

Status and plans for offshore wind in Japan

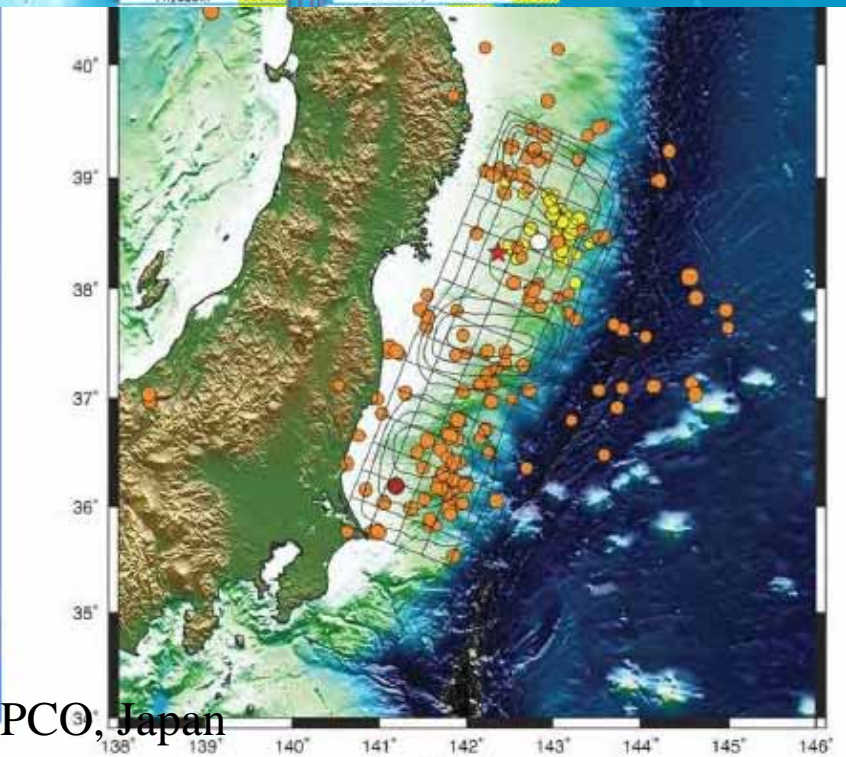
Chuichi Arakawa
The University of Tokyo

- This wind farm withstood Tsunami on 3.11
- 7 units of 2MW Wind Turbine
- Being developed as private sector for future such as more 7 units and Giga-watt farm

Kamisu, Japan / 2MW x 7

2011 Earthquake off the Pacific Coast of Tohoku, Japan

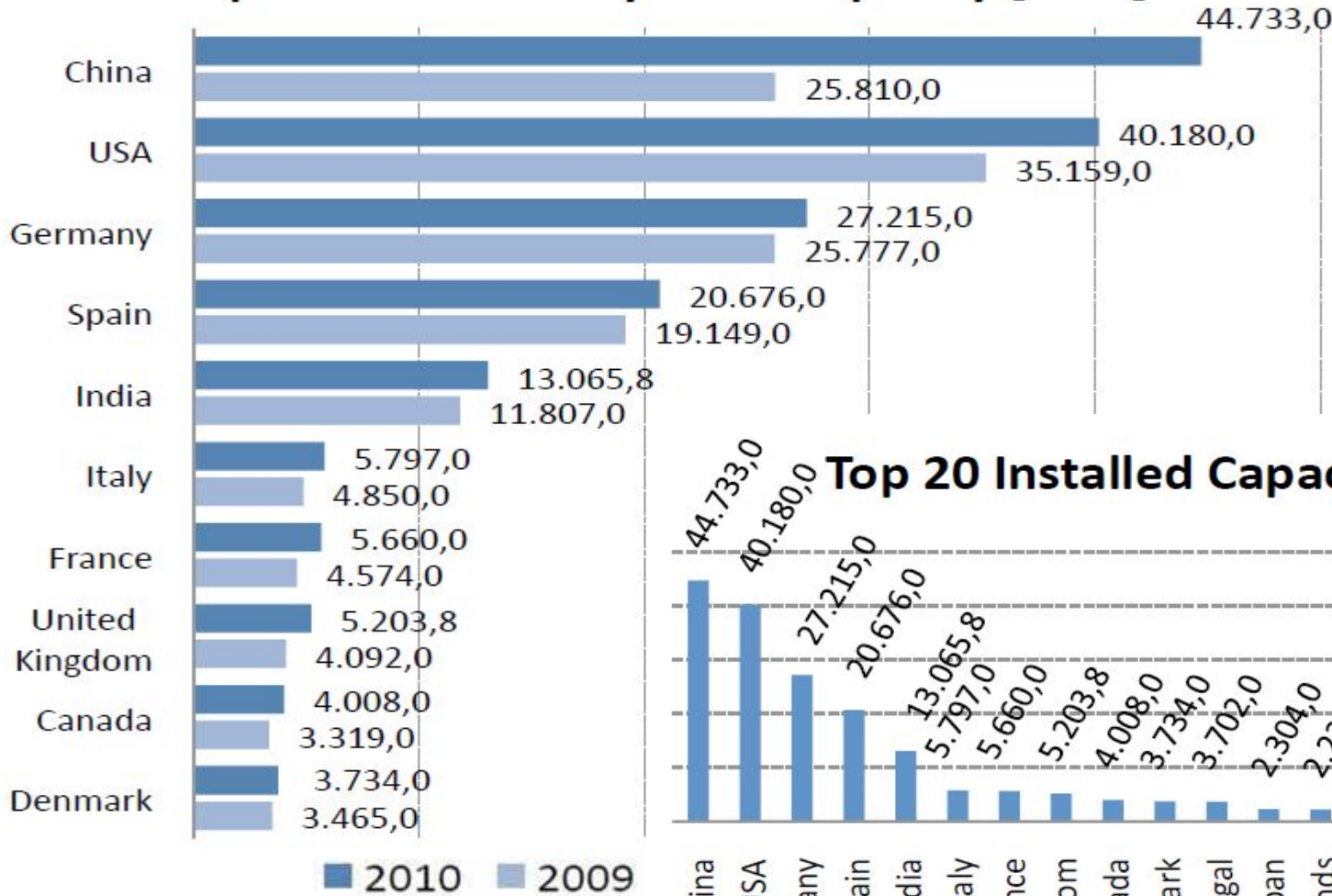
March 11, 2011, Magnitude 9.0
 Tsunami reached heights of up to 40.5m and travelled up to 10km.
 It caused meltdown of three reactors in Fukushima nuclear power plants.



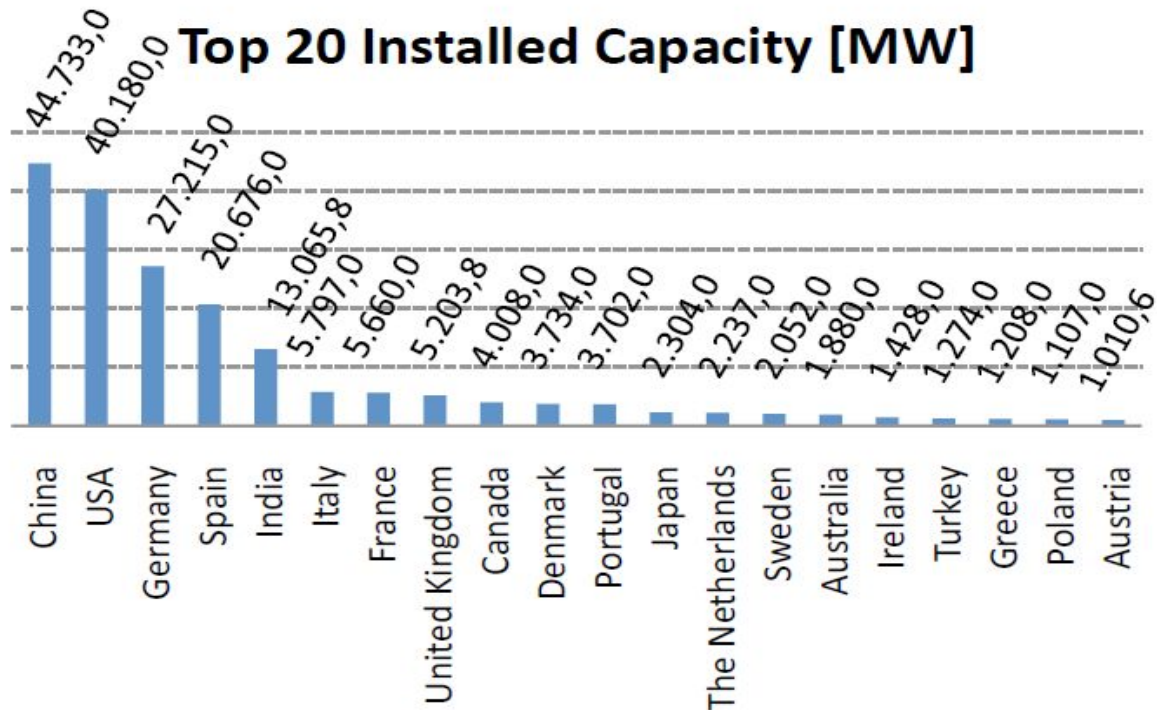
From interim report of TEPCO, Japan

Total Capacity of Wind Power

Top 10 Countries by Total Capacity [MW]



Top 20 Installed Capacity [MW]



From WWEA Annual Report

New Guideline for Wind Turbines in Japan and Asian Area

Typhoon Attack

Miyako Island was hit by huge Typhoon #14 on 11.Sep.2003 and all 7 WT were destroyed; 3 fallen down, 3 lost blades, 1 lost nacelle roof



NEW MW-class Machines in Japan



MWT92 (MHI) 2.4MW WT



SUBARU 80/2.0 (FHI) 2 MW WT

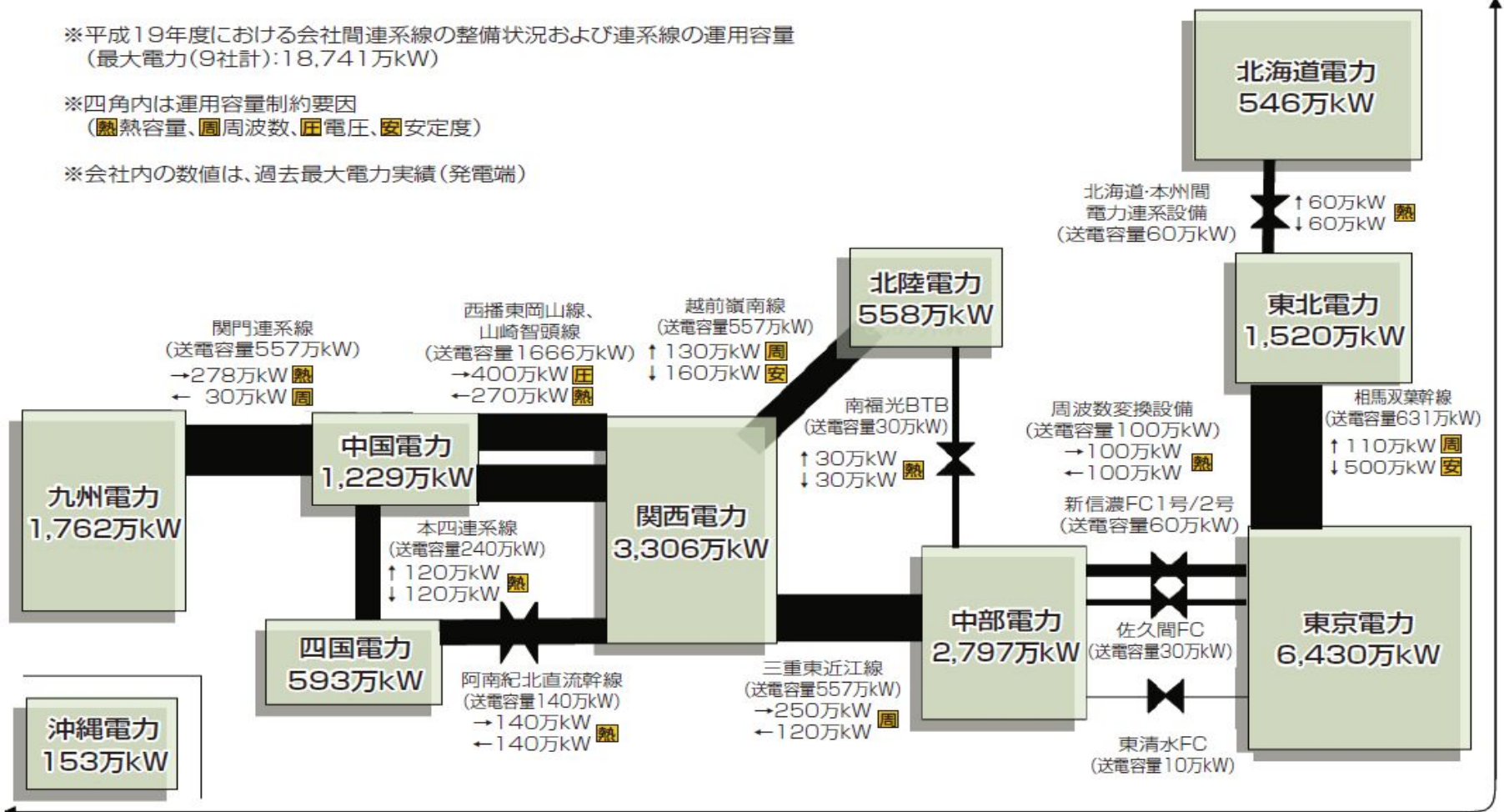
Grid Connection in Japan

- Wind power was not allowed to use grid connection between each area.
- Wind potential exists strongly in Hokkaido, Tohoku and Kyushu.

※平成19年度における会社間連系線の整備状況および連系線の運用容量
(最大電力(9社計):18,741万kW)

※四角内は運用容量制約要因
(**熱**熱容量、**周**周波数、**圧**電圧、**安**安定度)

※会社内の数値は、過去最大電力実績(発電端)

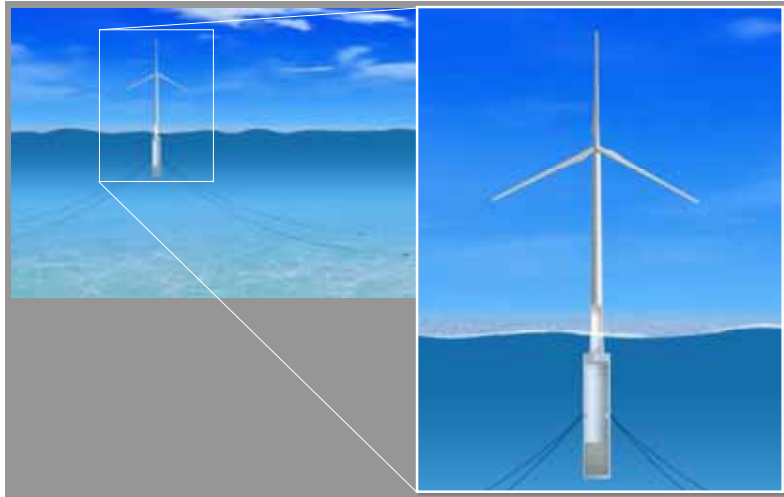


NEDO R&D Offshore Windpower Generation

- Offshore Windturbine Demonstration PJ
 - 2.4MW at Choshi, 2MW at Hibikinada in 2012
- Offshore Windfarm Feasibility Study
 - 4 districts are chosen in 2011.
- Super Large Windturbine Development
- Ocean Energy Potential Study
- Floating Offshore Windturbine Basic study

However, we have delay of more than 10 years for offshore in Europe. Furthermore, the national project is planned to have only one turbine. We should accelerate wind power to cover nuclear in high speed.

Domestic Project of Deep Offshore



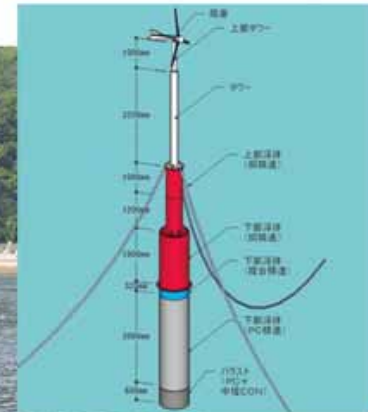
Spar type ; Prof. Suzuki in Uni. of Tokyo



Semi-sub type ; Prof. Ishihara in Uni. of Tokyo, TEPCO, etc



Sailing type ; Environment Institute & Prof. Kinoshita in Uni. of Tokyo

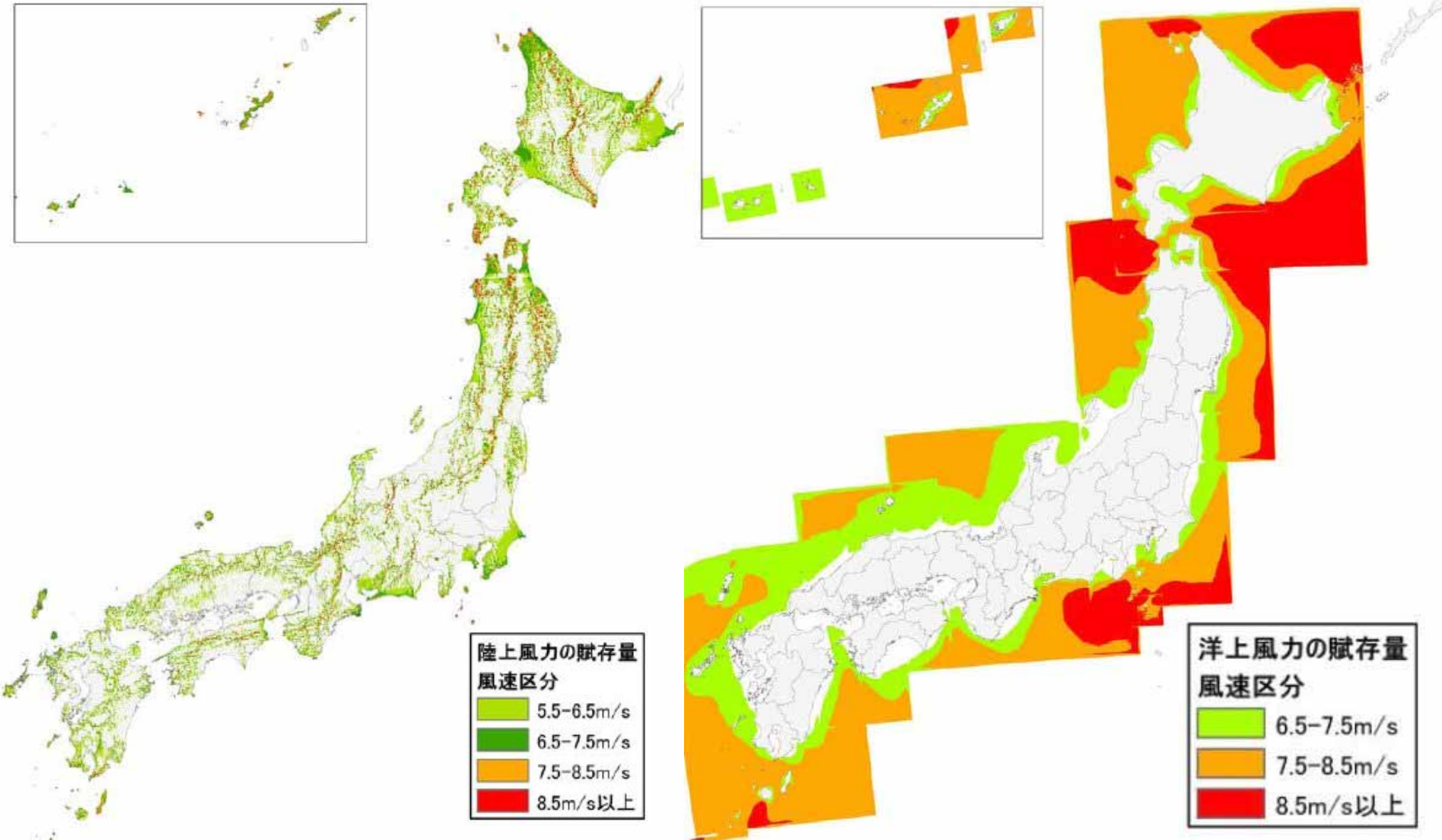


Scale model of Spar type: Prof. Utsunomiya in Kyoto Uni. , Toda-Kensetsu, etc

*After the Disaster
on March 11, 2011*

Potential Map of Wind Power in Japan

- Report of investigation for renewable energy in Ministry of Environment in 2011
- 280 GW for onshore, 1600 GW for offshore as potential value
- 273 GW for onshore , 141 GW for offshore under some scenario such as half-price



1. Japan's current situation and challenges of Wind Power

Wind power

- Total wind power site : 479 (less than 5 wind tower : 393)*
 - *Almost all of wind power site are small.
- Many sites are unprofitable due to higher than expected maintenance costs as a result of Japan's unique site conditions, e.g. strong mountain ridge turbulence
 - Site conditions are key to profitable projects / Significant need for deregulation and reduced grid integration barriers

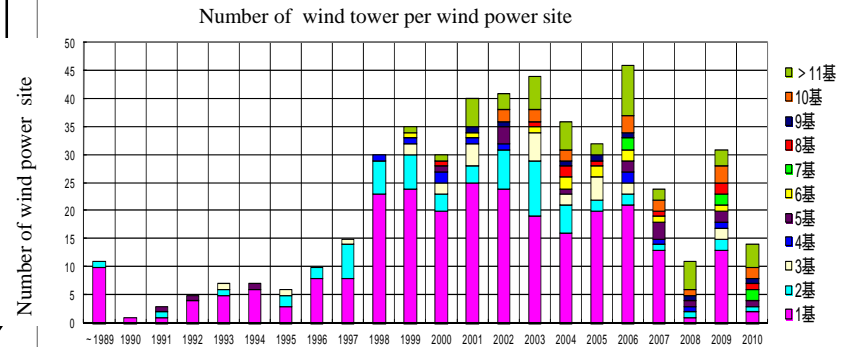
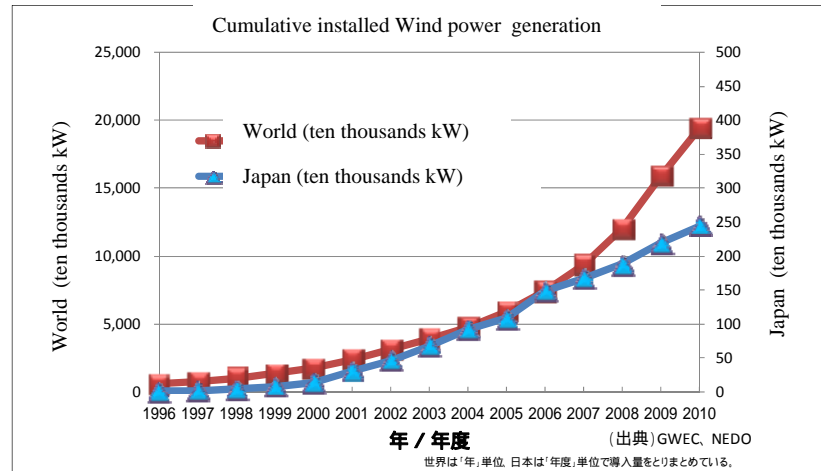
Offshore Wind power

- Commercialization of offshore wind is expected in the near future
 - Current cost is high, but there are significant offshore wind resources
- Europe- many shallow-water sea areas suited to offshore fixed bottom
 - Japan- shallow water areas are relatively small, therefore floating offshore wind power will be necessary, even when including the increased grid connection cost
- Based on a request from the Fukushima Prefecture, METI will demonstrate the world's largest scale level "floating offshore wind power" as five-year plan

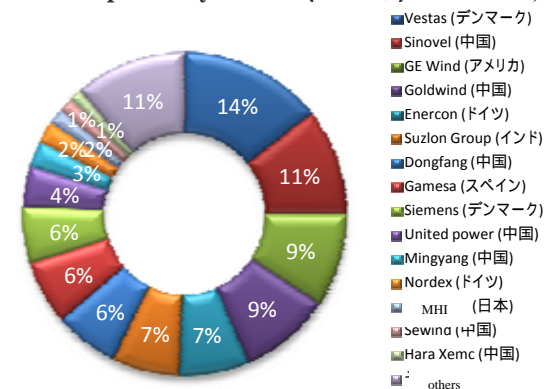
Challenges

- Lightning protection & wind forecasting & control technology development tailored to Japan to increase capacity utilization and cost reduction
- Regulatory reform promoting large-scale wind through: conversion of agricultural land, use of natural parks / national forests, & most importantly a regulatory landscape
- Measures are needed to promote: off-peak electricity storage, enhance & support grid connections

Source : METI, Japan



< Products of wind power by nations (2010年) > Total:40,722MW



(出典) 'BTM Consult - A Part of Navigant Consulting - March 2011, をもとに 興産エネルギー庁作成

2. Offshore Wind Energy R&D Project

(FY2008 ~ FY2014)

Research and Development of Offshore Wind Power Generation Technology (FY2012 budget 5.2 billion yen (FY2011 budget 3.73 billion yen)

Contents

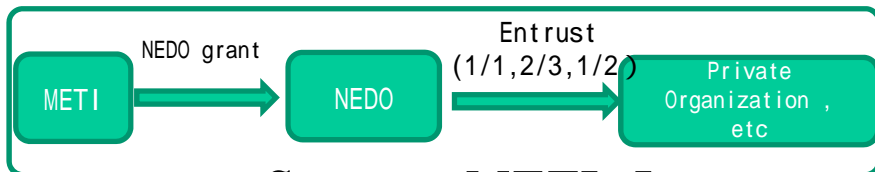
Domestic wind power generation reduce suitable sites by social acceptability issues such as noise and low frequency noise or landscape view concerns. In the future, large scale wind introduction to promote expansion of wind power needs to be deployed offshore.

R&D performed to establish offshore wind power technology suitable for Japan's meteorological and oceanographic conditions:

- Demonstrate wind observation/forecasting systems
- Demonstrate offshore fixed bottom wind power
- Demonstrate large (> 5MW) wind power systems
- Feasibility study for floating offshore wind power systems

Such R&D efforts will prove the safety, reliability and economic potential of offshore wind. The R&D will also accelerate the introduction of wind power in Japan, and assist the development a stronger domestic wind power industry resulting in greater international competitiveness

Conditions (applicant, subsidiary rate, etc.)



Source : METI, Japan

Image of project

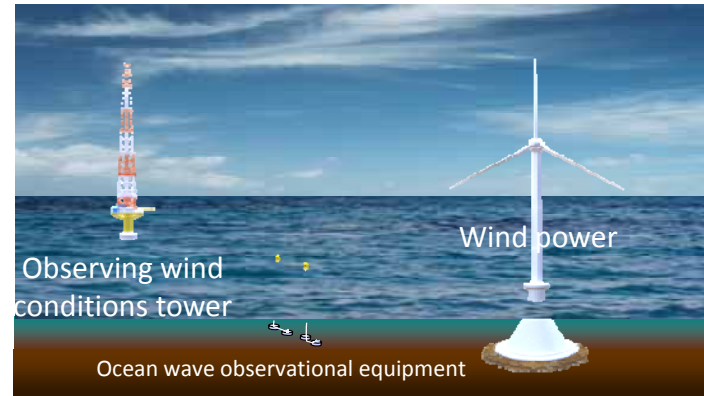


Image of observing wind conditions and demonstration research of offshore fixed bottom wind power
(provision: TEPCO, Tokyo Univ. , Kajima corporation)



Image of floating offshore wind power
(provision: MES, Tokyo Univ., TEPCO)

Floating offshore wind farm demonstration project (FY2011 3rd supplementary budget : 12.5 billion yen)

Contents of project

Summary / Purpose

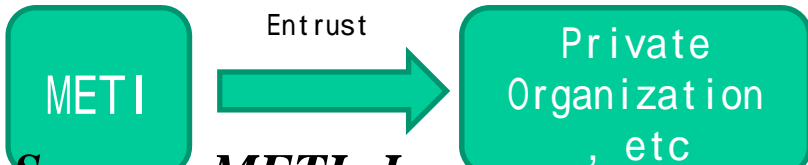
Affected areas in the east, in particular, Fukushima, are recovering from the earthquake damage. These areas are expected to provide large scale job creation due to accumulation of industries focused on renewable energy.

This project will clarify the safety, reliability and economic potential of floating offshore wind by demonstration and experiments of the world's largest level floating offshore wind power generation system off the coast of Fukushima prefecture.

After the completion of this project, This project is sought to make a new power generation business through the development of equipment as a result of this project.

By doing so, we aim to make a Japan a hub of wind power and contribute to the industrial revival in Fukushima

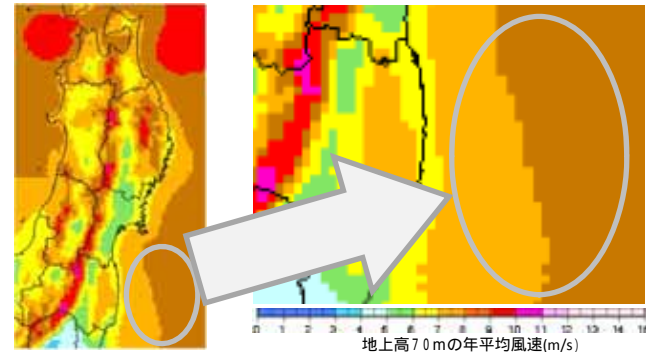
Conditions (applicant, subsidiary rate, etc.)



Source : METI, Japan

Image of project

Demonstration area : offshore of Fukushima Prefecture
Such areas as well as a better wind conditions, are expected to take advantage of the former facilities of the offshore gas field, already being developed or currently in not use, offshore areas of Fukushima Prefecture are favorable.



Demonstration assumed area



Image of floating offshore wind power
(provision : MES, Tokyo Univ., TEPCO)



Floating offshore wind turbine demonstration project

- Objective: demonstrating the first full-scale floating offshore wind turbine in Japan
- Duration: FY2010-2015
- Contractors: Toda Corp., Kyoto Univ., Fuji Heavy Industries (FHI), Fuyo Ocean Development & Engineering, National Maritime Research Institute (NMRI), and cooperative organisations

Floating type of offshore by Ministry of Environment (MOE)



*Source : MOE and Kyoto
University, Japan*





Demonstration site – Kabashima Island



Nordic Green Japan, 7 November 2011



Work plan FY2010-2015

Fiscal year	2010	2011	2012	2013	2014	2015
Environmental study	Methodology	Continuous study (from pre-construction to post-removal)				
100kW small-scale turbine	Basic design	Detailed design Construction	Establishment Operation	Removal		
2MW full-scale turbine		Detailed design	Construction	Establishment Operation		Removal
Other	Selecting site (Dec. 2010)					Economic feasibility study
Budget (billion JPY)	0.1	0.6	3.0e	1.3e	0.2e	1.1e

e: expected budget

- After the demonstration project, i.e. 2016, floating offshore wind turbines are expected to commercialise

Concluding Remarks

For Onshore Wind Power

- Social acceptance is essential to avoid the influence of infrasound, landscape, bird-strike and so on.
- Primary grid connection of wind power is important with the electric power company using the connections with other areas.

For Offshore Wind Power

- Offshore wind power has large potential due to the huge area of ocean around Japanese island of EEZ 6th.
- Deep offshore system will be a key technology for future development of wind power and recovery from the disaster.
- Fisherman's right will be reasonably taken into account for cooperating with developer instead of compensation.
- Penetration of wind power in Japan is important, not the research and technology.