Fukushima Floating Offshore Wind Farm Demonstration Project (Fukushima FORWARD)

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Contents

- Background and objective
- Technical challenges and solutions
- Social acceptance and collaboration
- Conclusion and perspectives
Background

Benefits

- Offshore wind energy potential along Japan is 1.2TW, while the total capacity of the conventional sources is 0.2TW.
- More than 80% of the offshore wind energy potential in Japan are located at deep water.

Challenges

- Floater concepts
- Measurement and Prediction technology
- Floating substation
- Cost efficiency
- Advanced Material
Fukushima FORWARD project

- **Ideal area for floating offshore wind**
  - Large wind energy potential at 20km-50km from coast, where water depth is 100m–200m
  - Strong power grid for nuclear and thermal power plants
  - Port facilities available

- **Benefits**
  - The accumulation of wind energy industry will help the restoration of this region.

**Wind Speeds**

- 7.4m/s (offshore)
- 4.3m/s (onshore)

![Graph showing wind speed distribution](image)
## Facility specifications of FORWARD project

<table>
<thead>
<tr>
<th>Facility Name</th>
<th>Scale</th>
<th>Wind Turbine type</th>
<th>Floater type</th>
<th>Project Term</th>
</tr>
</thead>
<tbody>
<tr>
<td>Floating Wind Turbine I</td>
<td>2MW</td>
<td>Downwind Type</td>
<td>Compact Semi-Sub</td>
<td>First</td>
</tr>
<tr>
<td>Floating Wind Turbine II</td>
<td>7MW</td>
<td>Upwind Type</td>
<td>V-shape Semi-Sub</td>
<td>Second</td>
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<tr>
<td>Floating Wind Turbine III</td>
<td>7MW</td>
<td>Upwind Type</td>
<td>Advanced Spar</td>
<td>Second</td>
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<tr>
<td>Floating Substation</td>
<td>25MVA/66kV</td>
<td>Substation</td>
<td>Advanced Spar</td>
<td>First</td>
</tr>
</tbody>
</table>

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- Substation
- 4 Column Semi-Sub
- Advanced Spar
- 3 Column Semi-Sub
Work packages

1 Preliminary study
   • site assessment
   • preliminary design

2 Measurement / prediction
   • metocean
   • floater motion
   • substation / power cable

3 Floating wind turbines
   • wind turbine
   • floater / mooring
   • advanced material

4 Grid integration
   • floating substation
   • dynamic cables

5 Operation & Maintenance
   • floater / mooring
   • wind turbine
   • substation / power cable

6 Environment issue
   • environmental assessment
   • marine navigation safety
   • collaboration with fishery

7 Documentation
   • technical review
   • manual
   • project report

8 Public relation
   • communication centre
   • seminar and symposium
# Presentation of consortium members

<table>
<thead>
<tr>
<th>Consortium Member</th>
<th>Main Rule</th>
</tr>
</thead>
<tbody>
<tr>
<td>Marubeni Corporation</td>
<td>【Project Integrator】 Pre-Studies, Approval and Licensing, Operation and Maintenance, Collaboration with Fishery Industry</td>
</tr>
<tr>
<td>The University of Tokyo</td>
<td>【Technical Advisor】 Measurement and Prediction Technology, Navigation Safety, Public relation</td>
</tr>
<tr>
<td>Mitsubishi Corporation</td>
<td>Pre-Studies, Approval and Licensing, Environmental Assessment</td>
</tr>
<tr>
<td>Mitsubishi Heavy Industries, Ltd.</td>
<td>V-Shape Semi-Sub Type Floater</td>
</tr>
<tr>
<td>IHI Marine United Inc.</td>
<td>Advanced Spar Type Floater and Floating Substation</td>
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<tr>
<td>Mitsui Engineering &amp; Shipbuilding Co., Ltd.</td>
<td>Compact Semi-Sub Type Floater</td>
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<tr>
<td>Nippon Steel Corporation</td>
<td>Advanced Steel</td>
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<tr>
<td>Hitachi, Ltd.</td>
<td>Floating Electric Power Substation</td>
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<tr>
<td>Furukawa Electric Co., Ltd.</td>
<td>Undersea and Dynamic Cables</td>
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<tr>
<td>Shimizu Corporation</td>
<td>Pre-Studies, Construction and Installation Technology</td>
</tr>
<tr>
<td>Mizuho Information &amp; Research Institute, Inc.</td>
<td>Documentation, Committee Operations</td>
</tr>
</tbody>
</table>
FORWARD vision and challenges

Green growth in Fukushima
- Industry accumulation
- Employment
- Restoration

Fukushima FORWARD

Technical challenge
- Floater concepts
- Measurement and prediction
- Floating substation
- Cost efficiency
- Advanced material

Social acceptance
- Navigation safety
- Environmental assessment
- Collaboration with fishery
- Public relation
Development phases and key success factors

2 Phases:

Phase I (2011~2013)
- Floating substation
- Compact semi-sub (2MW)

Phase II (2014~2015)
- V-shape semi-sub (7MW)
- Advanced spar (7MW)

3 key success factors:
- Design / Test / Improvement
- Cost efficiency / industrialization
- Technology maturity / Social acceptance
Thank you for your attention