

# EXPERIMENTAL STUDY OF FLOATING OFFSHORE WIND FARM (FOWF) IN FUKUSHIMA

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**SUMMARY:** Fukushima Floating Offshore Wind Farm Demonstration Project is world's first project of offshore wind power which consists of floating wind turbines and power sub-station. Marubeni promotes this project as a project integrator with consortium and research 4 themes, permitting process, establish control system of Operation & Maintenance, collaboration with fishery industry and project evaluation for future commercialization and expansion of offshore floating wind farm.

## INTRODUCTION

Power shortage and a nuclear crisis caused by the Great East Japan Earthquake two years ago triggered Japan's awareness to build renewable energy infrastructure. Implementation of renewable energy infrastructure and development of new technology are promoted by the Japanese Government.

Fukushima Floating Offshore Wind Farm Demonstration Project (Fukushima FORWARD) is the experimental study sponsored by the Ministry of Economy, Trade and Industry since March 2012. Marubeni promotes this project as a project integrator and form a consortium with another 9 companies and 1 university.

The purposes of this project are:

- 1) Redevelop Fukushima as a center of industry with a strong focus on renewable energy and create new industries.
- 2) Create practical business scheme and deploy large scale floating wind farms
- 3) Build up the experience and knowledge of the Floating Offshore Wind Farm (FOWF) and lead to the development of Japan's new export industry.

sub-station off the coast of Fukushima. The first phase of this project started from 2012 is to install 2MW floating wind turbine, the world's first 66kV floating power sub-station and undersea cable. The installation of these was successfully completed on 31st of October, and then the operation has been started since December 2013.

In the second phase, two units of 7MW wind turbines are scheduled to be installed in 2015.

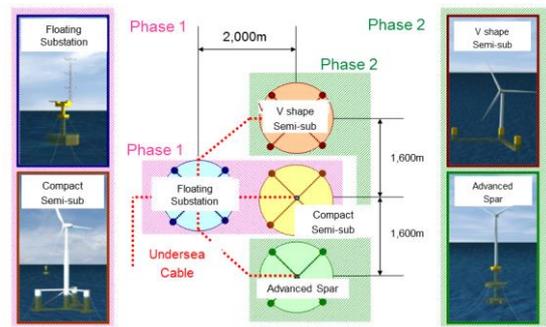


Figure 2. Plot of turbines and sub-station

## FUNCTION OF MARUBENI

Marubeni's function of this experimental study of FOWF is:

- 1) Permitting process; trying early acquisition for permits consulting with relevant ministry. (There is no precedent FOWF in Japan.)
- 2) Establish control system of Operation & Maintenance; Establish efficient control system for future commercialization.
- 3) Collaboration with fishery industry; seeking for approval and cooperation from fisheries.
- 4) Project evaluation; due diligence of estimated capacity, construction and maintenance cost.

## OPERATION & MAINTENANCE

It is required for O&M plan that maximizes availability at least cost by the best possible access to offshore plant, carrying out maintenance as efficiently as possible. In order to establish efficient control system, a comprehensive O&M plan for FOWF is to be produced through this

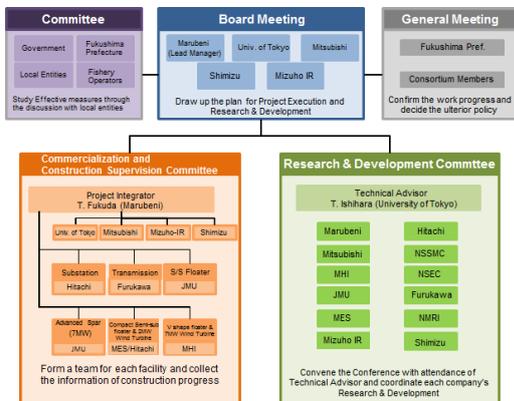


Figure 1. Project Execution Organization

## CONSTRUCTION PHASE

This experimental project consists of three floating wind turbines and one floating power

experimental study.

### **Data Monitoring**

With the start of operation, we have started supervisory control and data acquisition (SCADA) monitoring at switching station. The operating data of Generator and the image of floating system are monitored in real time.

### **Access System**

To improve accessibility to the turbines and the sub-station, we have been started to charter catamaran offshore support boat as a transfer vessel since December 2013. It provides more reliable, safer and effective access to the floater. The measuring instruments on boat also help to evaluate the sea condition.



Figure3. The catamaran boat 'J CAT ONE'

### **SAFETY NAVIGATION**

Prior to monitor safety navigation, a committee has been established to settle the measure of safety navigation during and after installation of the facilities. Lights, foghorns and AIS have been installed. It has been also carried out to notify to the parties concerned to keep a lockout for other vessels and keep distance from facilities.

### **COLLABORATION WITH FISHERY INDUSTRY**

It is vital to gain approval and cooperation to this experimental study from fisheries. Some experimental ideas are put in action to study the fish resource and fishing activity around project site and to discuss the project with the fishing industry.

### **Committee and Working groups**

A committee formed by the government, Fukushima prefecture, local public entity, representative of fishermen's union and authorities on the fields has been organized. As subordinates of the committee, working groups which consist of local fishermen, the government and us are also organized. We have been discussing about the impact on the sea and fishery operation after installation of facilities, the development of new fishing methods, and other measures which collaborate with fishery.

### **Catching Test**

Fish catching tests have been carried out continuously with the cooperation of fishermen to

investigate the sea condition before and after installation of facilities. To collect as much information as possible, the tests are carried out at various areas by different methods. The test shows that the installation of FOWT does not affect the catching condition so far.

### **Research of Fish Gathering Effect**

To ensure the fish gathering effect, which is said that fish is tend to be drawn to floater, the undersea condition around facilities is observed by ROV. Materials stuck with the floater, which may impact fish gathering, is also investigated. Seashells are found sticking with the chains a month after installation of facilities and some fish are found to migrate around the chains and sit near the anchors.



Figure 4. Fish gathering, by ROV



Figure 5. Seashells sticking with chains

### **Sea Information**

Sea information through observation equipment on floater is to be provided to fishermen. The useful ways for fishermen to receive info is under discussion. The information service such as online or radio may be provided.

### **ACKNOWLEDGMENT**

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