The wind power generation business of Mitsui E&S, which has been involved in the construction and manufacture of 234 wind turbines, has now begun on a full-scale basis – with the trend of the times as a tail wind.

While the shift to renewable energy has been accelerated, wind power is attracting a lot of attention.
In Japan, the Ministry of the Environment has set a 26% cut in greenhouse gas emissions by FY 2030 compared to FY2013 as the target, under which it is powerfully promoting the spread of wind power generation.
The Ministry of Economy, Trade and Industry forecasts a significant increase in the amount of power generated from wind power.
Mitsui E&S has been involved in the construction of a total of 98 wind turbines* in 14 projects and the manufacture of a total of 171 wind turbine towers. We have consolidated our technologies and expertise, which we have accumulated internally, into a single department.
We will make further moves toward a sustainable society where renewable energy will be utilized more effectively.

*The total number for onshore and offshore EPC, including those to be completed in 2019 and 2020

The steps we have taken to create wind power facilities by changing our approach and accumulating expertise

2003-

Began the assembly of wind power facilities ahead of other companies

In 2003, we built a wind power generation facility on the premises of the Chiba Works in anticipation of the growth of renewable energy. We assembled the facility by taking advantage of our technologies cultivated through the construction of steel bridges and iron frameworks of buildings. Based on this experience, we worked on the manufacture and assembly of 171 towers, thereby accumulating expertise.

2005-

Began to work on the design and production of wind turbine towers as well

In 2005, in a project in Tottori Prefecture, we internally designed a tower supporting the wind turbine for the first time. This tower is approximately 80 meters tall and has a diameter of about 4 meters. We successfully completed the extremely difficult process of tapering the tower while keeping its cross-section perfectly round. Thereafter, we worked on tower construction in 22 projects.

2006-

Also began to design and manufacture gearboxes ourselves

In 2005, we manufactured a gearbox (speed-up gear), which is mounted in nacelle, with a group company. While working on towers, main frames and gearboxes, we carried out the installation of the overall facilities. By taking advantage of both our strength in manufacturing and our strength in EPC in this way, we continued to explore market needs and study the business environment.

2012-

Focusing on the EPC* business and experimenting with offshore wind power generation

We have all the resources required for wind power generation within the group, including electric power, machinery and civil engineering resources. Taking advantage of this, we have been focusing our efforts on the EPC business, in which we have managed the entire process of multiple projects, from upstream to downstream. We will also make a foray into offshore wind power generation, which is expected to increase in the future.

※EPC:Engineering, Procurement, Construction)

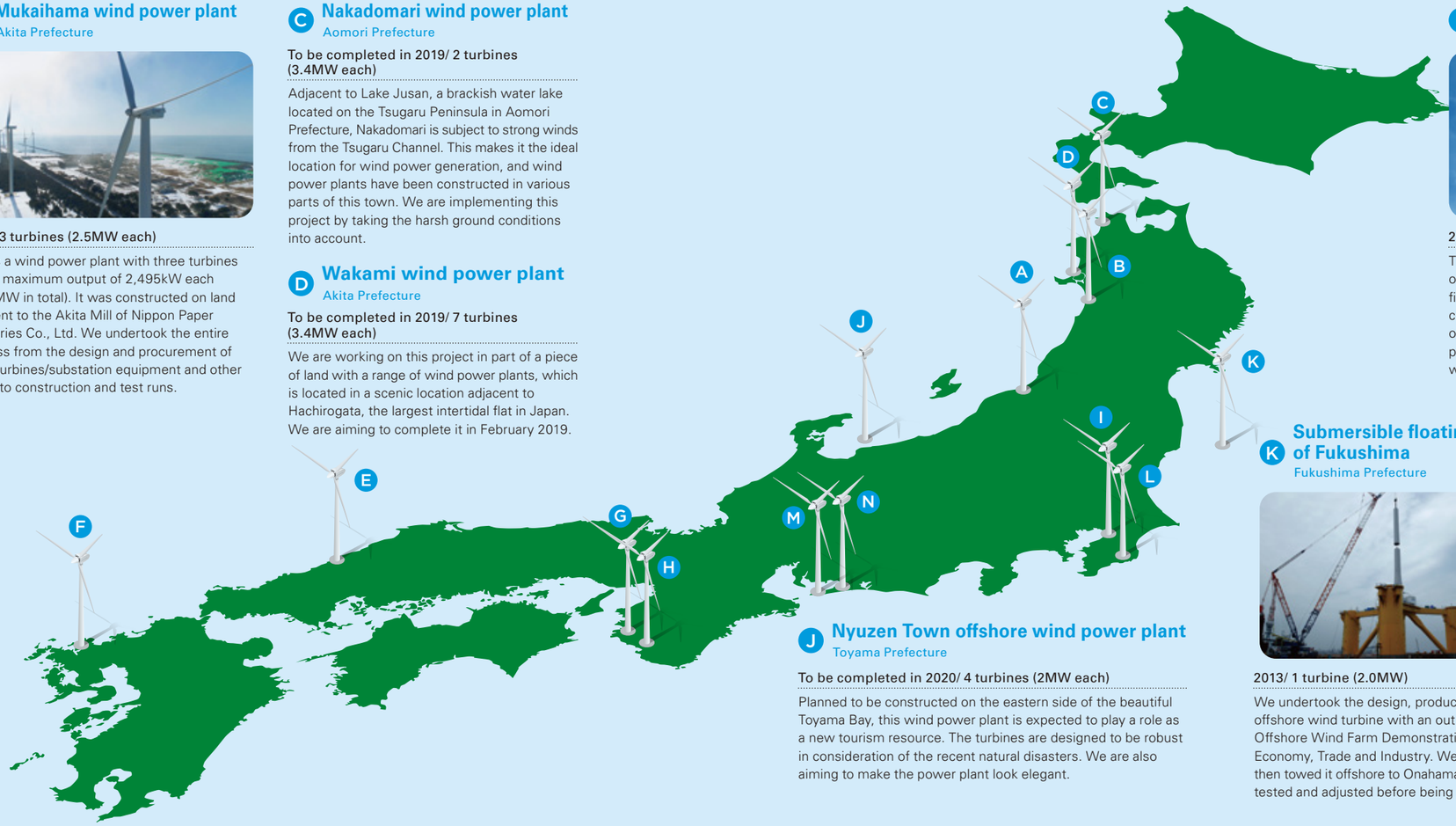
Action *for* Creation of a Sustainable Society

Wind turbines that Mitsui E&S has worked on are operating on the plains, in the mountains and offshore as important energy resources of Japan.

Total EPC in 13* projects + EPC in 1* project

*Including projects to be completed in 2019 and 2020

*floating offshore wind power generation project



A Tainai wind power plant,
Niigata Prefecture

2014/ 10 turbines (2MW each)

This is a full turn-key project, in which we worked on the entire process from design to procurement and onsite installation work. The total output of 20,000kW is equivalent to the electric power consumed by around 14,000 households.

B Mukaihama wind power plant
Akita Prefecture

2018/ 3 turbines (2.5MW each)

This is a wind power plant with three turbines with a maximum output of 2,495kW each (7.49MW in total). It was constructed on land adjacent to the Akita Mill of Nippon Paper Industries Co., Ltd. We undertook the entire process from the design and procurement of wind turbines/substation equipment and other items to construction and test runs.

C Nakadomari wind power plant
Aomori Prefecture

To be completed in 2019/ 2 turbines (3.4MW each)

Adjacent to Lake Jusan, a brackish water lake located on the Tsugaru Peninsula in Aomori Prefecture, Nakadomari is subject to strong winds from the Tsugaru Channel. This makes it the ideal location for wind power generation, and wind power plants have been constructed in various parts of this town. We are implementing this project by taking the harsh ground conditions into account.

D Wakami wind power plant
Akita Prefecture

To be completed in 2019/ 7 turbines (3.4MW each)

We are working on this project in part of a piece of land with a range of wind power plants, which is located in a scenic location adjacent to Hachirogata, the largest intertidal flat in Japan. We are aiming to complete it in February 2019.

E Wind Farm Hamada
Shimane Prefecture

2016/ 29 turbines (1.67MW each)

We installed 29 wind turbines with an output of 1,670kW each in Kanagi-cho and Yasaka-cho in Hamada City, Shimane Prefecture. The total output of this wind power plant will be 48,430kW (approx. 48MW). It is expected to generate 85,000MWh per year.

I MJ Ichihara wind power plant
Chiba Prefecture

2004/ 1 turbine (1.5MW)

This wind turbine was installed on the premises of the Chiba Works of Mitsui E&S as Japan's first large-scale wind power generation facility constructed in a shipyard. Taking full advantage of the location, we significantly reduced the problems related to the transportation of large wind turbine parts.

K Submersible floating wind turbine off the coast of Fukushima
Fukushima Prefecture

2013/ 1 turbine (2.0MW)

We undertook the design, production and installation of one downwind floating offshore wind turbine with an output of 2MW in the Fukushima Floating Offshore Wind Farm Demonstration Project Phase 1 by the Ministry of Economy, Trade and Industry. We assembled the turbine at the Chiba Works and then towed it offshore to Onahama Port in Fukushima Prefecture, where it was tested and adjusted before being moored in the area as the demonstration site.

J Nyuzen Town offshore wind power plant
Toyama Prefecture

To be completed in 2020/ 4 turbines (2MW each)

Planned to be constructed on the eastern side of the beautiful Toyama Bay, this wind power plant is expected to play a role as a new tourism resource. The turbines are designed to be robust in consideration of the recent natural disasters. We are also aiming to make the power plant look elegant.

F Hizen Minami wind power plant
Saga Prefecture

2007/ 12 turbines (1.5MW each)

This wind power plant was constructed in a location with a beautiful view of Genkainada, which is located in a coastal area of Hizen-machi in Karatsu City, Saga Prefecture. The Hizen Minami wind power plant (1,500kW x 12 turbines) began operating about three years after the Hizen wind power plant (1,500kW x 8 turbines).

G Yura wind power plant
Wakayama Prefecture

2011/ 5 turbines (2MW each)

We installed five wind turbines on the western side of Ameshi-yama (Mt. Ameshi) at an altitude of approximately 400 meters and achieved a generation capacity of 9,950kW (1,990kW x 5 turbines). We adopted downwind wind turbines, which are optimal for rough terrain such as mountains and hills.

H Inami wind power plant
Wakayama Prefecture

2018/ 13 turbines (2MW each)

We installed 13 wind turbines with an output of 2,000kW each in an area of approximately 27.2 hectares. During the installation work, we gave consideration to the natural environment of the mountainous area. In designing and constructing this wind power plant, we considered disaster control and aimed for its harmonious co-existence with the local community.

L Kamogawa wind power plant
Chiba Prefecture

2007/ 1 turbine (1.5MW)

This project is rare in the country overall in that the site of a quarry is used for wind power generation for infrastructure improvement. We are striving to ensure the economic efficiency of the work. For example, we designed the plant to take advantage of the current ground conditions.

M Atsumi wind power plant
Aichi Prefecture

2006/ 7 turbines (1.5MW each)

The majestic view of the wind turbines, which stand in a line at Cape Irago, attracts large numbers of tourists. They are widely covered by the media. For example, they were used in a TV commercial of a local automobile company.

N Tahara S&W
Aichi Prefecture

2014/ 3 turbines (2MW each)

Combining a solar power plant (mega solar farm) and a wind power plant, Tahara S&W is one of the largest hybrid power plants in Japan. It is also used as a location for environmental education by local educational institutions (elementary, junior high and high schools) of Tahara City.

In Japan, we have seas. Wind turbines are being built in the sea of Toyama. A bottom-mounted offshore wind power project that we are seeking to implement with a new construction method.

Bottom-mounted offshore wind power generation project off the coast of Nyuzen Town

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Tamehisa Yamaguchi

Nyuzen Town offshore wind power generation project (Toyama Prefecture)

■Number of wind turbines to be installed: 2MW-class wind turbine x 4 ■Output: Around 7.5MW ■Installation site: Eastern side of the marine area off the coast of Nyuzen Town, Toyama Prefecture ■Interconnection point: Nyuzen Substation, Hokuriku Electric Power Company

"Let's develop a Japanese way on our own." And we got to the small-scale bottom-mounting method.

In Japan, the potential of onshore wind power is limited. Accordingly, the promotion of offshore wind power is essential for ensuring that wind power generation spreads in this country. However, the construction of large-scale offshore wind farms such as those in Europe did not make any progress because there is no large specialized ship for installing wind turbines offshore in Japan. In this country, there are no offshore wind power plants that are fully privately funded. The introduction of offshore wind power generation would have only been delayed unless we found a new method.

"We needed to develop a method that could be put into practice immediately, instead of planning a large-scale facility and spending a long time on negotiations, environmental assessments and experiments." (Yamaguchi)

Accordingly, Yamaguchi and other staff members invented the small-scale bottom-mounting method, with which wind turbines are installed close to a fishing port or harbor where the water is not as deep. With this method, the foundation can be small, and the barrier of the installation cost is lowered if the waves are relatively gentle. Meanwhile, the salespeople began to prepare to realize the project and look for a potential site together with a wind power generation business operator.

"We have a salvage barge for port cranes." Development of a new construction method that uses a salvage barge with a fork

How could we install a wind turbine in a shallow water? Keiji Fukazawa, the head of the Wind Power Generation Group at the Project Department I, began to develop an installation work method in August 2015. As a result of comparing various methods, Fukazawa found that installation using a salvage barge with a fork was the optimal method. This salvage barge is used for installing port cranes. With the new method, an assembled wind turbine is transported on the fork, while the wind turbine remains standing and is unloaded accurately on the foundation. It is excellent in terms of both workability and economic efficiency. This idea was created because Fukazawa used to work at the Oita Works, where port cranes are manufactured. Fukazawa created a 1/30-size model and conducted various shock analyses and tank tests at Akishima Laboratories. He confirmed that a little remodeling enables the salvage barge for transporting cranes to be used for wind turbine transportation.

"Having the experience of constructing offshore structures, including the caisson foundations of the Great Seto Bridge and the Rainbow Bridge, we can do many things with our internal technologies. In addition, we hold regular information exchange meetings called the Offshore Wind Turbine Meetings with engineers from Mitsui E&S Shipbuilding Co., Ltd. and MODEC, Inc., which was also advantageous." (Fukazawa)

Nyuzen Town in Toyama Prefecture was selected as the site. We are aiming to start operating the plant in 2021.

An operating company was established though joint investment by Mitsui E&S and the wind power generation business operator. It was decided that the facilities will be installed at Nyuzen Town in Toyama Prefecture, which faces the Sea of Japan. Boring exploration of the sea bed and negotiations with the municipal government and local fishermen's union made steady progress. As a result, it was finally determined that Japan's first privately funded offshore wind firm will be born in 2021.

"The municipal government expects that the wind turbines standing in the Sea of Japan will also be a tourism resource. We believe that it is sure to be an instagrammable spot." (A related person)

Tenyu, a 148.3-meter-long salvage barge built by Mitsui E&S Shipbuilding Co., Ltd., was selected as the salvage barge with a fork to be used for installing the turbines. The wind turbines will travel about 40 kilometers along the coast on Tenyu, from a port near the factory where they will be assembled. The wind turbines that are being transported will also attract attention. Members of Mitsui E&S continue to take on challenges with the aim of succeeding in this project, which will significantly advance wind power generation in Japan.

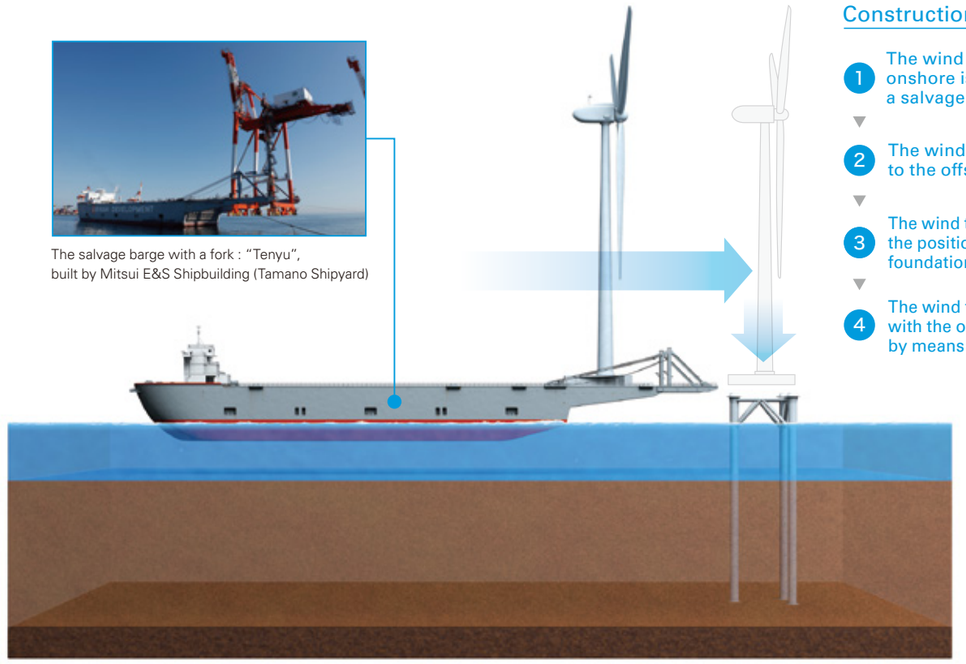
Point 01 Small-scale, bottom-mounted facilities

For the project in Nyuzen Town, steel structure foundations, in which we have strength, and small-scale, bottom-mounted facilities, which can be installed at a relatively low cost for the work barge, have been selected. The installation work will be carried out in a water area managed by the municipal government, which minimizes the number of negotiation partners. Further, environmental assessment by the national government, which would be necessary if the output were 7.5MW or more, is not required, which significantly shortens the period prior to commercialization. We aim to begin operating the wind farm in January 2021.

Point 02 Establishment of an original construction method that uses a salvage barge with a fork

In the project, Mitsui E&S Engineering will apply a construction method with which the wind turbine will be transported on a barge with a fork while the wind turbine remains standing. The work barge to be used in the project has been used for installing cranes that load and unload containers in ports. We will remodel it for use in the project, which will enable us to keep the cost significantly low. This method will also enable us to complete offshore work, which is easily affected by weather and offshore conditions, within far fewer days, which will also reduce the cost.

The salvage barge with a fork : "Tenyu", built by Mitsui E&S Shipbuilding (Tamano Shipyard)



Construction procedure

1. The wind turbine assembled onshore is loaded on a salvage barge with fork.
2. The wind turbine is towed to the offshore foundation.
3. The wind turbine is moved to the position directly above the foundation and installed there.
4. The wind turbine is integrated with the offshore foundation by means of onsite welding.

Point 03 Together with the local community – Participating in the business

In this project, the Mitsui E&S Group will also participate in the business by investing in the company that will operate the power plant. In addition to constructing the wind power generation facilities, we are responsible for creating a mechanism that can create value sustainably, such as establishing a system for collaborating with local companies and the municipal government and building a consensus with the local fishery people. We are also committed to PR activities with people from the town office, with the aim of making the four seaside wind turbines a tourism resource of the town.

General Manager Shigeru Tokumaru of the Environment and Energy Department, Mitsui E&S Engineering Co., Ltd., shaking hands with Mayor Haruhito Sasajima of Nyuzen Town, Toyama Prefecture.