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Japan Energy Newsletter

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1 Development Trends for Floating Wind Power Plants

Japan is promoting the introduction of offshore wind power as a new renewable energy source to help achieve carbon neutrality. Due to Japan's geographic limitations, such as its small land area and large forest areas, it is unlikely that solar power systems and land-based wind farms will be widely adopted. However, given that Japan is an island country surrounded by oceans, it is possible for offshore wind power to be utilized across the nation. Considering Japan's geographic features, such as the lack of shallow seas adjacent to its shoreline, floating offshore wind turbines are more suitable for deployment than bottom-fixed foundation type turbines. Japan-based utility companies such as Tokyo Electric Power (TEPCO) and JERA have recently begun to develop floating wind power plants through partnerships with leading European companies.

1.1 Background

The Japanese government has declared that it hopes to achieve carbon neutrality by 2050, which will require accelerating the adoption of renewable energy sources to meet that target.[1] Since Japan is an island country surrounded by oceans, offshore wind power could be widely utilized across the nation. Japan has the world's sixth-largest exclusive economic zone (EEZ) and has very few shallow seas adjacent to the shore, making floating offshore wind power plants more suitable to the country's needs than bottom-fixed foundation platforms. The Japanese government aims to introduce 10 million kW of offshore wind power generation, including floating wind power, by 2030 and will increase the wind power generation to 30 to 45 million kW by 2040. [2] In July 2020, four areas, including Choshi City in Chiba Prefecture, were designated as offshore wind power promotion areas under the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities. [3]

1.2 Development and Deployment Trends in Offshore Floating Wind Power Plants in Japan

Since the offshore wind industry is mainly led by European companies, Japanese companies have partnered with many of these companies to promote the energy source in Japan. For example, TEPCO's Renewable Powers (TEPCO RP) submitted a proposal for an offshore wind development project off the coast of Choshi City, Chiba Prefecture, through a joint venture with Ørsted, a Danish energy company that transitioned from oil and gas to renewable energy businesses. [4] JERA, a joint venture of TEPCO and Chubu Electric Power Co., and J Power, a power producer, are also planning to participate in offshore wind power projects in two water areas off of the coast of Akita

[1] https://www.japan.go.jp/key_policies_of_the_suga_cabinet/carbon_neutrality.html
[2] https://www.meti.go.jp/shingikai/energy_environment/yojo_furyoku/pdf/002_02_02.pdf
[3] https://www.meti.go.jp/press/2020/07/20200721005/20200721005.html
[4] https://www.tepco.co.jp/rp/about/company/press-information/press/2021/1611275_19679.html

Prefecture through a consortium with Norway's Equinor.[5] ENEOS, a Japanese energy company, announced in July 2021 that it had signed a joint project development contract with BW Ideol, headquartered in France, to develop floating offshore wind farms in Japan.[6] ENEOS is also involved in a similar project with KEPCO.

TEPCO RP announced its participation in Norway's TetraSpar Floater Demo Project in February 2021. The project is being jointly conducted by RWE Renewables (RWE), Shell New Energy (Shell), and Stiesdal Offshore Technologies A/S (SOT). These three companies have invested in a new firm, TetraSpar Demonstrator ApS (TSD), which is implementing the demonstration project. In November 2020, the assembly and installation of TetraSpar's foundation components were completed and transported to the port of Grenaa in Denmark. TetraSpar will test the turbine in the summer of 2021 by mounting the wind turbine onto a foundation using a land-based crane at the Marine Energy Test Centre (Metcentre), which is about 10km off the coast and in 200m depth waters near Stavanger, Norway. The turbine will be fixed to the seabed with three anchor lines and connected to the grid. The project will use a Siemens Gamesa Renewable Energy 3,600kW wind turbine. Compared to other floaters, the TetraSpar floater has an advantage from its simplified manufacturing, assembly and installation processes, and reduced costs.[7]

In June 2020, JERA announced that it had signed an agreement with French firm IDEOL SA (IDEOL, now BW Ideol[8]) and ADEME INVESTISSEMENT SAS (ADEME INVESTISSEMENT) to establish a floating wind turbine company.[9] The new company plans to develop floating wind turbines using IDEOL's dumping pool technology[10] and will support the early-stage construction of wind power projects around the world. IDEOL specializes in the design, solution marketing, and business development of floating wind turbines and has deployed its technology in Japan and France. ADEME INVESTISSEMENT is an investment company established in 2018 under the French Environment and Energy Management Agency (ADEME). The new company has been preparing for bids for floating wind turbines deployment projects in Scotland and France during the first half of the 2020s.

In similar news, ENEOS announced in July 2021 that it has signed a joint project development contract with France-based BW Ideol to develop floating offshore wind farms in Japan.[11] ENEOS aims to increase its total power generation capacity of renewable energy sources, with the goal of reaching more than 1 million kW by FY2022. In addition, ENEOS has also participated in a project off the coast of Goto City, Nagasaki Prefecture with KEPCO, as well as a project off the coast of Happo Town and Noshiro City in Akita Prefecture since September 2020.

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[5] https://www.jera.co.jp/information/20200909_532
[6] https://www.eneos.co.jp/newsrelease/20210707_01_01_1170836.pdf
[7] https://www.tepco.co.jp/rp/about/company/press-information/press/2021/1572776_19679.html
[8] https://bw-group.com/our-businesses/bw-ideol/
[9] https://www.jera.co.jp/information/20200622_508
[10] This patented dumping pool technology features a donut hole in the center of the floating body, which can suppress the shaking of the floating body at sea. The floating foundation using this technology has good workability due to its small size and simple shape and can be made of concrete as well as steel, which has a great cost advantage in manufacturing and installation.
[11] https://www.eneos.co.jp/newsrelease/20210707_01_01_1170836.pdf

KEPCO announced in June 2021 that it will build and operate the country's first commercial-scale floating offshore wind farm off the coast of Goto City, Nagasaki Prefecture, through a consortium with other Japan-based construction and energy companies. [12] The consortium, chaired by Toda Construction, is composed of Japanese utility companies and energy firms, including KEPCO, Chubu Electric Power (Chuden), ENEOS, Osaka Gas, and INPEX. Unlike many other Japanese offshore wind projects in development, the project does not involve any European partners. The project was selected by the Ministry of Economy, Trade and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT).

Floating offshore wind power is estimated to have about three times the potential of land-based wind power in the surrounding waters of Japan.[13] However, there is still significant uncertainty about the feasibility of the technology, which has discouraged the acceleration of the development of offshore wind farms. In FY2021, the Japanese government will fully withdraw an early demonstration project off the coast of Fukushima Prefecture. The project, which had received $546 million USD[14] in funding, had been undertaken to seek a new power source alternative to the Fukushima Daiichi nuclear power plant. One of the major factors which led to the decision to withdraw the project was the lower utilization rate of the offshore wind power farm. According to Marubeni, who participated in the demonstration project, the utilization rates of the tested 2MW and 5MW-scale offshore wind power plants were 36.5% and 26.7%, respectively, compared with more than 30-35% at the average rate of standardized commercial offshore wind power generators. Therefore, it was concluded that the Fukushima offshore wind project was not economically feasible for commercialization.

2 Current Trends for the Utilization of Hydrogen for Decarbonization

Hydrogen is expected to be one of the technologies that will help reduce greenhouse gas emissions in the energy supply chain, ensure Japan's energy security, and create a new industry. Along with several companies, the Japanese government has been pursuing the development and demonstration of a series of technologies for hydrogen production, storage, distribution, and utilization. This report summarizes the hydrogen development and demonstration activities undertaken by the Japanese government, including New Energy and Industrial Technology Development Organization (NEDO), and several companies.

[12] https://www.kepco.co.jp/corporate/pr/2021/pdf/20210611_2j.pdf
https://www.chuden.co.jp/publicity/press/1206582_3273.html
[13] https://www.eneos.co.jp/newsrelease/20210707_01_01_1170836.pdf
[14] 60 billion yen.

2.1 NEDO's R&D and Demonstration Activities Including the Utilization of Hydrogen[15]

Unlike fossil fuels, hydrogen energy is a clean energy that does not emit CO2 when burned. Demand for hydrogen is expected to grow in the future as it will be one of the methods for achieving carbon neutrality by 2050. The Green Growth Strategy Through Achieving Carbon Neutrality in 2050[16], which was published by the Ministry of Economy, Trade and Industry (METI) in December 2020, describes hydrogen energy as a key strategic technology that can be leveraged in a wide range of fields, such as power generation, transportation, and industrial sectors. Hydrogen can be used as fuel for stationary fuel cells, fuel cell vehicles, and industrial facilities. METI's Green Growth Strategy expects Japan to increase its hydrogen consumption to a maximum of 3 million tons in 2030 and 20 million tons in 2050.

Japan must improve its production, storage and transportation hydrogen technologies and create a supply chain to expand the use of hydrogen. There are various existing methods/sources to produce hydrogen, such as fossil fuels, water electrolysis with electricity, and using the by-products from industrial processes.[17] Japan has recently been focusing on developing "green hydrogen," which is produced by water electrolysis using electricity coming from renewable sources. At the same time, Japan has been studying various methods for hydrogen storage and distribution, such as pipeline injection and storage as a liquid or a gas. It will also be crucial for Japan to deploy a wide network of hydrogen stations to create a domestic hydrogen supply chain.

NEDO, a Japanese quasi-R&D funding organization that promotes the development of new clean energy technology, has been conducting many studies and demonstration projects supporting the realization of a hydrogen-based society. Since the 1980s, NEDO has been working on developing technologies such as fuel cells, hydrogen stations, large-scale hydrogen supply chains, and Power-to-Gas (P2G).[18] However, due to unresolved technical issues, economic constraints, and the lack of infrastructure development, Japan has not yet reached the large-scale utilization of hydrogen. Japan has therefore sought to establish a hydrogen-led society model. The model will focus on certain regions, with considerations of their geographic locations and characteristics, to support hydrogen utilization in a wide range of industrial applications. As part of its efforts to support the realization of a hydrogen-based society, NEDO announced 14 hydrogen projects on July 28, 2021, aiming for large-scale hydrogen utilization at industrial complexes, ports, and factories. The projects' goals are to advance the development of "green hydrogen," examine the feasibility of building imported hydrogen processing facilities, and create an integrated energy system model that utilizes hydrogen.

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[15] https://www.nedo.go.jp/news/press/AA5_101462.html

[16] "Green Growth Strategy Through Achieving Carbon Neutrality in 2050" Formulated

[17] By-product hydrogen can be generated in industrial processes such as the production of caustic soda by salt electrolysis and coke oven gas at steelworks.

[18] Power to Gas is the process of converting renewable energy into hydrogen gas for storage and utilization. The method is expected to be utilized to balance energy demand and supply when renewable energy is heavily deployed to a market.

Since FY2021, NEDO has implemented 14 projects under the following two themes. Projects under Theme 1 will be run for up to 2 years, and projects under Theme 2 will run for up to 5 years.

1. Hydrogen Production and Utilization Potential Study (11 Projects): Projects under Theme 1 will conduct feasibility studies on an integrated energy system model for green hydrogen production, storage, distribution, and utilization, as well as learning about domestic and international hydrogen deployment case studies. These projects will also evaluate the feasibility of building large-scale hydrogen stations for processing the imported hydrogen in preparation for building a commercial-scale hydrogen supply chain in the future.

2. Regional Hydrogen Utilization Hub Model (3 Projects): These projects will seek to develop a regional hydrogen utilization hub model for promoting the use of hydrogen in different applications, including industrial complexes, ports, and factories. They will contribute to the development of an integrated energy system that includes the process of hydrogen production, storage, and distribution.

The following projects involve the participation of utility companies.[19]

Contractors	Theme	About the Project
Kawasaki Heavy Industries, Obayashi, Kansas Electric Power (KEPCO)	1	Introduce a Hydrogen Cogeneration System (CGS) in the Port Island area of Kobe City
KEPCO, Iwatani	1	Study and verify a model for hydrogen and methane production using renewable energy sources, such as solar power, by Hydro Edge's hydrogen plant. Hydro Edge is a liquid hydrogen company funded by Iwatani and KEPCO.
Green Power Investment, Hokkaido Electric Power (HEPCO), Nippon Steel Engineering, Imoto Lines, Air Water, KYOCERA Communication Systems	1	Study hydrogen production using surplus electricity from Ishikari Bay New Port Offshore Wind Power Plant, which is scheduled to begin operations in 2023, and evaluate a hydrogen supply chain in the surrounding area.
ENEOS, ENEOS Research Institute, Kawasaki City	1	Study a hydrogen supply model in the Tokyo Bay Area, including the feasibility of building the infrastructure for processing the imported hydrogen and a hydrogen pipeline.

2.2 Notable Activities by Other Entities in the Past

NEDO, along with other organizations, has participated in many hydrogen research & development and demonstration projects in the last few years. In March 2020, NEDO

[19] https://www.nedo.go.jp/content/100935314.pdf

announced that the Fukushima Hydrogen Energy Research Field (FH2R), the world's largest green hydrogen production facility, had been completed.[20]

NEDO, Toshiba Energy Systems & Solutions (Toshiba Energy), Tohoku Electric Power (Tohoku), and Iwatani had been constructing the FH2R in Namie Town, Fukushima Prefecture since 2018. With a 20 MW solar power facility installed on a 180,000 square meter site, FH2R can produce hydrogen through a 10 MW hydrogen generation facility and utilizes P2G technology to process the surplus energy from the onsite solar power systems. Throughout the demonstration operation period until FY2020, the project focused on projecting the hydrogen production volume and adjusting projections based on the hydrogen demand forecast. The project's biggest challenge was optimizing the operation of the hydrogen production and storage to meet the power balance between supply and demand without using storage batteries.

In June 2019, the Ministry of the Environment (MOE) announced the launch of a Green Hydrogen Production and Hydrogen Mixed Gas Utilization Demonstration Project. The announcement was made during the opening ceremony of a hydrogen facility in Noshiro City, Akita Prefecture.[21] The hydrogen facility will mix the hydrogen produced from wind power with a high-calorie gas. The hydrogen-gas blend will be supplied to households and businesses in the area. Similarly, in April 2021, Shunan City in Yamaguchi Prefecture, which is home to the Shunan Industrial Complex, announced that it would revise its existing Hydrogen Utilization Plan.[22] The Shunan City Hydrogen Utilization Council, in collaboration with business, industry members, experts, and related agencies, studied the potential of utilizing the hydrogen produced by the Shunan Industrial Complex for promoting urban development.[23] The Council has been working on expanding the introduction of hydrogen stations, hydrogen fuel cells, and ENE-FARM stationary fuel cells for tourist destinations, industrial facilities, and central urban areas. The Council plans to continue to install hydrogen-related equipment in the region.

[20] https://www.nedo.go.jp/news/press/AA5_101293.html

[21] https://www.env.go.jp/press/106873.html

[22] http://www.city.shunan.lg.jp/site/council-hydrogen/
http://www.city.shunan.lg.jp/uploaded/life/67957_172767_misc.pdf

[23] Participating companies include Idemitsu and Shunan Complex-related companies; Toyota Motor and other automobile-related companies; energy solutions companies; Toshiba Energy; transportation-related companies; and construction-, machinery-related companies.