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Challenges for Promoting Offshore Wind Power Generation

Akiko Sasakawa[1]

Expectations for technological innovations

Expectations for offshore wind power generation are rising due to the decarbonization trends. Under the policy of reaching carbon neutrality by 2050, the Japanese government’s Green Growth Strategy has set out a goal of increasing offshore wind power generation capacity to 10 GW by 2030 and 30-45 GW by 2040. Offshore wind capacity expansion is the key to developing renewable energy into a major electricity source.

Wind power generation, in which windmill turbines convert wind energy into electricity, features a relatively high efficiency among renewable energy power generation means. Unlike solar photovoltaic plants, wind power plants can generate electricity day and night so long as the wind blows. Wind power capacity expansion can hold down unit power generation costs. Thus, the wind power is viewed as an economically efficient power source.

Japan has expanded mainly onshore wind capacity since the 2000s. However, due to the limited availability of suitable onshore sites for wind power generation and time-consuming procedures for assessing wind power generation projects’ impact on the environment, wind capacity’s share of total power generation in Japan was limited to 0.7% in FY2019.

Under this circumstance, offshore wind power generation is attracting attention. Offshore wind farms are less vulnerable to location constraints than onshore facilities and can get greater wind pressure more stably.

Japan as an island nation is viewed to have high potential for offshore wind power generation. According to the Japan Wind Power Association, the potential capacity for bottom-mounted offshore wind farms (with platforms supported by columns fixed to the seabed) in Japan is estimated at 128 GW. Potential capacity for floating wind farms (with floating platforms anchored to the seabed with cables) for deep waters with depths between 100 and 300 meters is estimated at 424 GW, more than triple the potential capacity for bottom-mounted farms (see the table).

The United Kingdom as an island nation forerunning Japan

Europe has driven global offshore wind power generation growth since Denmark built the world’s first commercial offshore wind power plant in 2002. According to the Global Wind Energy Council, Europe accounted for more than 60% of global offshore wind

[1] Senior Researcher, New and Renewable Energy Group, Electric Power Industry & New and Renewable Energy Unit

capacity totaling 35.3 GW in 2020. Of 6.1 GW in new offshore wind capacity installed in 2020, China accounted for about a half, increasing its presence in the global market. However, Europe still captured 49% of the new capacity.

Among European countries, the United Kingdom attracts attention with the world's largest offshore wind capacity covering about 30% of the global total. The island nation similar to Japan has promoted offshore wind power generation since the second half of the 1990s. In 2000, it launched the allocation of offshore wind contracts within U.K. sea areas. In a bid to promote renewable energy power generation, the U.K. government introduced the Renewable Obligation System in 2002, requiring electricity retailers to procure a certain percentage of electricity from renewable energy including offshore wind. In addition, the government provided subsidies covering 10% of offshore wind projects. Since 2009, it has implemented an incentive measure for offshore wind projects under the Renewable Obligation System.

Backed by such policy support, U.K. offshore power generation has remarkably grown while achieving cost cuts and technological advancement. From only 4 MW in 2002 when the Renewable Obligation System was introduced, U.K. offshore wind capacity increased substantially to 1.3 GW in 2010 and 10.2 GW in 2020. As the leading offshore wind power generator, the U.K. government has set a goal of boosting offshore wind capacity to 40 GW accounting for about 40% of its total electricity supply by 2030.

Challenges and prospects for Japan

Both the United Kingdom and Japan are island nations having long coastlines and great potential capacity for offshore wind power generation. However, Japan lacks experience with offshore wind power generation and must develop a business environment to promote offshore wind capacity expansion.

In this respect, Japan introduced a fixed price for purchasing electricity from offshore wind capacity under the Feed-in-Tariff system in 2014 and effectuated the revised Ports and Harbors Act in 2016 to promote offshore wind power generation at port and harbor areas. In 2019, the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities was put into force. The act calls for designating "offshore power generation promotion sites" where wind farms would be adequately connected to grid networks without affecting fishing and shipping operations among areas with great potential for offshore wind power generation. Wind power generation project operators would be allowed to occupy such designated sites for up to 30 years. The act is thus designed to reduce business risks for promoting offshore wind power generation.

Japan has fewer shoaling coasts than the United Kingdom. Offshore wind farm in deep sea areas would cost more for installation, operational management, and maintenance. To cut such costs, larger-size windmills would have to be adopted to increase power generation capacity. Large work ships and port and harbor facilities for shipping windmill supporters

would be indispensable for constructing such large offshore wind power generation facilities.

In addition to the cost and infrastructure challenges, how to develop competitive supply chains is also a key challenge. Given that Japan has no windmill production facilities and must depend on imports from abroad, the Green Growth Strategy has set out a goal of increasing the local content of the entire life cycle for offshore wind power facilities to 60% by 2040.

The offshore wind power generation industry is a broad-based sector rivaling the automobile industry as one wind turbine consists of 10,000 to 20,000 parts. The promotion of the offshore wind power generation industry is expected to have great spillover effects for related industries, contributing to creating new jobs. An increase in the local content of offshore wind facilities is projected to help cut costs for imports from Europe and China and for transportation of large components.

Taiwan, South Korea, and other Asian economies are expected to make progress in expanding offshore wind capacity. Japan needs to develop its internationally competitive offshore wind power generation industry by raising the local content of relevant facilities, serving as an Asian hub to promote relevant component exports, and leading the formulation of regional supply chains.

[Table] Comparison of bottom-mounted and floating offshore wind farms

	Bottom-mounted	Floating
Characteristics	A wind power generator is fixed on a platform supported with columns fixed to the seabed in waters with depths of up to 50 meters.	A floating platform is anchored to the seabed with cables in waters with depths of more than 50 meters.
Representative platform types	Platforms have been developed to meet seabed, depth and other natural conditions. Representative types include (1) the monopile type, (2) the jacket type and (3) the gravity type.	Floating platforms have been developed to meet marine and wave conditions. Representative types include (1) the pontoon type, (2) the semi-submersible type and (3) the spar type.
Potential capacity in Japan	128 GW	424 GW

(Note) Potential capacity in Japan has been estimated by the Japan Wind Power Association. ("Seeking to develop offshore wind into a major power source" July 17, 2020)

(Sources) Compiled by the author from "A Guidebook for Bottom-Mounted Offshore Wind Farms" and "A Guidebook for Floating Offshore Wind Farm Technology" by the New Energy and Industrial Technology Development Organization (NEDO)

Contact:report@tky.ieej.or.jp