Offshore Wind Power Experience in Japan (2016)

- Hakata, 2011
  - Lens type 3kW X 2 units
    -(Floating)

- Sasebo, 2009
  - 1/10 Model
    -(Floating)

- Kabashima at Goto Islands
  - 2012~14 FHI 100kW
  - 2013-16 Hitachi 2MW
    -(Floating)
  - Relocated to
    - Fukuejima, 2016
    - Hitachi 2MW
      -(Floating)

- Akita, 2015
  - Siemens 3MW

- Sakata, 2004
  - Vestas
    - 2MW X 5 units

- Hibikinada, 2013
  - JSW 2MW

- Choshi, Jan 2013
  - MHI 2.4MW

- Saga, (2013, failed)
  - 500kW Model
    -(Floating)

- Setana, 2003
  - Vestas
    - 600kW
    - X 2 units

- Black: Early exam.
- Green: Fixed type
- Brown: Floating (small)
- Blue: Floating type
- : National Project

Note: FHI's WTG division has merged by Hitachi in July 2012.
Offshore Wind Power Experience in Japan (2016)

- 59.6 MW, 28 turbines, 9 projects at 8 locations in total at the end of Feb. 2017. It is 1.8% of total wind power installation (3,234 MW) in Japan.

- 44.2 MW, 23 turbines (74%) are commercial or local government owned projects. Almost all of them are very close to seashore, so-called “Semi-offshore”. Dolphin type or Monopile type foundations are used at these projects.

- Real offshore projects (more than 1 km from seashore) are National projects.
   Fixed type by NEDO: 4.4 MM, 2 turbines at Choshi and at Kitakyusyu
   Gravity type (Jacket type foundation)

   Floating type by MOE: 2 MW, 1 turbine at Kabashima (Spar type floater) (GOTO-FOWT) → It granted to Goto city, relocated 10 km southeast to Fukue island, reconnected to grid, and started commercial operation in Apr. 2016.

   Floating type by METI: 9 MW, 2 turbines at Fukushima (Semi-sub type floater) (Fukushima FORWARD, on going) → 5 MW turbine on advanced spar type floater was anchored in 2016 and it starts official operation in Mar. 2017.

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<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Distance (km)</th>
<th>Depth (m)</th>
<th>Rated (MW)</th>
<th>No. of WTG</th>
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</table>

* National projects
O : Relocated, Under commissioning
Offshore projects by Local governments and private companies

Dec. 2003
At Setana port in Hokkaido
By Local government (Setana)
700m offshore, 3m in depth
Vestas 600kW x 2 turbines
Dolphin type foundation
1st offshore wind power in Japan

Feb. 2010 at Kamisu in Ibaragi
By Wind Power Group
Offshore from 40~50m, 4m in depth
FHI (Hitachi) 2MW x 7 turbines
Monopile foundation (∮ 3m)
They withstood huge Tsunami in 2011.

Demonstration of Offshore Wind Power Generation by NEDO, at Choshi, Chiba Pref.

WTG: MWT92/ 2.4 offshore model
Foundation: Gravity type
Output: 2.4MW
Rotor Dia.: 92m
Hub Ht.: 80m
Water Depth: 12m
3km from seashore

Ref: NEDO (New Energy and Industrial Technology Development Organization)
Demonstration of Offshore Wind Power Generation by NEDO, at Hibikinada, Fukuoka Pref.

Anemometer Tower
Under sea cable
Switching Gear

Hybrid Gravity Foundation

JSW J82 2MW gearless PMSG WTG

In Operation on June 2013.
Ref: NEDO

1/10 Model, spar type floater
Co-research by Sasebo Heavy Industry and Kyoto University (in Sep.2009 at Sasebo bay in Nagasaki pref.)

Hybrid Spar type Floater is made by pre-stressed Concrete.
Total length : 12.5 m
Undersea length : 7 m
Lenz type wind turbines by Kyushu University

3kW X 2 units, on the hexa shape floater by polystyrene foam in operation Dec.2011 at Hakata bay in Fukuoka pref.

Skwid: offshore wind and marine stream hybrid power system, 500kW, by MODEC

- Vertical wind turbine and Savonius water wheel (ballast weight) are connected by gear coupling
- Supported by Japanese NEDO
- MODEC intended to 500kW prototype demonstration at Genkai-nada in Saga pref. in 2013.
- Two troubles happened and MODEC quitted project. Water wheel has dropped during transportation. It damaged at anchoring, and sunk by storm.
MOE Floating WTG Project at Kabashima in Goto Islands, Nagasaki Pref. (GOTO-FOWT)

Hitachi’s Down wind type 2MW wind turbine
28 Oct. 2013: in Operation

2MW floating turbine was relocated in 2016

MOE’s national project has finished in Mar. 2016.
The turbine was granted from MOE to Goto city local government.
Toda Co. has moved WTG about 10km southwest from Kabashima to Fukuejima.
Fukuejima has more population (38k) and larger electricity capacity than Kabashima.
It was re-connected to the gridline and started commercial operation in Apr. 2016.
METI approved offshore wind tariff 36 JPY/kWh for it. (1st and only case in Japan)

Ref: Press release by Toda Co. on 15 Apr. 2016
Photo: Taken by Mr. Hoichi Nishiyama
Toda Co. announced to develop 21MW floating offshore windfarm at Goto islands on 3 Oct.2016

http://www.toda.co.jp/hairyo.html

**METI’s Fukushima Recovery, Experimental Offshore Floating Wind Farm Project (FukushimaFORWARD)**

**Project Consortium:** 11 members

- Marubeni (Project integrator)
- MHI
- University of Tokyo
- Mitsubishi Corp.
- IHI Marine United
- MES
- Nippon Steel
- Hitachi
- Furukawa Electric
- Shimizu Corp.
- Mizuho Information & Research

**2013**

- Hitachi JMU Spar

**2013**

- Hitachi 2MW Mitsui semi-sub

**2016**

- MHI 7MW MHI semi-sub

**2017**

- Hitachi 5MW J MU Spar

Source: Fukushima offshore wind consortium
Floating substation (Hitachi) on advanced spar type floater (JMU), since 2013

1st 2MW turbine (Hitachi downwind type) on semi-sub type floater (Mitsui Zosen), since 2013

2nd 7MW turbine (Mitsubishi hydraulic type) on semi-sub type floater (Mitsubishi), since 2016

3rd floating turbine
- 5MW turbine (Hitachi, downwind type) is ready for shipping.
- Advanced spar type floater is under construction at dockyard in Osaka.
- The turbine was installed on the floater at Osaka bay and carried to Fukushima in 2016.

5MW Floating Wind Turbine for Fukushima Project has been completed at Osaka on 24 May 2016.

April, 2016, at Sakai Dockyard of HITZ

On 2 May at Osaka bay Sumoto port

On 9 May

On 24 May

On 19 May The floater has leaned temporarily. But, it was recovered within 5 days.

On 18 May

On 14 May

Hitachi’s Down wind type 5MW turbine HTW126
Coming Offshore Wind Power Projects in Japan (2016)

- 1926 MW, 18 projects at 13 locations in total now. Most of them are under EIA procedure.
- 1406 MW, 13 projects are commercial projects. The earliest one shall be “Kashima port 1st”.
- 5MW floating turbine is added at Fukushima in 2017
- 3–4 MW floating turbine shall be added at Kitakyushu in 2018 by NEDO new project
- Japanese Government (MOE) settled two offshore Test fields

Legal Hurdles;
- Port associated area: Cleared in 2016
- General common area: Start discussion in 2016

### Coming Offshore Wind Power Projects in Japan (2016)

<table>
<thead>
<tr>
<th>Type</th>
<th>Location</th>
<th>Port</th>
<th>WTG (MW)</th>
<th>No. of WTGs</th>
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*National projects **Estimated by JWPA
*** 3GW is offered at Akita far offshore by NGO, besides this table
Roadmap for the Wind Power Introduction for Japan, proposed by the JWPA

- 10GW prospect at Energy mix plan shall be achieved at early 2020s.
  (3.2GW at 2016 + 10.8GW during EIA process = 14GW)
- JWPA proposes 36.2GW toward 2030 for the next stage.

Japan has Huge Wind Energy Resources

- Onshore: ave. wind speed 6.5m/s considering social acceptance
- Offshore: ave. wind speed 7m/s
  Distance 30km<
  Sea depth 200m< considering social acceptance
Hurdles against offshore wind in Japan

- Small official target by Japanese government (820MW).
- Restricted shallow sea area (surrounded by deep sea)
- Floating wind power for deep sea by national projects were very expensive.
- Poor grid infrastructure at good wind area (Hokkaido & Tohoku, northern Japan)
- Moderate wind speed (Low income) at offshore area in central & western Japan
- Big law uncertainty at “General common sea area” (So-called Thomas Hobbes’s “the war of all against all”. “Who has the permission rights?” is not clear now. Concerning Fishermen’s rights, Decommissioning, etc.)
- Lack of “Jack up ships/SEP”, “Base ports”
- “Cabotage / Labor restriction” for Jack up ships
- Long EIA process (4-5 years)

Japanese trade company Marubeni retired from Kashima port2 offshore project due to low profitability with low wind speed. (SBEnergy/Softbank retired from neighbor port1 project. Local developer Komatsuzaki group continues it.)

Marubeni cancels part of port-based project

10 Jan.2017

Another developer, Windpower Energy Group, won the bidding for the southern portion of the port area and will reportedly continue with the project.

The prefectural government will reopen bidding for Marubeni’s portion of the port project in February.

In August 2016, Marubeni signed an agreement with a consortium of companies, including utilities, to carry out feasibility studies for two proposed projects at two port sites in the Akita prefecture, in the northern part of the major Japanese island, Honshu.

Marubeni has halted development of a project in Kashima Port (pic: Onyo at WTS Wikivoyage)
“Port and Harbor Law” has been amended to promote offshore wind power development in Japan on 13 May.

Japanese MILT amended “Port and harbor law” to promote offshore wind power at Port associated area in May 2016

The contents of amendment make it clear;

- “How to bid for the offshore wind power” at port associated area.
  (including how to expand “port associated area”)
- The concrete contents for the bidding/auctions
  (including decommission at the end of the projects)
- The winners get “20 years occupation permission”.
  (It’s too short for “from planning to decommissioning”.
  We have to request permit extension during project lifetime.)

http://www.city.kitakyushu.lg.jp/kou-ku/30300004.html

Local Industry Group (Kyushu Electric Power, J Power, etc.) won the Kitakyushu bidding in Feb.2017

Consortium picked to build Japan’s largest offshore wind farm

A consortium led by regional Japanese utility Kyuden Mirai, has been chosen to develop what would be the Asian country’s largest offshore wind farm to-date, a 475ba (515ba) project expected to add 229MW to the current fleet.

Sited off the coast of Fukusuka prefecture on the western island of Kyushu, construction of the Hibiunada wind farm would start in 2022 following an environmental impact assessment expected to take three to four years to complete, the Hibiunada Wind Energy group, which includes utility J-Power, Saibu Gas and engineering firm Kyudenko, said in an official statement.

The wind farm would be built around as many as 44 turbines installed on jacket foundations roughly 10km off the port of Hibiunada, in Kitakyushu’s Wakamatsu Ward. The project will span 2,700 hectares across four adjacent sites, where wind speeds average about 7 metres per second.

The Kitakyushu government said that the project will necessitate upgrades to Hibiunada’s port infrastructure.

In addition, Hokutsuka will likely establish an O&M base near the port, while NSSMC will set up a foundation production facility.

The consortium might also spearhead the construction of a gearbox production base, the local government said.

The auction for the Hibiunada project is the first public offering of near-shore development rights since the Port and Harbour Law was revised last May. The amendments have given project owners the right to operate wind farms in ports beyond the original occupancy limit of 10 years.

The Kitakyushu Seaport and Airport Bureau opened up bidding for the Hibiunada project in August, with an initial plan of at least 50MW.

The municipal authorities have already overseen the construction of several pilot projects near the Hibiunada port, most notably with the 2013 installation of a 2MW Japan Steel Works turbine on a four-legged, trussed steel jacket foundation in 15 metres of water.

The Ministry of Environment also launched a study in early 2015 to assess the feasibility of building a 700MW fixed-foundation project off Hibiunada.

The island of Kyushu is rapidly emerging as a potential hub for offshore wind. In early 2015, the UK Carbon Trust announced plans to set up a tidal and floating wind energy test facility with the authorities in Nagasaki prefecture.
Jack-up ship problem can be solved in Japan

Offshore wind power developments in Japan have many hurdles now, but we can clear them gradually.

Thank you for hearing.