

Japan Expanding Floating Wind Farm Amid Intensifying Global Race

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**Pilot project off Fukushima is currently world's largest
Japan has 500 gigawatts of potential floating wind capacity**



Tugboats pull a floating wind turbine from off the coast of Sumoto Port on July 2.

Japan's ambition to lead in the development of floating wind turbines is facing stiff competition from rivals in Europe -- most notably from France -- as companies and governments press to lower costs and prove the technology can rival other sources of clean energy.

At the center of Japan's effort is a demonstration project off the coast of Fukushima north of Tokyo. The largest floating turbine project of its kind at the moment consists of a 2-megawatt turbine, a 7-megawatt turbine, a substation, and a 5-megawatt model, which was towed into place last month and is expected to begin generating power soon.

The project, funded by Japan's Ministry of Economy, Trade and Industry, is being developed by a 10-member consortium including Mitsubishi Heavy Industries Ltd. and Hitachi Ltd. One of the goals is to show whether floating offshore wind can be commercially viable.

"Japan is completely behind Europe" in the development of wind turbines, said Takafumi Shigemura, who's overseeing the project for Marubeni Corp., the Japanese trading company that leads the consortium. "But we are ahead in making floaters to build up our expertise, and there are many docks for shipbuilding available. So we have an advantage."

The Fukushima project's 5-megawatt turbine, the last of the turbines to be installed, is made by Hitachi. The turbine has been moored and testing will begin as early as next month before it becomes fully operational later this year.

Seaborne Construction

Given Japan's relative lack of expertise in seaborne construction compared with European rivals experienced in offshore oil and gas development, costs tend to be high, said Tsukasa Sato, a deputy director at the new and renewable energy division for the trade and industry ministry. "The task is to study how to reduce cost," Sato said.

That's not easy for a project that's testing various technologies for the first time. The 7-megawatt turbine supplied by Mitsubishi Heavy, which deploys a hydraulic drive train instead of mechanical gears, is expected to restart in January after tests led to extra construction work, the company said by e-mail.

Globally, investment in floating offshore wind was a fraction of that for turbines fixed to the bottom of the sea. The floating offshore market is valued at \$490 million to date, including both demonstration projects and a commercial venture off the coast of Scotland that's yet to produce power. That compares with \$113.4 billion invested in traditional offshore wind farms with concrete foundations on the bottom of the seabed, according to data compiled by Bloomberg New Energy Finance.

Floating offshore wind is likely to remain a bit player. By 2020, \$530 million more is expected to be funneled into floating offshore globally, while \$50 billion will be added to fixed-bottom, according to BNEF.

Japan's trade and industry ministry has so far set aside 50 billion yen (\$499 million) for the Fukushima project, which is now in its fifth year.

Though costly, the payoff for Japan may be great. The resource-poor nation has 500 gigawatts of potential floating wind capacity, according to a June 2015 report by Carbon Trust, an environmental group.

Japan first plied the waters of offshore floating wind off Nagasaki in southwestern Japan where a pilot project saw the installation of a 2-megawatt turbine in October 2013.

In Europe, two demonstration projects are underway with the 2-megawatt Hywind project 10 kilometers off the southwest coast of Norway and Portugal's 2-megawatt WindFloat program.

France Emerging

A few more projects are soon expected to come online that will exceed Fukushima's 14 megawatts. Scotland's 30-megawatt Hywind project, now under construction, has secured financing and is expected to go online in 2017, according to Tom Harries, a wind analyst for Bloomberg New Energy Finance. A 25-megawatt project in Portugal is in the process of securing backing, and may go online around 2018.

Meanwhile, France has the potential to be a big player. The country has awarded financial support to two floating projects, each with 24 megawatts of capacity which are to be commissioned by 2020, according to Harries.

"Besides a few demonstration turbines, Japan is yet to show any clear support for floating wind on a larger scale," Harries said. "To grow and sustain a floating wind industry, Japan will have to demonstrate more transparency on support for future projects and on a longer time horizon," he said, adding that France is planning another auction for floating projects.

In Japan, operators of the Fukushima project have said installation of the first 2-megawatt turbine cost about 2 million yen a kilowatt. Even with offshore wind operators winning more favorable tariffs compared with onshore projects, costs must still come down to at least 500,000 yen a kilowatt, Marubeni's Shigemura said.

Getting permission to develop offshore wind is also a hurdle, with local fishermen and others potentially claiming a say in the matter, Shigemura said.

"For developers, this poses a risk," he said.

Fukushima Findings

Below are some of the findings from the Fukushima demonstration project so far:

- The world's first floating substation, set up to increase transmission efficiency, has been trouble-free since its installation in 2013, said Takeshi Ishihara, a professor at the University of Tokyo who has been leading the project.
- A V-shaped design has been shown to reduce the number of components needed for the floating structure on which a turbine is installed, allowing for a 40 percent reduction in cost a megawatt, according to Ishihara.
- A winch fixed to the floater to pull up mooring chains eliminates the need to deploy a crane, boosting work efficiency and safety, according to the professor.