun in earnest.

"Bottom-fixed" offshore wind turbines have been the most common type installed. Meanwhile, the Japanese government plans to expand the deployment of "floating" turbines, more suited to Japan's coastlines, which are characterized by water depths that increase rapidly with distance from shore. It plans to set installation targets and industrial strategies for floating offshore wind. The government is also working on legislation to expand areas for offshore wind development from ports and within territorial waters to Japan's exclusive economic zone (EEZ). Some companies are entering various sectors of the offshore wind industry, such as the manufacturing of components and construction of specialized vessels to serve offshore wind projects.

While Japan is making progress in offshore wind deployment, challenges also exist. To help accelerate this progress, it is crucial to implement the following steps for the deployment of offshore wind power generation.

Create a national grand design for offshore wind, with clear and ambitious targets

The government needs to create a grand design that provides an overall picture of how Japan plans to promote offshore wind, as well as medium- and long-term installation targets that are far more ambitious than those previously set. The targets should indicate how much wind will be operational, and by when, for fixed-bottom and floating technologies.

Envision the full scope of an offshore wind supply chain, and create a roadmap

The government should calculate the future demand for components, vessels, and workers, plot out the locations of wind farms, and consider what work is necessary for the development of port facilities in order for offshore wind to become a major industry and to be deployed on a large scale. Based on such calculations, the government could create a roadmap for the development of the supply chain for the offshore wind industry. Included in the roadmap should also be consideration of how to expand the share of components and equipment made in Japan, as well as an export industry in 2030 and beyond.

Clarify policies on maritime use in Japan's exclusive economic zone (EEZ)

Areas available for offshore wind development will increase dramatically once projects within Japan's EEZ are enabled by legislation. This would also mean an increase in the number of fisheries communities and stakeholders that wind project proponents would need to negotiate with. Marine spatial planning should be used to help identify stakeholders in a transparent manner and find efficient ways to use marine areas.

Promote consensus-building with local communities

Offshore wind development is a large-scale endeavor that can have massive impacts on local communities. While offshore wind can stimulate the economy and create jobs, communities may have concerns or even oppose development. It is crucial to address environmental concerns and gain support from residents. It is also important to have discussions and build consensus through dialogue with local residents including fishermen with the participation of the Fishery Agency in the Public-Private Council and other statutory councils that are attended by the Ministry of the Economy, Trade and Industry and the Ministry of Land, Infrastructure, Transport and Tourism.

Choshi Offshore Wind Power Plant（Choshi, Chiba)

I. Offshore Wind Power

Why is it Important for Decarbonization in Japan?

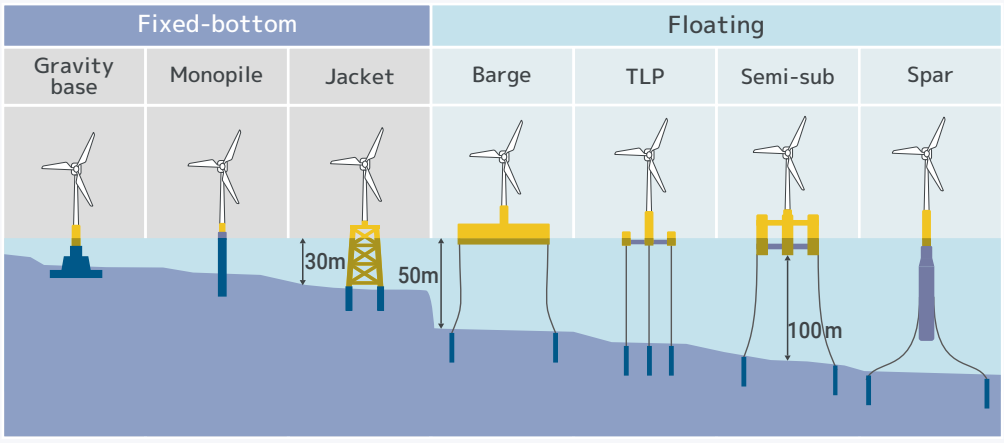
This section summarizes the types of offshore wind and the reasons why offshore wind is important for Japan's decarbonization.

01 Offshore wind power

Offshore wind power refers to wind turbines for electricity generation that are built off the coast, in contrast to being built onshore such as in coastal and mountain areas. There are two types of offshore wind power generation (Figure 1): one with turbines fixed to the seabed ("fixed-bottom" offshore wind) and the other installed on floating foundations ("floating" offshore wind).

Most offshore wind projects in Japan, either in operation or under planning, have been fixed-bottom, since the country's first offshore wind power station started running in Setana Town, Hokkaido in 2004.[1] But there is great potential for and growing interest in floating offshore wind in countries like Japan and the U.S. that have few shallow-water sites suitable for fixed-bottom offshore wind.[2] Countries are vying to be leaders in floating offshore wind technology and this provides an opportunity for Japan to become a global leader.

Fig. 01 Types of offshore wind



Prepared by Climate Integrate based on MLIT material[3]

1 Setana Town, Hokkaido website (in Japanese)

2 IRENA "Floating Foundations: A Game Change for Offshore Wind Power" 2016.12

3 Ministry of Land, Infrastructure, Transport and Tourism (MLIT) "Taskforce on base port development - locations and sizes" February 17, 2022 (p.5) (in Japanese)

02 Why Japan needs offshore wind

Deployment of offshore wind could play a crucial role for Japan in tackling climate change, ensuring a stable supply of energy, and developing the nation's industry.

Tackling climate change

The COP 28 UN Climate Conference, held in late 2023, agreed to transition away from fossil fuels and triple renewable energy capacity by 2030 in order to limit warming to 1.5° C.[4]

The power generation sector is Japan's largest source of greenhouse gas emissions. Thermal power (fossil fuel combustion) accounted for 72.7% of the country's power generation in FY2022,[5] and the country has long relied on imports for most of the fossil fuels used. The government introduced a feed-in tariff (FIT) program in 2012 to expand the use of renewable electricity, but the share of renewables in power generation remains at 21.7% (as of FY2022).[6]

The government aims to increase the share of renewables to 36–38% by 2030.[7] This target does not appear ambitious as the share of renewables in the global electricity mix is already around 30% today and projected to be near 50% by 2030.[8] Still, it may be difficult for Japan to achieve the 36–38% share given that construction of commercial-scale solar projects has been slowing[9] and that it usually takes about eight years to develop a large-scale wind farm.[10] It is hoped that deployment of types of solar and wind that can be quickly installed through 2030 will accelerate, to be followed by a massive ramp-up of offshore wind.

Ensuring a stable energy supply

Advantages of wind power generation include a reduced reliance on imported fuels and a potential contribution to Japan's energy security. Furthermore, offshore wind is expected to see costs drop significantly and therefore become increasingly economically viable. According to a "Clean Energy Scenario" by Lawrence Berkeley National Laboratory (U.S.), offshore wind could play a significant role in Japan (Box 1). Larger wind turbines can be installed offshore

4 United Nations Framework Convention on Climate Change (UNFCCC) "COP28 Agreement Signals 'Beginning of the End' of the Fossil Fuel Era" December 13, 2023

5 Ministry of Economy, Trade and Industry (METI) "FY2022 energy demand and supply (preliminary figures)" November 29, 2023 (in Japanese)

6 METI "FY2022 energy demand and supply (preliminary figures)" November 29, 2023 (in Japanese)

7 METI "Outline of Strategic Energy Plan" October 2021

8 International Energy Agency (IEA) "World Energy Outlook 2023" October 2023

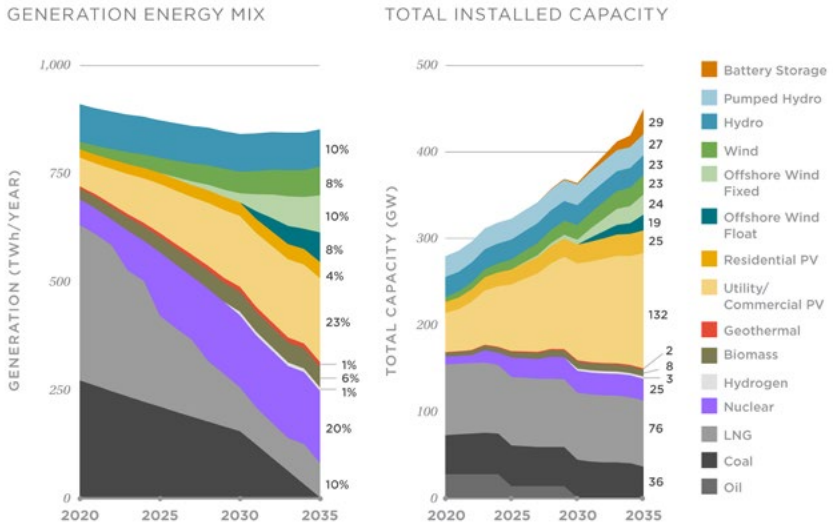
9 Japan Photovoltaic Energy Association "Solar power generation today and challenges" October 27, 2023 (p.22) (in Japanese)

10 METI "Reference material" March 8, 2021 (p.4) (in Japanese)

than onshore, and this could contribute to increasing the amount of power generated, reducing Japan's reliance on fossil fuels and contributing to an economically rational energy transition.

Box 1: A power generation scenario for Japan: 43 GW of offshore wind by 2035

In a February 2023 study by Lawrence Berkeley National Laboratory (U.S.) on the decarbonization of Japan's power sector,[11] a Clean Energy Scenario is achievable by 2035, with a shift to 90% clean energy. The key is to scale up renewables quickly while costs drop significantly. The scenario shows that it is feasible to increase the share of renewables to 70% (including 43 GW of offshore wind, consisting of floating 19 GW and fixed-bottom 24 GW) by 2035 while reducing electricity costs and ensuring a stable supply of electricity. Climate Integrate also published a set of recommendations that are key to realizing the scenario.[12]



11 Lawrence Berkeley National Laboratory (LBNL) "The 2035 Japan Report" February 2023

12 Climate Integrate "Policy Change to Trigger a Shift" March 1, 2023

Developing an industry

Surrounded by oceans, Japan has massive possible deployment at about 552 GW of offshore wind potential,[13] the equivalent of about 550 nuclear reactors by some estimates. Japan also has the potential to develop a globally competitive industry, while other countries as well signal their intentions to deploy more offshore wind. Furthermore, the offshore wind industry is not limited to the manufacture of wind turbines and components. It has a wider reach to other business sectors such as developing port infrastructure as well as building vessels for the construction of wind farms and the transfer of equipment and crew. This creates opportunities to develop businesses and create jobs not only in host communities of offshore wind farms but also in other parts of Japan.

According to 2019 estimates by the Japan Wind Power Association,[14] an industry group, the installation of 10 GW of offshore wind capacity by 2030 could be worth 5–6 trillion yen in direct investment, 80,000–90,000 jobs, and 13–15 trillion yen in economic ripple effects (Box 2).

Ishikari Bay New Port Offshore Wind Farm

13 Japan Wind Power Association (JWPA) "Toward mainstreaming offshore wind" July 17, 2020 (p.14) (in Japanese)

14 JWPA "Proposals to make wind a main power source" May 30, 2019 (p.4) (in Japanese)

II. Offshore Wind Capacity

This section summarizes the development of offshore wind and installed capacity.

01 Global capacity

Vindeby, the world's first offshore wind station (5 megawatts (MW)), started operating off the coast of Denmark in 1991.[15] Orsted, a Danish major offshore wind developer, and others summarize the global development of offshore wind as follows.

Fig. 02 **Offshore wind development**

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1991 | 2001 First farms	• First offshore wind farms built by countries (pilot projects) • Political wish to develop national wind industry and fiscal concerns over energy imports lead to first offshore wind farms • In 1998, Denmark announces plans to build five wind farms of 150 MW each • Denmark, UK, Sweden, the Netherlands
2002 | 2011 Scaling up	• Emerging political demand for climate action and new EU targets • More countries implement policies to promote, accelerate offshore wind • In 2003, first commercial farm (60 MW) built in UK. In 2009, UK surpasses Denmark in installations to become world's largest market. • Finland, China, Belgium, Germany
2012 | 2017 Driving down costs	• Industry commits to hard push for cost cuts, leading to a 60% cost reduction • Taiwan, Japan, US
2018 | Present Going global	• Costs have come down. Offshore wind going global with more countries turning to offshore wind energy • South Korea, Ireland, France, Poland, India

Compiled by Climate Integrate based on Orsted[16] and BVG Associates[17] materials

15 Orsted "Making green energy affordable"

16 Orsted "Making green energy affordable – How the offshore wind energy industry matured – and what we can learn from it"

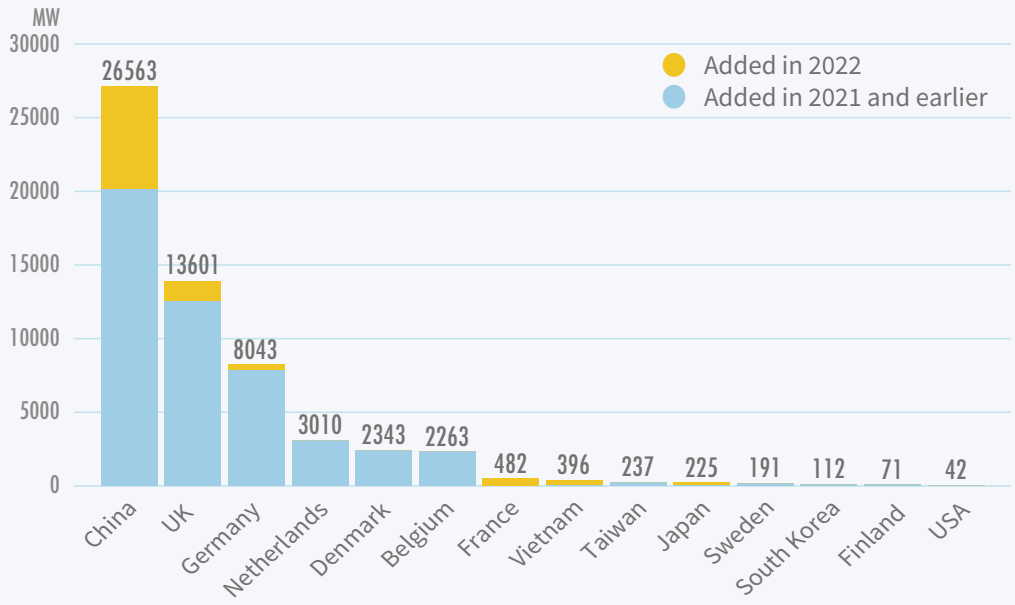
17 BVG Associates "UK offshore wind history"

European countries led offshore wind development for many years. A change came in 2021 when China became the largest market in total installed capacity as developers rushed to complete projects before the expiration of the Chinese feed-in tariff program at the end of that year. China's addition of 12.7 GW in 2021 alone surpassed the total installed capacity of 12.3 GW (2021) in the UK.[18]

As of the end of 2022, China remained the largest market, followed by the UK and Germany, while Taiwan and Japan were ranked 9th and 10th, respectively.[19] A total 9.4 GW of offshore wind was added worldwide that year, bringing the global cumulative installed capacity to 57.6 GW.[20]

Fig. 03

Cumulative offshore wind installations, WFO



Prepared by Climate Integrate based on WFO document[21]

Countries have been announcing ambitious offshore wind targets in recent years (Appendix 1 – Global offshore wind targets/ambitions/potential, and policies). In April 2023, nine North Sea nations announced the Ostend Declaration,[22] to increase the offshore wind power generation

18 World Forum Offshore Wind (WFO) "Global Offshore Wind Report 2021" February 2022

19 WFO "Global Offshore Wind Report 2022" February 2023

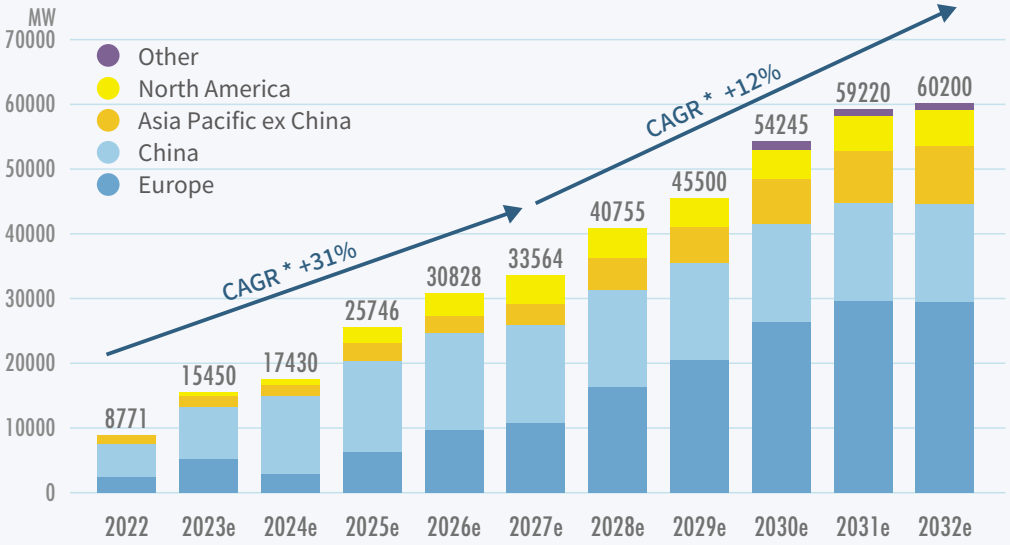
20 WFO "Global Offshore Wind Report 2022" February 2023

21 WFO "Global Offshore Wind Report 2022" February 2023

22 Alexander De Croo (Prime Minister of Belgium) "Ostend Declaration on the North Seas as Europe's Green Power Plant" April 24, 2023

capacity in the North Sea to 120 GW by 2030, and 300 GW by 2050. Meanwhile, the U.S.[23] and the UK[24] have set their respective targets specifically for floating offshore wind power, signaling their ambitions to become leaders in the emerging technology. The Global Wind Energy Council (GWEC), an international trade organization for wind power, estimates that annual installations of offshore wind will steadily increase and yearly additions will reach 54 GW by 2030 from 15.5 GW in 2023.[25] However, that is below the levels presented in 2021 in a scenario by the International Energy Agency (IEA) to achieve net zero emissions in the power sector by 2050 in which offshore wind deployment needs to accelerate globally at the rate of 80 GW/year through 2030, and 70 GW/year through 2050.[26]

Fig. 04 New offshore wind installations, GWEC



* Compound Annual Growth Rate

Prepared by Climate Integrate based on GWEC materials[27]

23 The White House "FACT SHEET: Biden-Harris Administration Announces New Actions to Expand U.S. Offshore Wind Energy" September 15, 2022

24 Gov.UK "British energy security strategy" April 7, 2022 (set as "ambition")

25 Global Wind Energy Council (GWEC) "Global Offshore Wind Report 2023" August 28, 2023 (p.91)

26 IEA "Net Zero By 2050" October 2021 (p.74)

27 GWEC "Global Offshore Wind Report 2023" August 28, 2023 (p.91)

02 Capacity in Japan

Offshore wind development in Japan has just begun in earnest. Following the introduction of feed-in tariffs in July 2012, a scheme intended to boost renewable energy, solar power led Japan's renewable deployment. Wind was slow to expand, partly due to new requirements for environmental impact assessments (EIA), and challenges regarding grid connections. Most wind projects up to now have been built onshore (about 5 GW as of December 2023 in cumulative capacity)[28] with offshore wind totaling just 298 MW (as of January 2024). (Appendix 2 – Domestic offshore wind farms)

In recent years, however, there have been increasing expectations for wind power, especially offshore wind, to produce clean energy. In 2020, a public-private council was set up to discuss how to strengthen the industrial competitiveness for offshore wind and set targets of 30–45 GW by 2040.[29] The government has been implementing major policy changes and new schemes. Japan's offshore wind development, which started near shore, is eyeing areas further away from the coast for large-scale deployment.

Ishikari Bay New Port Offshore Wind Farm

28 Calculated by Climate Integrate based on JWPA "Japan's cumulative wind capacity as of December 2023" February 2, 2024 (in Japanese)

29 Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation (Public-Private Council) "Vision for Offshore Wind Power Industry (1st)" December 15, 2020

III. Offshore Wind Policies in Japan

This section provides a timeline of offshore wind policy development in Japan.

01 Schemes to promote renewables

Feed-in tariff program and environmental impact assessments

Following the Fukushima nuclear accident triggered by the earthquake that struck eastern Japan in March 2011, the government introduced the feed-in tariff (FIT) program in July 2012, to incentivize producers of renewable electricity (solar, onshore and offshore wind, geothermal, biomass, small hydro) and diversify Japan's power sources. However, the development of wind power in Japan was slow, partly due to new regulations requiring environmental impact assessments (EIA) for wind power projects of 10 MW or larger.[30] The EIA requirement was put in place three months after the FIT program began, adding years to project completion timelines.[31] Responding to industry requests, the government eased the restrictions in October 2021 by raising the threshold to 50 MW.[32]

02 Policies to promote offshore wind

Approvals for development in port areas

The Port and Harbor Act were amended in July 2016 so that developers could build and operate wind farms in port areas for up to 20 years.[33] Wind projects near ports have advantages such as the proximity to the grid, as well as access to piers and wharves to transfer equipment.[34] Japan's first large-scale commercial offshore wind farms became operational within the port areas of Noshiro (84 MW) and Akita (55 MW), both in Akita prefecture, in December 2022 and January 2023, respectively.

30 Ministry of the Environment (MOE) Environmental Impact Assessment Network (in Japanese)

31 MOE "Size of wind farms subject to environmental impact assessments" January 21, 2021 (p.6) (in Japanese)

32 MOE Press release October 1, 2021 (in Japanese)

33 MLIT Press release July 1, 2016 (in Japanese)

34 MLIT "Draft legislation - Port and Harbor Act" (in Japanese)

Designation of promotion zones

In April 2019, the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities took effect.[35] Under the Act, the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure and Transportation (MLIT) can designate "promotion zones" for offshore wind projects within Japan's territorial waters (12 nautical miles, or 22 km, from shore, excluding port areas). The ministries can also hold tenders to build and operate wind farms in the areas for up to 30 years.[36] As of October 2023, there were 10 such promotion zones around Japan.

The ministries can also designate two types of precursor zones that later can be upgraded to "promotion zones" with government approval, and as of October 2023, these amounted to nine "prospective zones" and eight "potentially suitable zones" across Japan.

Fig. 05

Offshore wind zones as of Oct. 2023, METI

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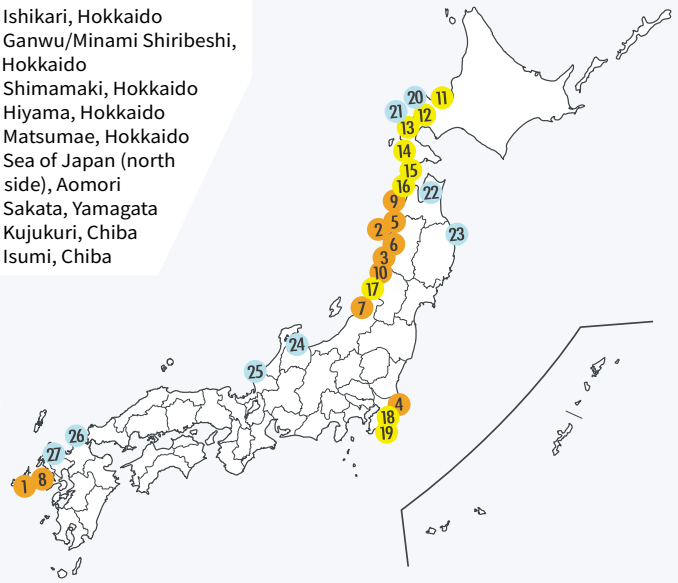
Promotion Zones
1 Goto, Nagasaki (floating)
2 Noshiro/Mitane/Oga, Akita
3 Yurihonjo, Akita
4 Choshi, Chiba
5 Happo/Noshiro, Akita
6 Oga/Katagami/Akita, Akita
7 Murakami/Tainai, Niigata
8 Saikai (Enoshima), Nagasaki
9 Sea of Japan (south side), Aomori
10 Yuza, Yamagata

Prospective Zones
11 Ishikari, Hokkaido
12 Ganwu/Minami Shiribeshi, Hokkaido
13 Shimamaki, Hokkaido
14 Hiyama, Hokkaido
15 Matsumae, Hokkaido
16 Sea of Japan (north side), Aomori
17 Sakata, Yamagata
18 Kujukuri, Chiba
19 Isumi, Chiba

Potentially Suitable Zones
20 Ganwu/Minami Shiribeshi, Hokkaido (floating)
21 Shimamaki, Hokkaido (floating)
22 Mutsu, Aomori
23 Kuji, Iwate (floating)
24 Eastern side, Toyama (fixed-bottom, floating)
25 Awara, Fukui
26 Hibikinada, Fukuoka
27 Karatsu, Saga



Prepared by Climate Integrate based on METI website[37]

Designation of base ports

With amendments to the Port and Harbor Act in February 2020, the transport minister can

35 METI, MLIT "Offshore wind policies" February 2022 (p.2) (in Japanese)

36 Prime Minister's Office "Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities" December 13, 2018 (in Japanese)

37 METI website (in Japanese)

designate "base ports" so that space can be leased at wharves for wind turbine projects and related maintenance work.[38] The amendments also extended space leasing for wind power producers in port areas to 30 years, up from 20 years.[39]

Public-Private Council targets 10 GW offshore wind by 2030 and 30–45 GW by 2040

In December 2020, a council comprised of government officials and representatives from the offshore wind sector (referred to as the "Public-Private Councilc), compiled a set of strategies in a document titled "Vision for Offshore Wind Power Industry (1st edition)," to strengthen the industry in Japan. It announced offshore wind targets of 10 GW by 2030 and 30–45 GW by 2040.[40] The announcement gave a big boost to the country's offshore wind development prospects. It should be noted, however, that the targets refer to projects that could be at various stages after government approval, so it cannot be assumed that all of the capacity implied in these targets will be operational by then.[41] Japan's Sixth Strategic Energy Plan, approved by Cabinet in October 2021, foresees only 5.7 GW of offshore wind to be operational by FY2030,[42] and it is unclear how much offshore wind will be operational by 2030 and 2040.

Expansion into exclusive economic zone (EEZ)

Offshore wind developments in Japan initially started in areas near the coastline. Early projects in Ibaraki Prefecture had turbines installed within several meters of the shore.[43] As of April 2024, developers are allowed to build wind farms within Japan's territorial waters (up to 12 nautical miles, or about 22 km), and the government is considering how to allow developments within the country's EEZ which extends up to 200 nautical miles (about 370 km) from the coastal baseline.

Japan's fourth Basic Plan on Ocean Policy, approved by Cabinet in April 2023, stated that the government would prepare the regulatory framework to allow offshore wind development in Japan's EEZ.[44] In March 2024, Cabinet approved the related legislation.[45] Expansion into the EEZ means a dramatic increase in marine area available for offshore wind development. Given that Japan is surrounded by deep waters due to its steep gradients offshore, wind projects in Japan's EEZ will use floating turbines that can be installed in water depths of 50 meters or

38 MLIT "Summary of offshore wind base port systems" (in Japanese)
39 House of Councilors Legislation information December 6, 2019 (in Japanese)
40 Public-Private Council "Vision for Offshore Wind Power Industry (1st)" December 15, 2020
41 METI, MLIT "Toward EEZ expansions" November 15, 2023 (p.4) (in Japanese)
42 METI "Energy demand and supply outlook for FY2030" October 2021 (p.30) (in Japanese)
43 Wind Power "Wind Farm Projects" (in Japanese)
44 Cabinet Office "The Fourth Basic Plan on Ocean Policy" April 28, 2023 (in Japanese)
45 METI News release March 12, 2024 (in Japanese)

Chart.01

Targets and potential for Japan's offshore wind industry (GW)

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	2030	2035	2040	2050	Potential
Government	5.7 GW (6th Strategic Energy Plan)				178–460 GW (potential for business viability)[46]
Public-Private Council	10 GW		30-45 GW (including floating)		
JWPA				Fixed-bottom: 40 GW Floating: 60 GW[47]	552 GW Fixed-bottom: 128 GW Floating: 424 GW[48]
LBNL		Fixed-bottom: 24 GW Floating: 19 GW			

Compiled by Climate Integrate

more,[49] rather than fixed-bottom turbines.[50]

In June 2023, METI and MLIT launched a new taskforce comprised of academics and power producers to discuss industry strategies for floating offshore.[51] Following the taskforce discussions, the Public-Private Council was to release the second edition of its "Vision for Offshore Wind Power Industry" by the end of FY2023,[52] but no announcement has yet been made as of March, 2024.

Centralized model

The government is developing a framework for a "centralized" model for the efficient deployment of offshore wind power with the national and local governments playing central roles. In November 2023, METI and MLIT presented draft guidelines on how to implement the centralized model. Roles to be played by the national and local governments are as follows :[53]

46 MOE "Guide for Renewable Energy Potential System" March 2024 (p.36, 58) (in Japanese)

47 JWPA "JWPA Japan Wind Vision 2023" May 2023 (p.3)

48 JWPA "Toward mainstreaming offshore wind" July 17, 2020 (p.14) (in Japanese)

49 New Energy and Industrial Technology Development Organization(NEDO) "Floating offshore wind technology guidebook" March 2018 (p.14) (in Japanese)

50 Public-Private Council, NEDO "Technology development roadmap for competitive offshore wind industry" April 1, 2021 (in Japanese)

51 METI News release June 23, 2023 (in Japanese)

52 Cabinet Secretariat ministerial meeting on renewables and hydrogen "Inter-ministry action plans for renewable energy expansions" April 4, 2023 (p.2) (in Japanese)

53 METI, MLIT "Draft guidelines for the centralized system for offshore wind" November 15, 2023 (in Japanese)

1. Designating development areas, holding tenders to select project developers
2. Coordinating affairs with local communities
3. Conducting site surveys (wind conditions, seabed geology, weather, marine conditions)
4. Securing grid access
5. Conducting environmental impact assessments (EIA)

In March 2024, MOE's Central Environment Council (advisory body) provided its recommendations regarding EIAs to the environment minister. One recommendation regarding projects within Japan's territorial waters was to eliminate the requirement for project proponents to submit a "primary environment impact consideration document" and "scoping document" (normally required for an EIA), if the site is in a promotion zone designated by METI and MLIT based on a site survey conducted by MOE. For projects within Japan's EEZ, one recommendation was for MOE to conduct studies based on literature and environmental data at an early stage before an area is designated as a candidate site. If METI designates an area as a candidate site based on those studies, the project proponent could avoid the need to submit a "primary environmental impact consideration document." [54] Going forward, it is anticipated that MOE will take action based on the Council's recommendations.

54 MOE "Central Environment Council recommendations for EIA for wind projects (1st version)" March 7, 2024 (in Japanese)

IV. Measures and Challenges for Offshore Wind Expansion

This section examines measures that could be taken and challenges that need to be addressed to expand offshore wind power generation in Japan. Special attention is given to the current status of measures to develop domestic supply chains and build consensus with residents and fishing communities.

01 Developing the supply chain

Outlook for strong market development

The supply chain for offshore wind has massive potential in both scope and scale and could have significant ripple effects on industries in Japan. The above-mentioned Public-Private Council's offshore wind targets (10 GW by 2030 and 30–45 GW by 2040) were set based on industry calculations that at least 1 GW of offshore wind capacity needs to be built every year until 2030, then 2–4 GW annually up to 2040, for investment payback and for the industry to be globally competitive.[55] That represents a significant increase from Japan's average annual new wind capacity to date of roughly 220 MW (mostly onshore) since the FIT program was introduced.[56] Achieving these targets would clearly require a massive build-out of the domestic supply chain. The importance of developing the supply chain will increase as Japan aims to expand the deployment of floating offshore wind.

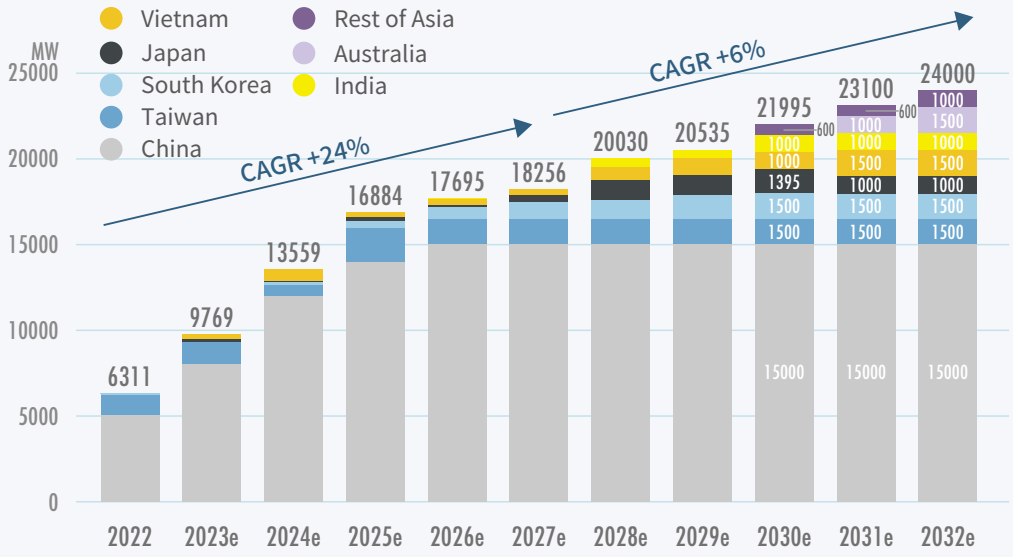
Figure 6 depicts China's projected dominance in the Asia Pacific region in the coming years, but it also indicates that Taiwan, South Korea, and Vietnam are forecast to expand offshore wind installations, with Australia expected to join the fray in 2031. This means massive demand for related equipment, competition for resources and workforces, and the need for a robust supply chain to support deployment in the whole region. Japanese power producers will face competition from these countries and need to secure equipment and vessels to ensure the steady expansion of offshore wind within the country. As offshore wind supply chains grow in the Asia-Pacific region, an early entry into the global market could help Japanese companies secure larger market shares.

55 JWPA "Toward mainstreaming offshore wind" July 17, 2020 (p.16) (in Japanese)

56 Climate Integrate calculated average annual installation based on JWPA "Preliminary figures on Japan's wind power generation (as of December 2023)" February 2, 2024 (in Japanese)

Fig. 06

Growth projections for offshore wind in the Asia-Pacific region, GWEC



* Compound Annual Growth Rate

Prepared by Climate Integrate based on GWEC[57] materials

Supply chain development

The offshore wind supply chain includes components (blades, nacelles, towers, cables, foundations, etc.), and vessels (specialized for installation, cable laying, transport, etc.). Ports also need to be upgraded or built to accommodate large-sized equipment. Certain challenges of developing a supply chain need to be addressed in Japan, where offshore wind is still in its infancy.

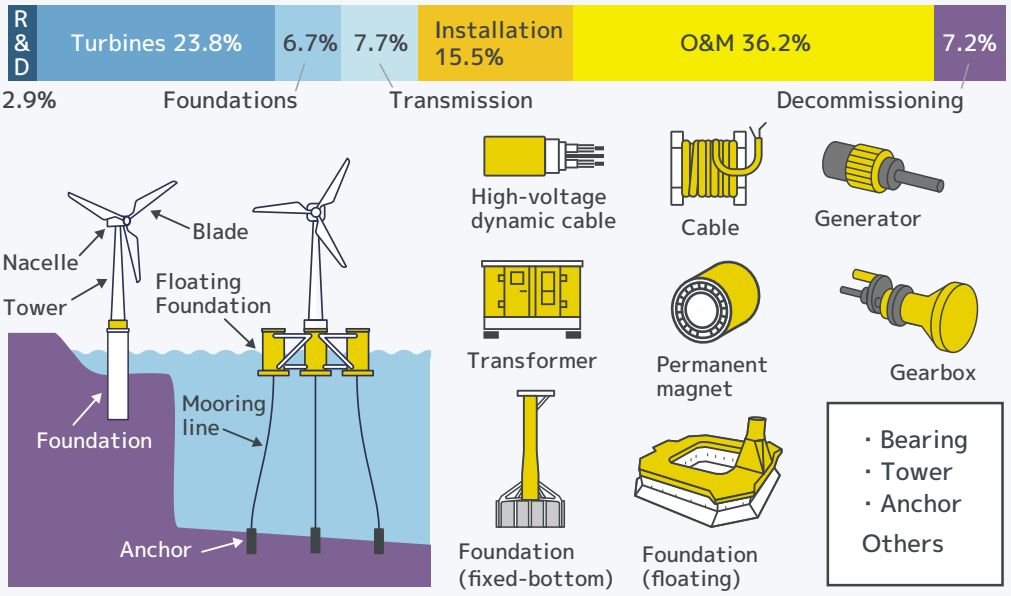
The government said in an inter-ministry action plan released in April 2023 that it will build a robust domestic supply chain by improving productivity in the manufacture of essential components for floating offshore wind, and other products and components, and by promoting the widespread use of domestically-built work vessels.[58]

57 GWEC "Global Offshore Wind Report 2023" August 28, 2023 (p.99)

58 Cabinet Secretariat ministerial meeting on renewables and hydrogen "Inter-ministry action plans for renewable energy expansions" April 4, 2023 (in Japanese)

Fig. 07

Key components of offshore wind supply chain, Cabinet Secretariat



Prepared by Climate Integrate based on Cabinet Secretariat materials[59]

Box 2: Economic ripple effects

The Japan Wind Power Association (JWPA) estimated in 2019 that the deployment of 10 GW in offshore wind capacity in Japan by 2030 could be worth 5–6 trillion yen in direct investment, generate 80,000–90,000 jobs, and create 13–15 trillion yen in economic ripple effects.[60] In a more recent analysis, the industry group said that installing 140 GW of wind capacity (40 GW of onshore and 100 GW of offshore) by 2050 could create 355,000 jobs, have an economic ripple effect of 6 trillion yen per year, and reduce fossil fuel imports worth 2.5 trillion yen per year.[61]

Akita Prefecture estimated in 2022 that installations of 2 GW of offshore wind capacity in the prefecture could create 37,600 jobs and bring economic impacts of 382 billion yen (both direct and indirect) in construction, operation and maintenance (O&M), and decommissioning.[62]

59 Cabinet Secretariat GX Promotion Office "Sectorial investment strategies 4" November 16, 2023 (p.46) (in Japanese)

60 JWPA "Proposals to make wind a main power source" May 30, 2019 (p.4) (in Japanese)

61 JWPA "JWPA Wind Vision 2023" May 29, 2023

62 Akita Prefecture "The 2nd Akita New Energy Industry Strategies (revised)" March 2022 (in Japanese)

Offshore wind in Japan could have annual economic ripple effects of 1 trillion yen by 2030 and 2 trillion yen by 2050, according to estimates by METI, published in a report on research and application plans for offshore wind cost-reduction projects, one of the national Green Innovation Fund projects.[63] METI's estimates were made assuming the following:

1. Offshore wind capacity in Japan: 1.68–3.68 GW by 2030, 45 GW by 2050
2. Japan's share in other Asian markets: 25% in 2030 and 2050

(a) Wind turbines and components

Japan has been importing wind turbines as major domestic turbine makers, including Hitachi, MHI, and Japan Steel Works, have all ceased production in recent years. Domestic manufacturers do produce other parts and components, such as generators, bearings, and permanent magnets, and the government has acknowledged that their manufacturing potential has been underutilized.[64] Japan would face risks such as cost increases if it continued to rely on imported wind turbines as the size of turbines continues to grow.

The nacelle is a structure that houses key components including the generator, gearbox (where used), yaw bearing, yaw system, etc. Toshiba has been building a network of suppliers for nacelles in Japan. Since signing a strategic partnership agreement with GE Renewable Energy in 2021 to localize key manufacturing processes in Japan for the American company's turbines,[65] Toshiba has been lining up component suppliers near offshore wind sites such as Chiba and Akita.

For foundations, JFE Engineering has completed the construction of the first factory in Japan to produce monopiles (a type of foundation) and transition pieces in Okayama Prefecture.[66] The factory started operations in April 2024 and has the capacity to produce about 50 foundations a year.[67]

(b) Ports

Three main types of ports are required for offshore wind development:[68]

63 METI "R&D and application plans to reduce cost of offshore wind" October 1, 2021 (in Japanese)

64 Cabinet Secretariat et. al. "Green growth strategy through achieving carbon neutrality in 2050" June 18, 2021 (p.31) (in Japanese)

65 GE Renewable Energy, Toshiba Energy Systems & Solutions News release May 11, 2021

66 JFE Holdings Sustainability report 2023 "Climate Change"

67 JFE Engineering "Offshore wind foundations" (in Japanese)

68 MLIT "Taskforce on offshore wind port development (1st meeting, document 3)" May 31, 2023 (p.24) (in Japanese)

- Industrial hub ports (for work vessels, manufacturing of components and equipment)
- Base ports
- Operation and maintenance (O&M) ports

Base ports and O&M ports can have overlapping roles for installation, repair work, O&M, and dismantling. But special consideration of specifications is needed when developing ports for the deployment of floating offshore wind turbines. They require more space and more diverse port functions. For example, foundations for floating offshore wind usually weigh 2–10 times heavier than for fixed-bottom turbines, and they take up more space.[69]

In February 2022, a taskforce convened by MLIT indicated the potential locations and number of base ports that would be required to achieve the target of 30–45 GW by 2040 proposed by the Public-Private Council (Figure 8). The taskforce report also included specification requirements for these ports to accommodate larger components and projects. Japan has five base ports (Akita, Kashima, Kitakyushu, Noshiro, Niigata) designated by the Minister of Land, Infrastructure, Transport and Tourism.[70] Two more ports will be added later (Aomori, Sakata).[71] The ministry reconvened the taskforce in May 2023 to expand the scope of discussions to identify additional port specification requirements for the installation of floating offshore wind turbines.

(c) Vessels

The types of vessels for offshore wind development and operation include:

- Wind turbine installation vessels (WTIV) (jack-up vessels, heavy lift vessels)
- Crew transfer vessels (CTV)

MLIT estimates Japan would need about 50 CTVs by 2030 and 200 by 2040 to achieve the Public-Private Council targets,[72] while no estimates for other types of vessels have been made public. Shimizu Corporation announced in October 2022 the completion of the "Blue Wind" installation vessel.[73] Penta Ocean said in September 2023 that its CP-16001 installation vessel with a 1,600-ton lifting crane was completed.[74] A tally by Climate Integrate identified at least 20 offshore wind-related vessels in Japan, including those under construction.[75]

Given that construction of large-scale wind projects is not expected to take off until 2027 or

69 MLIT "Taskforce on offshore wind port development (1st meeting, document 3)" May 31, 2023 (p.34) (in Japanese)

70 MLIT "Summary on base port system" (in Japanese)

71 MLIT "Designation of base ports" April 8, 2024 (in Japanese)

72 MLIT "Safety design guidelines for CTVs" March 31, 2023 (in Japanese)

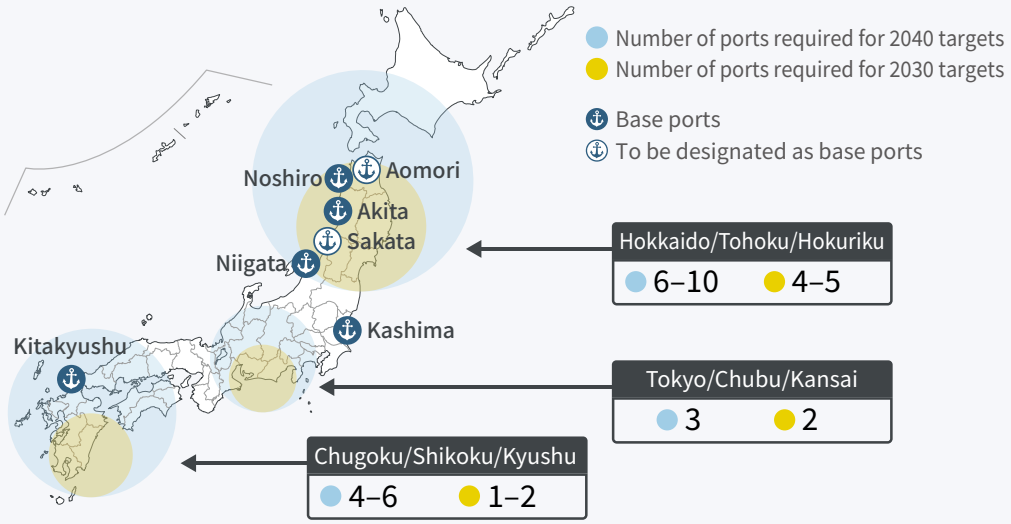
73 Shimizu News release October 6, 2022

74 Penta Ocean News release September 27, 2023

75 Estimates compiled by Climate Integrate based on information from METI, MLIT, company websites

Fig. 08

Taskforce estimates on number of base ports required (Feb. 2022 document), MLIT



Prepared by Climate Integrate based on MLIT material[76]

2028 in Japan, GWEC anticipates no bottlenecks will occur during the forecast period, so long as new vessels in the pipeline are delivered on time.[77] A shortage of vessels could occur, however, if Japan plans to build more offshore wind farms. Meanwhile, Japanese installation vessels could be also used for projects in other Asia-Pacific markets.

Roadmap for a domestic supply chain

A whole-of-government approach is needed in order to build this supply chain. Once the targets and industrial strategies for floating offshore wind have been established, they can be used as a basis to plan out the required supply chain. In the southwestern region of Kyushu, a branch of METI aims to build a robust local offshore wind supply chain. In 2023, the Kyushu Bureau of Economy, Trade and Industry set up a regional offshore wind industry network to provide a forum to share information and ideas and cooperate for the development of the supply chain.[78] In March 2024, 14 companies, including NTT Anode Energy, Tokyo Electric, Marubeni, and Mitsubishi Corp., set up the Floating Offshore Wind Technology Research Association. The group will collaborate to develop optimal design criteria and standards for floating systems, and study serial production technologies for floating offshore wind.[79]

76 MLIT "Base port locations and sizes to achieve 2050 Carbon Neutrality" February 17, 2022 (p.20) (in Japanese)

77 GWEC "Global Offshore Wind Report" August 28, 2023 (p.33)

78 Kyushu Bureau of Economy, Trade and Industry "Kyusu offshore wind network" August 2023 (in Japanese)

79 Floating Offshore Wind Technology Research Association "Launch of the Floating Offshore Wind Technology Research Association" March 15, 2024

Other roadmaps may be useful references as Japan develops its own supply chain such as one by the National Renewable Energy Laboratory (NREL) in the U.S., and one by RenewableUK, a British trade association (Box 3).

Box 3: Roadmaps abroad

United States

The National Renewable Energy Laboratory (NREL) of the U.S. Department of Energy has published two reports on the offshore wind supply chain roadmap, one in March 2022 and the other in January 2023. NREL found that the U.S. will need 2,100 wind turbines, 6,800 miles (10,900 km) of cable, and nearly a hundred vessels to achieve the national target of 30 GW of offshore wind installed capacity by 2030.[80] The reports also presented a detailed roadmap with suggested actions and identified challenges and solutions needed to develop an offshore wind supply chain that is domestically sourced. A domestic supply chain that can supply the demand for 4-6 GW installed annually will likely require an investment of at least $22 billion (3.3 trillion yen) in ports, large installation vessels, and manufacturing facilities, according to the reports.

Chart.02

Required Resources to deploy 30 GW by 2030 (NREL)

Climate Integrate

Wind turbines 2,100	Foundations 2,100	Miles of cable 6,800 miles (10,900 km)
Crew transfer vessels 58	Wind turbine installation vessels 4–6	Service operation vessels 11
Cable lay vessels 4	Scour protection installation vessels 2	Transport vessels 4–8
Heavy lift vessels 4–6	Full-time equivalents average annual workforce 12,300–49,000	

Prepared by Climate Integrate based on NREL material[81]

United Kingdom

In the UK, a March 2023 report by the Floating Wind Offshore Wind Taskforce found that to realize the floating offshore wind scenario of 5 GW by 2030 and 34 GW by

80 National Renewable Energy Laboratory "Supply Chain Road Map for Offshore Wind Energy in the United States"

81 NREL "Supply Chain Road Map for Offshore Wind Energy in the United States"

2040, 5–7 integration ports would be needed, and 4–6 substructure manufacturing/assembly ports,[82] requiring 4 billion pounds (760 billion yen) in port investment.[83] The report, sponsored by RenewableUK and The Crown Estate, among others, pointed out that no port facilities in the UK can currently fulfill the infrastructure requirements to deploy floating offshore wind, and made a series of recommendations.

02 Building consensus with residents and fishing communities

To expand a nation's offshore wind capacity, it is crucial to have suitable policies and regulatory frameworks in place and to improve the relevant technologies. But that is not enough. Local acceptance is also key. Coordination with local communities and fishery groups is one of the most crucial elements in offshore wind development to address the concerns of residents and fishers.

Once a promotion zone has been designated, the government will hold a tender to select wind project developers. In the selection process, the government will consider the expected economic impacts and cost of wind power, and also take into account the ability of project developers to coordinate with the heads of local governments and cooperate with the local fisheries and shipping industries.[84]

In a "prospective zone," a council of stakeholders is set up under the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities (which entered into force in 2019). The council is to be comprised of national and local government officials, fishery groups, and academics, and to serve as a forum for consultation to have the zone designated a "promotion zone." [85]

Although the council is expected to play a role in involving the local community and fishing stakeholders in the project development process, it is often difficult to define the scope of who should be consulted, especially among fishermen, who often cover a wide area in their fishing activities. It is hoped that local governments will host study sessions with residents at an early stage of the process and that the Fishery Agency will prepare maps to help identify

82 Floating Wind Offshore Wind Taskforce "Industry Roadmap 2040" March 2023 (p.4, 50)

83 Floating Wind Offshore Wind Taskforce "Upgrading our ports is essential to kickstart UK floating offshore wind industry" March 15, 2023

84 METI, MLIT "Guidelines for tenders in promotion zones" revised October 2022 (p.8) (in Japanese)

85 METI, MLIT "Guidelines for the designation of promotion zones" revised July 2021 (p.13) (in Japanese)

which fishermen are operating where.[86]

Box 4: Case study: Working with the fishing community in Choshi City

It is crucial to gain the understanding of local fishermen when developing offshore wind projects. Choshi City, Chiba Prefecture, is home to a 2.4 MW offshore wind turbine, which started as a government pilot project in 2013 and is operating commercially today.[87] Nearby, Mitsubishi Corporation and C-Tech are developing a 390 MW offshore wind farm scheduled to start operating in 2028.[88] With these projects, Choshi represents a successful example of cooperation among stakeholders.

As one example, a maintenance service company was established in September 2020, shortly after Choshi had been selected as a "promotion zone" for offshore wind. The company, Choshi Cooperative Business Offshore Wind Service (C-COWS), was founded by the Choshi Fisheries Cooperative Association, Choshi City, and the Choshi Chamber of Commerce and Industry, to provide maintenance services and training for workers for offshore wind farms, and offer tours.[89]

In June 2023, Mitsubishi Corp. and Choshi City signed a cooperation agreement to improve services for citizens by using digital technologies relating to energy, mobility, and infrastructure.[90]

According to the local stakeholder council's guidelines, offshore wind developers are to contribute to a local government fund and the Chiba Prefecture Fishery Promotion Fund and study the impacts of the wind turbines on local fishing.[91]

One factor in the success of offshore wind power in Choshi, one of Japan's major fishing grounds, may have been the pilot project's track record in providing a forum for coordination among stakeholders to select a turbine location that would have the minimum impact on fishing. It may have also helped that the fishermen were already familiar with the sight of a turbine thanks to the pilot project.

86 Renewable Energy Institute "Proposals for the Coexistence of Offshore Wind with Local Communities and the Fishing Industry" July 29, 2022

87 TEPCO Renewable Power "Choshi Off-shore Wind Power Plant Overview"

88 Mitsubishi Corporation "Our business projects"

89 C-COWS News release September 16, 2020 (in Japanese)

90 Choshi City, Mitsubishi Corporation News release June 13, 2023 (in Japanese)

91 Council for off the coast of Choshi City "Opinions of the council" June 5, 2020 (in Japanese)

V. Policy Proposals for Offshore Wind Expansion

Create a national grand design for offshore wind, with clear and ambitious targets

To achieve an energy transition in Japan that is aligned with the Paris Agreement, the government needs to create a grand design that provides an overall picture of how Japan plans to promote offshore wind, as well as medium- and long-term installation targets that are far more ambitious than before. This will send policy signals, both in Japan and globally, by showing the magnitude of Japan's offshore wind market ambition, and its potential. Future targets should be set separately for floating and fixed-bottom offshore wind, and they should be articulated as explicit targets for actual generation capacity in operation, not just "in the pipeline."

Envision the full scope of an offshore wind supply chain, and create a roadmap

Assuming that 10 GW of offshore wind capacity will be operational by 2030 based on the Public-Private Council's targets, using 15 MW turbines on fixed-bottom foundations, about 670 turbines and foundations would be needed. Similarly, 3,000 turbines and foundations would be needed if 45 GW were to be in operation by 2040. These estimates can be used to calculate the required length of cable and the number of vessels and workers, considering the locations of wind farms and conditions of port facilities. Japan needs a roadmap for the offshore wind supply chain build-out to develop a major industry and deploy it on a large scale.
The roadmap also needs to incorporate a time frame beyond 2030 to consider a greater share of components and equipment made in Japan, as well as the export market.

Clarify policies on maritime use in Japan's EEZ

Areas available for offshore wind development will increase dramatically once projects within Japan's EEZ are enabled by legislation. This greater distance from the coast would also mean an increase in the number of fisheries communities and stakeholders that wind project proponents would need to negotiate with.[92] Marine spatial planning should be used to help identify stakeholders in a transparent manner and find efficient ways to use marine areas.[93]

92 Fishery Agency FY2020 annual report "Resource management in Japan" Chart 3–6 (in Japanese)

93 Mitsubishi Research Institute website July 24, 2023 (in Japanese)

Promote consensus-building with local communities

Offshore wind development is a large-scale endeavor that can have massive impacts on local communities. While offshore wind can stimulate the economy and create jobs, communities may have concerns about its impact on birds, noise, and low-frequency sound, or even oppose the construction of offshore wind farms. In efforts to expand offshore wind, it is crucial to ensure sufficient opportunities for dialogue and adequate information disclosure to address environmental concerns and also to provide benefits to local communities in order to gain their support.

Among the key issues in Japan is the relationship with fishermen. Opposition from fishermen is not unique to Japan. Offshore wind has a relatively short history of about 30 years and research is still ongoing regarding impacts on fishing. Japan can learn from experiences in other countries and from different regions in Japan, and this could lead to better solutions.

The Public-Private Council on offshore wind developments is jointly hosted by METI and MLIT. It is important to have discussions and build consensus through dialogue with local residents including fishermen with the participation of the Fishery Agency in the Public-Private Council and other statutory councils.

In Closing

An expansion of offshore wind power generation will not only increase the share of clean energy and ensure a stable supply of energy in Japan, but also promote industrial development and create jobs. Floating offshore wind in particular presents Japan with the potential to develop a globally competitive industry by actively promoting the technology before the rest of the world begins to fully embrace power generation by floating wind turbines. It is time for Japan to grasp this opportunity by encouraging collaboration between the public and private sectors, utilizing existing and developing new industries, and promoting industrial and corporate cooperation.

Climate Integrate

Climate Integrate is an independent climate policy think tank in Japan. Through integrated approaches to connect scientific, political, and social dimensions, we support actions for decarbonization by civil society, business and the public sector.

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Policy Agenda and Prospects

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