

Sakiyama 2MW Floating Offshore Wind Turbine



Introduction

In the floating offshore wind turbine demonstration project by the Ministry of the Environment from 2010 to 2015, the outsource group represented by TODA CORPORATION and etc. successfully installed the world's first hybrid spar-type (floating structure with its lower part made of concrete and the upper part made of steel), 2,000kW-class floating offshore wind turbine facility.

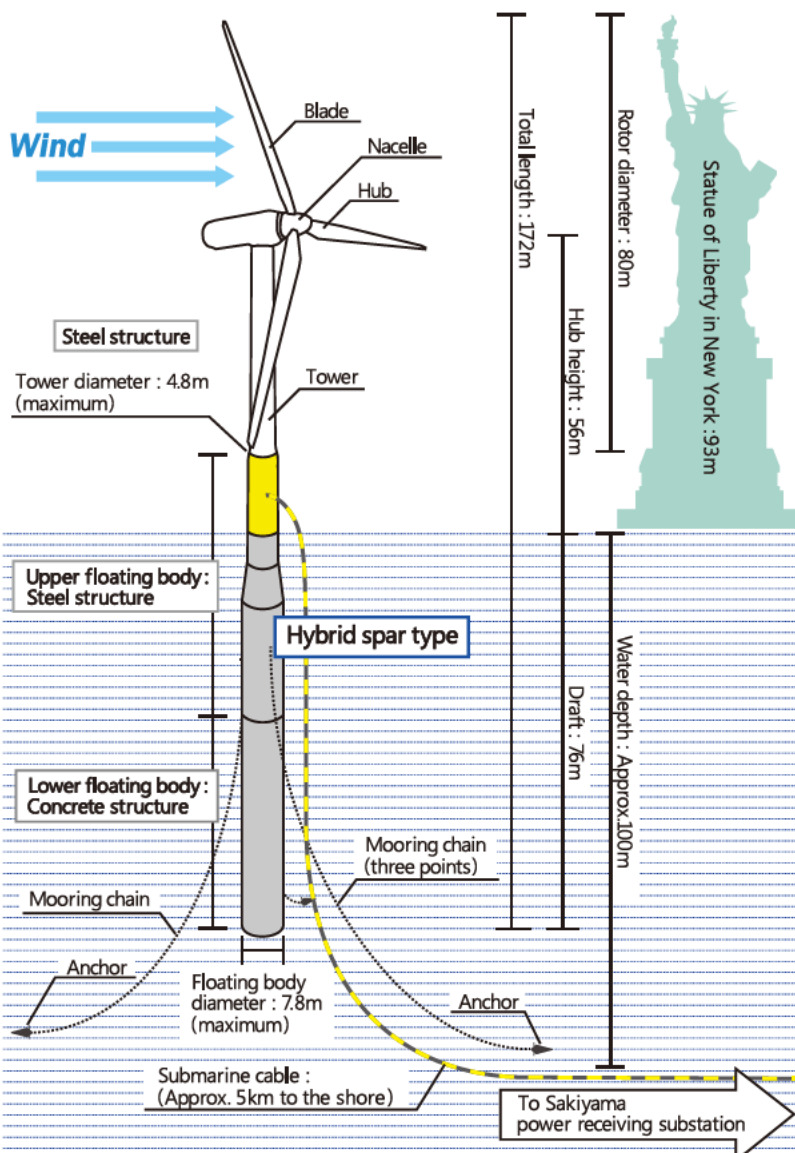
On October 28, 2013, Haenkaze, the first commercial-scale floating offshore wind turbine facility in Japan, was installed off the coast of Kabashima, Goto City, with the understanding and support of local residents and the fishing industry.

Since then, continued efforts have been made to deepen the knowledge for the full-fledged operations of the floating offshore wind turbine facility including expertise in operations, testing and maintenance. At the same time, the impacts on the surrounding sea area, marine life and living environment have been continuously investigated. With the aim of realizing floating offshore wind power generation operated in harmony with the fishing industry, the demonstration has been carried out, and its result has confirmed the safety and eco-friendliness of the floating wind turbine facility.

After the completion of the project by the Ministry of the Environment in FY 2015, Goto City and Goto Floating Wind Power LLC have jointly continued the operations of the wind turbine based on Goto City's basic initiative for renewable energy, aiming to promote floating offshore wind turbines.

Full-scale model

Down wind-type turbine*
Maximum power output 2,000kW (*Wind turbine in which a rotor is on the lee side of the tower)



"Seven Questions" to Understand the Sakiyama 2MW Floating Offshore Wind Turbine

Q1. What is the scale of the wind turbine?

This floating offshore wind turbine facility uses a 2,000kW generator, which is commonly used in wind turbines operated in Japan.

Q2. What is the hybrid spar type?

It is a type of structure featuring state-of-the-art technology developed in Japan. By using a hybrid of steel and concrete (steel in the upper part and concrete in the lower part) for the elongated spar-type floating body, the wind turbine's center of gravity is lowered, resulting in improved stability. This has also resulted in significant cost reductions with the use of purely domestic concrete.

Q3. How much does one wind turbine weigh in tons?

It weighs about 3,400 tons. It keeps its balance by loading ballast of about 1,400 tons into the inner space of the hollow lower spar.

Q4. Is there any possibility that the wind turbine might fall over?

It is designed to pick itself up and return to the original position no matter how much it tilts, just like a roly-poly toy.

Q5. How do you prepare for a typhoon?

If the wind speed exceeds a predetermined level during a typhoon, we stop the rotation of the rotor to neutralize the force of the wind.

Q6. How many households can this wind turbine supply with electricity?

It is a 2,000kW-class wind turbine and has the capacity to supply about 1,800 households.

Q7. How is the generated electricity used?

The wind turbine is connected to Kyushu Electric Power's grid to supply the generated electricity to the residents of Goto Islands including Fukuejima.

Up to completion of wind turbine



1. Steel upper floating body manufactured in a plant is connected with concrete-made lower floating body at the quay to complete the hybrid spar-type floating body.



4. The tower, nacelle and rotor are attached to the floating body, which completes the wind turbine.



2. The floating body (hybrid spar type) is loaded onto a salvage barge and transported to the assembly site in the sea north of Kabashima.



3. The floating body is lifted and raised by a large floating crane, and floated on the sea.



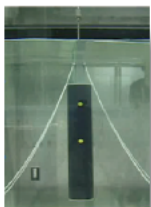
5. After its completion, the wind turbine is towed from the assembly site in the sea north of Kabashima to the installation site.



6. To complete the installation, mooring chains and submarine cables are connected to the turbine at the installation site.

Progress in Floating Offshore Wind Turbine Project

- 2007 Joint research by Associate Professor Utsunomiya of Kyoto University (currently Professor at Kyushu University) and TODA CORPORATION commenced Two-dimensional water tank experiment at 1/100 scale (Kyoto University)
- 2008 Deep water tank experiment at 1/20 scale (National Maritime Research Institute)
- 2009 Ocean field experiment at 1/10 scale (Sasebo City, Nagasaki Prefecture)
- 2010 Demonstration project outsourced from the Ministry of the Environment Demonstration site selected (off the coast of Kabashima, Goto City)
- 2012 Small-scale experiment model (1/2 scale, 100kW) installed: Japan's first grid-connected floating offshore wind turbine facility
- 2013 Demonstration model (2,000kW) installed: Japan's first commercial-scale floating offshore wind turbine facility
- 2015 Demonstration model relocated to a site off the coast of Sakiyama
- 2016 After the completion of the project by the Ministry of the Environment, the operations continued by Goto City and Goto Floating Wind Power LLC.



1/100

2007



1/20

2008



1/10

2009



Selection of demonstration site

2010



Small-scale experiment model 100 kW

2012



Demonstration model 2,000 kW

2013

2016

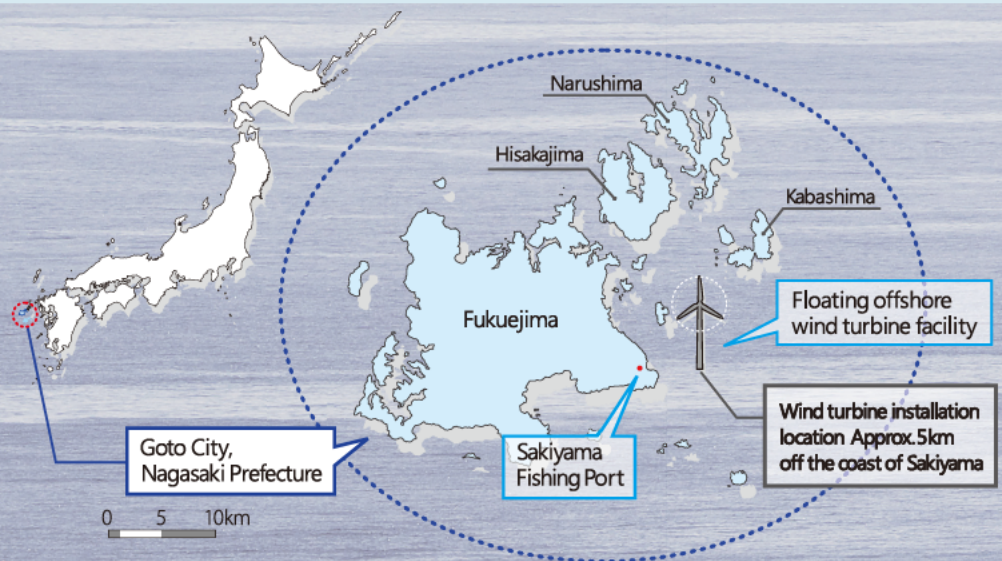
Project by the Ministry of the Environment (from 2010 to 2015)

Facility Outline

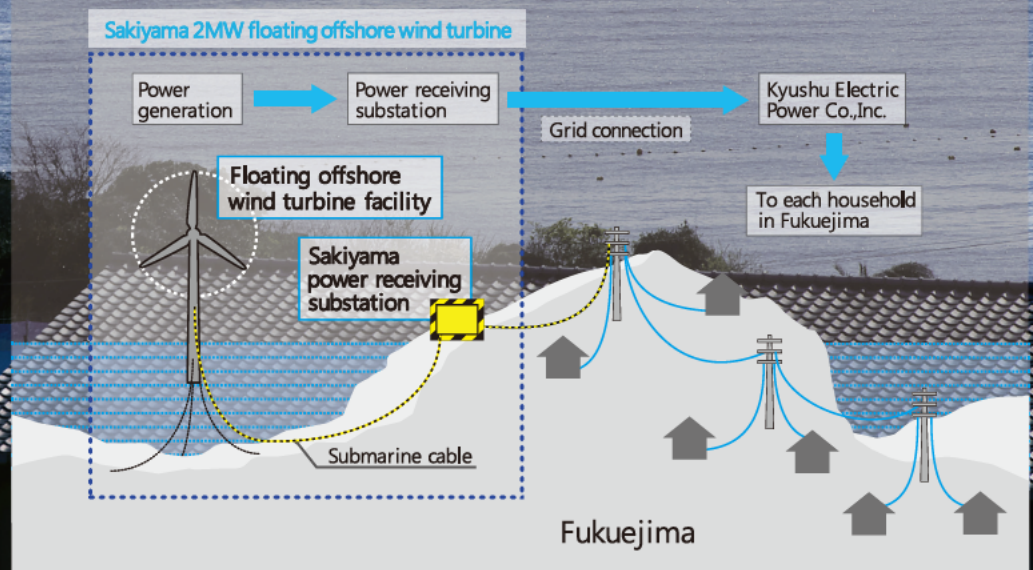
Name of power plant	Sakiyama 2MW floating offshore wind turbine
Location	Approx. 5.0km off Sakiyama Fishing Port, Shimosakiyama-cho, Goto City, Nagasaki Prefecture
Owner	Goto City
Operator	Goto Floating Wind Power LLC.
Name of vessel	Haenkaze (Non-self-propelled vessel)
Wind turbine generator	Downwind type, HTW2.0-80 (Hitachi, Ltd., 2MW class)
Floating facility	Structure type : Hybrid spar type Mooring system : Three-point catenary mooring system



Installation Site



Transmission of Electric Power



Contact Goto Floating Wind Power LLC
Address : 1190-9 Fukue-cho, Goto City, Nagasaki Prefecture

Front and back cover photographs by Hoichi Nishiyama