

Offshore wind in Japan

- Status, prospects and challenges-



Mitsuhiro Yamazaki

Deputy Director, NEDO Europe office in Paris
New Energy and Industrial Technology Development Organization(NEDO), Japan

New Energy and Industrial Technology Development Organization (NEDO)



Mission:

- Address energy and global environmental problems
- Develop Industrial technologies

Organization: Established in 1980; under the Ministry of Economy, Trade and Industry of the Government of Japan

Head Office: Kawasaki City, Japan

Personnel: Approximately 900

Budget: 130 Billion yen ($\yen130$ Billion €) (FY2016)

Chairman: Mr. Kazuo Furukawa



NEDO's Activities

NEDO supports
not only *Domestic R&D in Japan*
but also *International collaboration*



Because...

Open innovation



*Breakthrough
in common social issues*



NEDO's Science and Technology

Basic Research

Technology Development

Demonstration



Renewable energy



Energy conservation



Electronics /ICT



Materials/nanotech



Energy storage

Smart community



**Environment/
clean coal**



Robotics



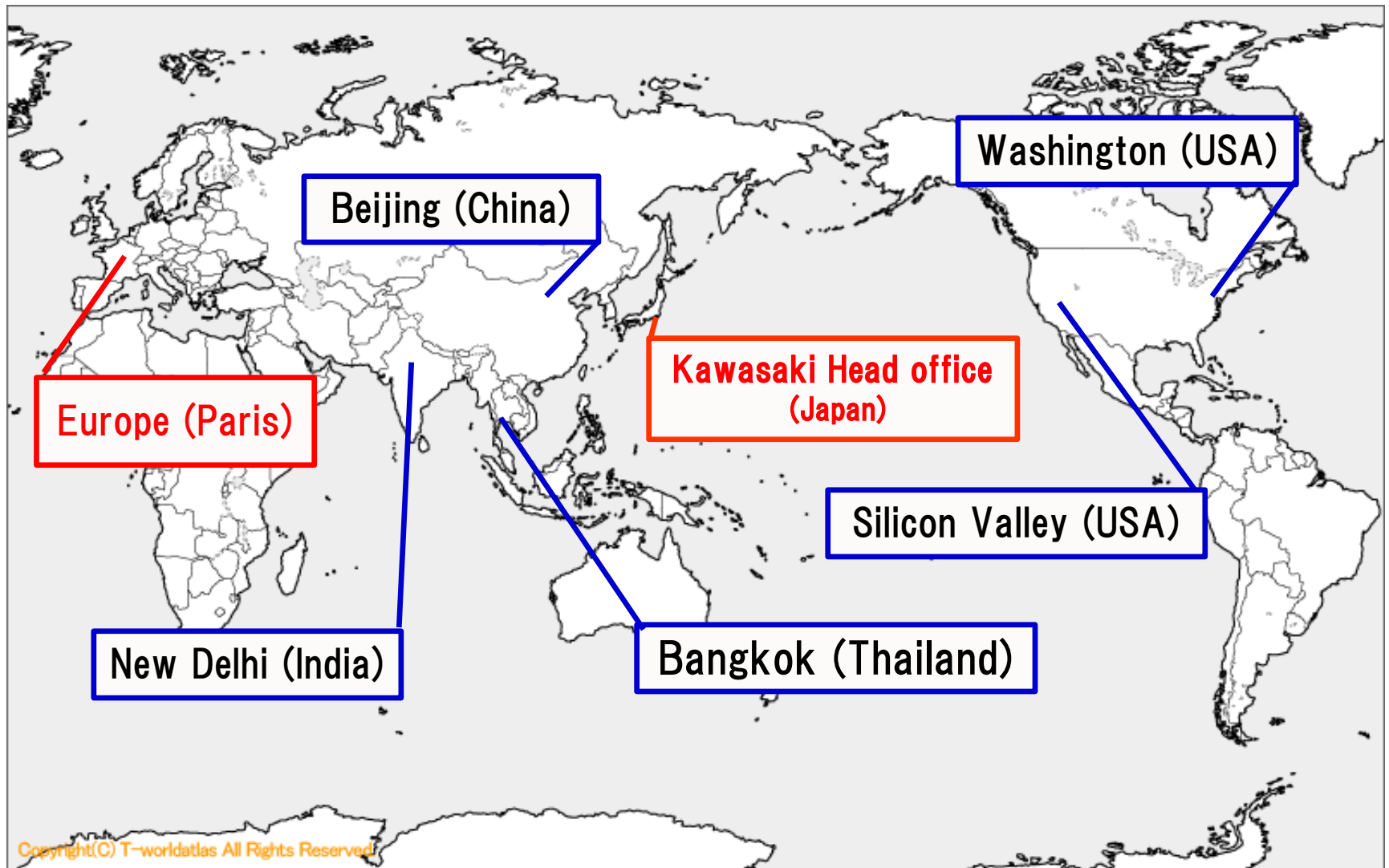
Water treatment



Bio/medical



NEDO Overseas Offices



Paris office cover on EU27 countries.

NEDO activity in Europe (Example)

Lyon (France)

Smart city applications for re-developed urban area



Speyer (Germany)

Establish the local energy production and consumption model smart community



Manchester (U.K.)

Energy switching of heat consumption of households and aggregate energy storage capability



Malaga(Spain) (finished)

Navigate EV drivers to charging stations efficiently considering with power system and solve traffic congestions



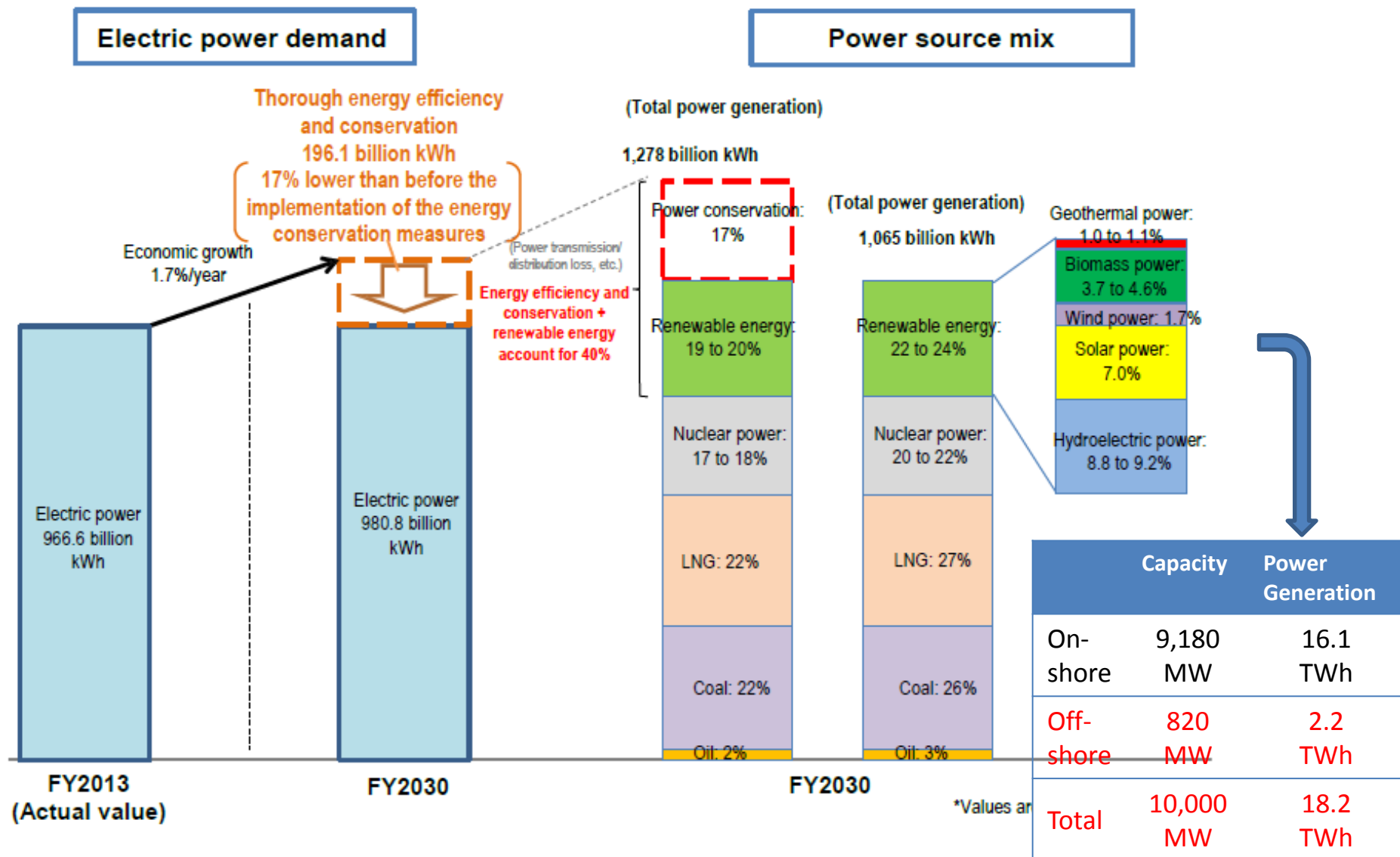
Bochum (Germany)

Medical service robots using the robot suit "HAL (Hybrid Assistive Limb)"



NEDO cooperate with CDTI, to conduct Spain-Japan seminar in specific technology area.

Long-term Energy Supply-demand Outlook



Tariff for renewables in FY2016



Wind	Onshore		Offshore(*)
	Over 20kW	Under 20kW	
Tariff	22JPY/kWh 0.18€	55JPY/kWh 0.46€	36JPY/kWh 0.30€
PJ term	20 years	20 years	20 years

*Limited to the wind firm which not only located in the offshore but also need vessels for construction and operation



PV	Under 10kW	Over 10kW
Tariff	25~27JPY/kWh 0.21€	24JPY/kWh 0.20€
PJ term	10 years	20 years



Geothermal	Over 5MW	Under 15MW
Tariff	26JPY/kWh 0.22€	40JPY/kWh 0.33€
PJ term	15 years	15 years



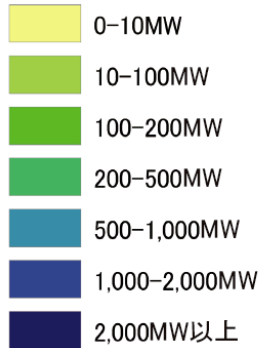
Biomass	Bio gas Generation	Thinned tree		Crop residue	Scrap wood	Other residue
		Under 2MW	Over 2MW			
Tariff	39JPY/kWh 0.33€	40JPY/kWh 0.33€	32JPY/kWh 0.27€	24JPY/kWh 0.20€	13JPY/kWh 0.11€	17JPY/kWh 0.14€
PJ term	20 years	20 years	20 years	20 years	20 years	20 years

*Tax will add to above tariff, JPY/EUR=120

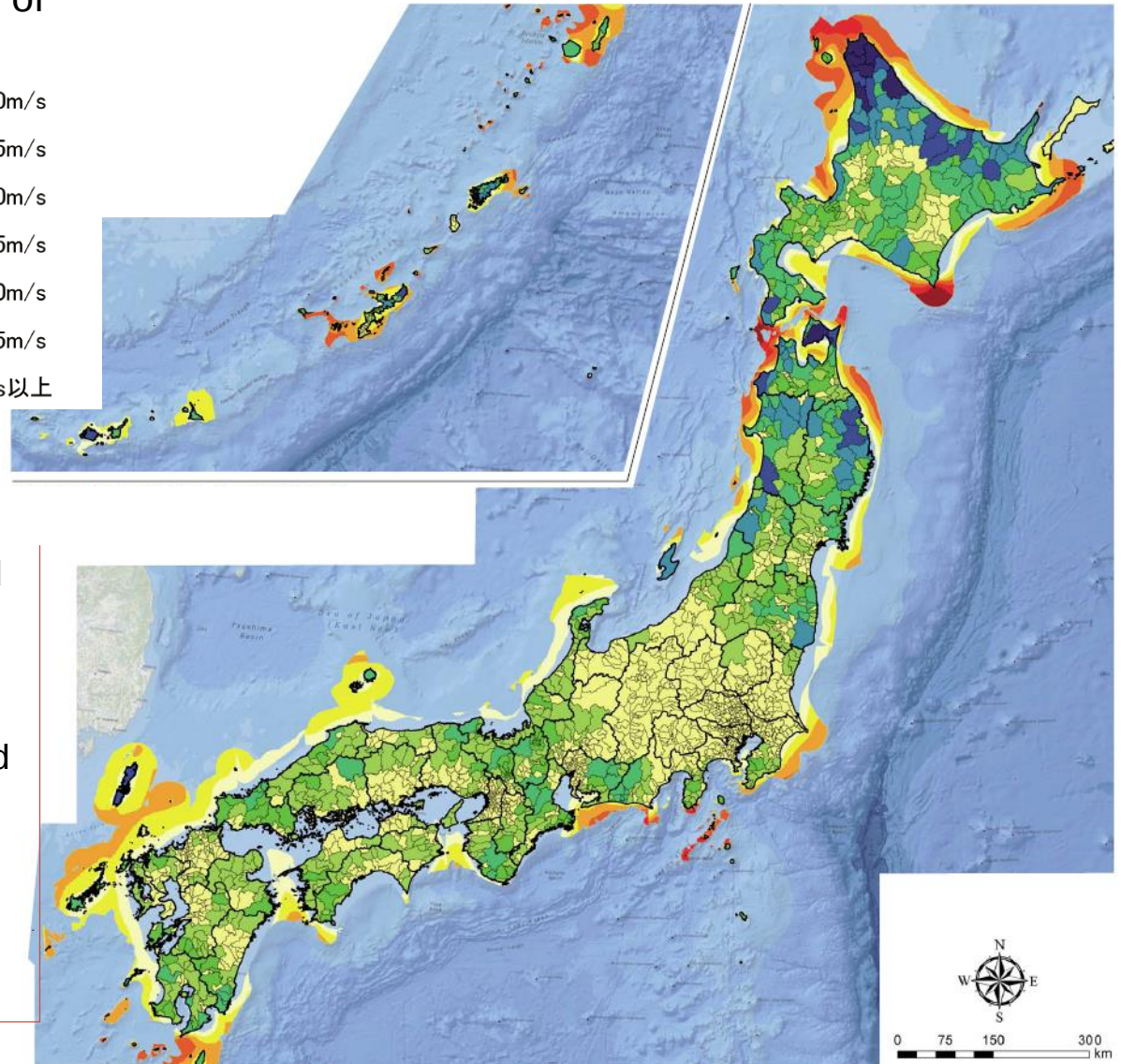
Source: METI website(2016) 8

Japan has Huge Wind Energy Resources

Potential of onshore



Potential of offshore



Onshore : Average wind speed
6.5m>

considering social
acceptance

Offshore : : Average wind speed
7m>

Distance 30km<

Sea depth 200<

considering social
acceptance

Status (1) -RD&D on offshore wind-

- There are 2 bottom-fixed offshore (Choshi and Kita-kyushu) and 2 floating offshore (Fukushima and Goto) demonstration project has been implemented.
- In addition to above PJ, new demonstration project lead by NEDO for low-cost floating offshore wind is starting.

Goto, Nagasaki (Floating type)

✓ Floating offshore wind turbines(100kW) was installed in June 2012. Floating offshore wind turbines (2MW-class) was installed and started of operation in October 2013. (Ministry of the Environment)



2MW Haenkaze

General coastal area

Port area

(As of Jan. 2016)

Fukushima (Floating type)

✓ The world's first full-scale offshore wind power generation is pointed about 120m below the surface of the sea, roughly 20km off the coast of Fukushima since 2011.

- Installed 2MW in 2013, and 7MW in 2015.
- Planned to be installed 5MW in summer, 2016.



2MW MIRAI



7MW SHINKAZE



5MW HAMAKAZE

Kita-Kyushu (Bottom-fixed type)

✓ Installation of 2MW-windmill was completed in March 2013. Power generation has been started since June 2013.

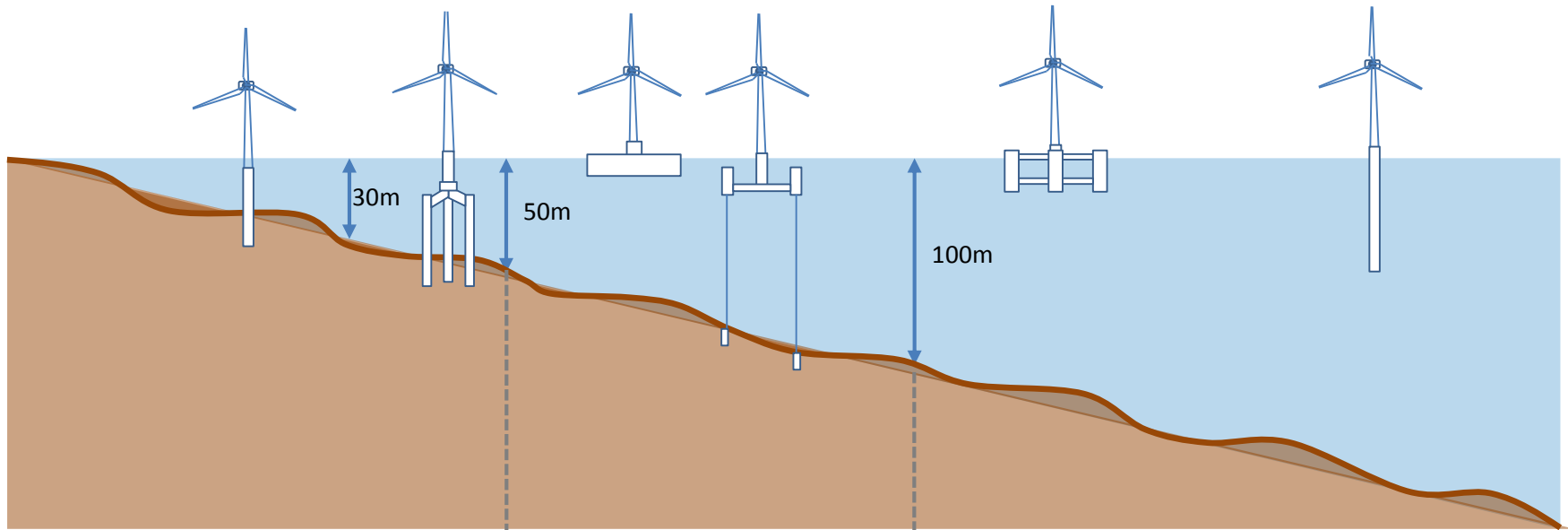


Choshi (Bottom-fixed type)

✓ Installation of 2.4MW-windmill was completed in October 2012. Power generation has been started since March 2013.



The type of offshore wind



[NEDO Project]



Gravity foundation
at Choshi in Chiba
Prefecture



Jacket and gravity
hybrid foundation
at Kitakyushu in
Fukuoka Prefecture

[NEDO Project]



Demonstration of advanced
floating offshore wind generation
➢ Water depth is form 50m to100m
➢ Weight reduction of floating
Offshore wind turbine system
To achieve cost reduction

[METI Project]



Fukushima floating offshore wind farm
demonstration project
from left, 2MW compact semi-sub, 7MW
V-shape semi-sub and 5MW advanced spar

[MOE Project]



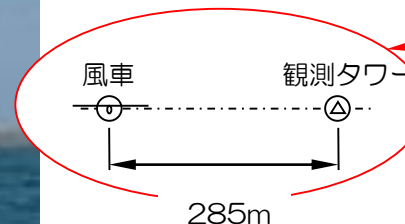
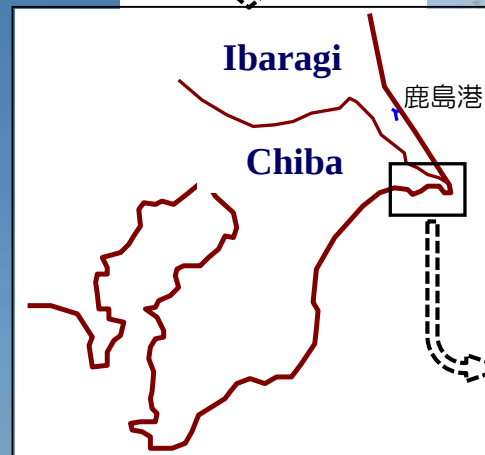
Spar type of
floating offshore
wind at Kabashima
Island in Nagasaki
Prefecture

bottom-fixed

floating

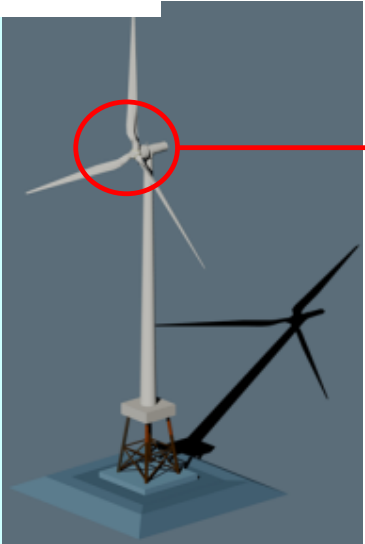
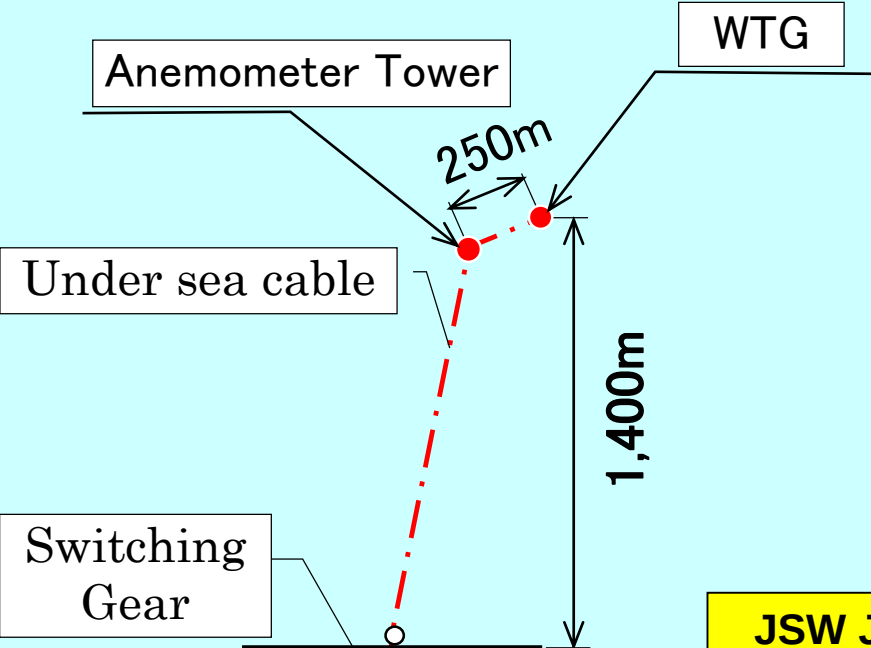
Demonstration of Offshore Wind Power Generation by NEDO, at Choshi, Chiba Pref.

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



Source: JWPA

Demonstration of Offshore Wind Power Generation by NEDO, at Hibikinada, Fukuoka Pref.

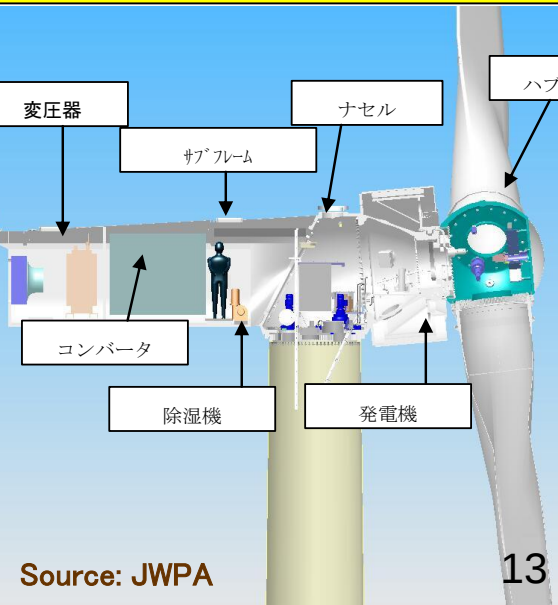


Ref: NEDO

Hybrid Gravity Foundation

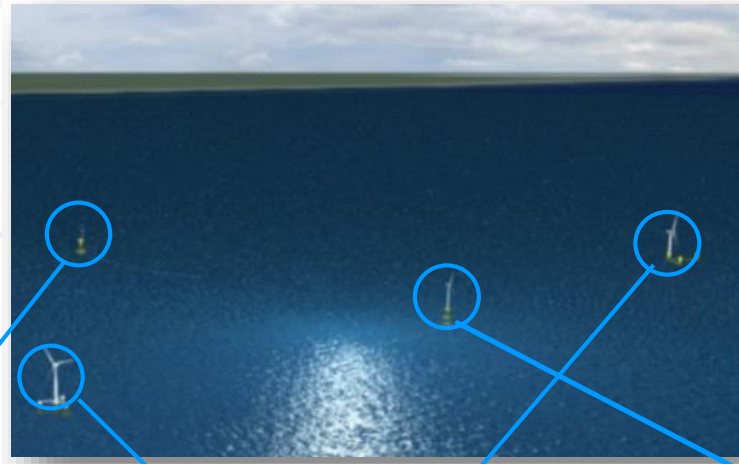
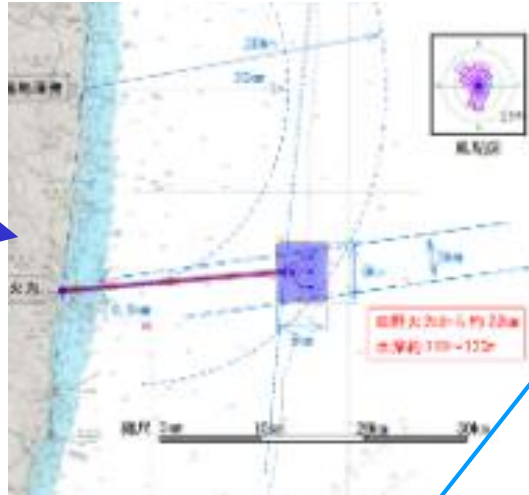
JSW J82 2MW gearless PMSG WTG

In Operation on June 2013.
Ref:NEDO



Source: JWPA

METI's Fukushima Recovery, Experimental Offshore Floating Wind Farm Project (Fukushima FORWARD)



Project Consortium: 11 members

Marubeni (Project integrator)

MHI

University of Tokyo

Mitsubishi Corp.

Japan Marine United

MES

Nippon Steel & Sumitomo Metal Co.

Hitachi

Furukawa Electric

Shimizu Corp.

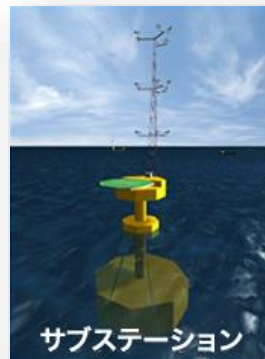
Mizuho Information & Research

2013

2013

2016

2016



**Hitachi
JMU Spar**



**Hitachi 2MW
Mitsui semi-sub**

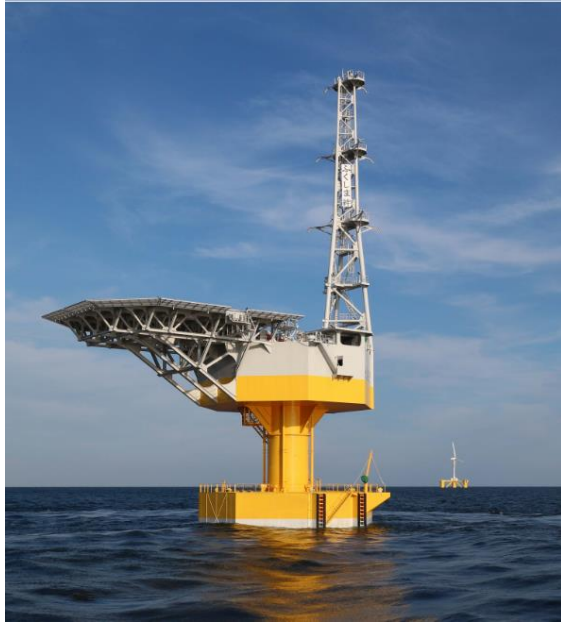


**MHI 7MW
MHI semi-sub**



**Hitachi 5MW
JMU Spar**

Latest Picture for FukushimaFORWARD



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)
, under commissioning now

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 will be installed on the floater at sea and carried to Fukushima in 2016.

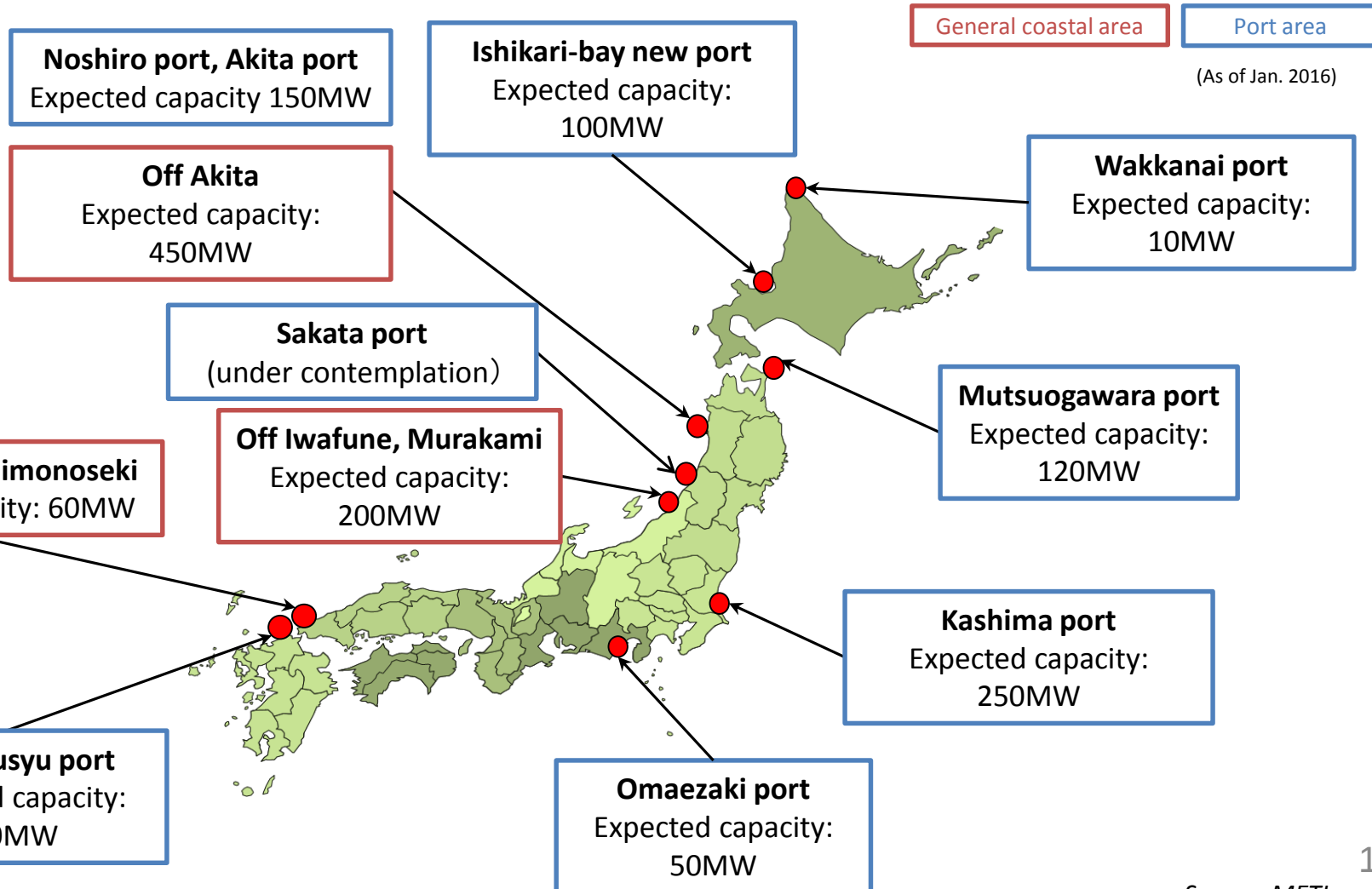
Fukushima Forward site (including video)

<http://www.fukushima-forward.jp/english/index.html>

Source: JWPA

Status(2) –Commercial offshore wind projects-

- Several bottom-fixed offshore wind firm are in progress across the country.
- FIT, 36JPY(0.30 euro)/kWh, is big incentive.



Prospects

-Accumulative Capacity Transition and Outlook in Japan-

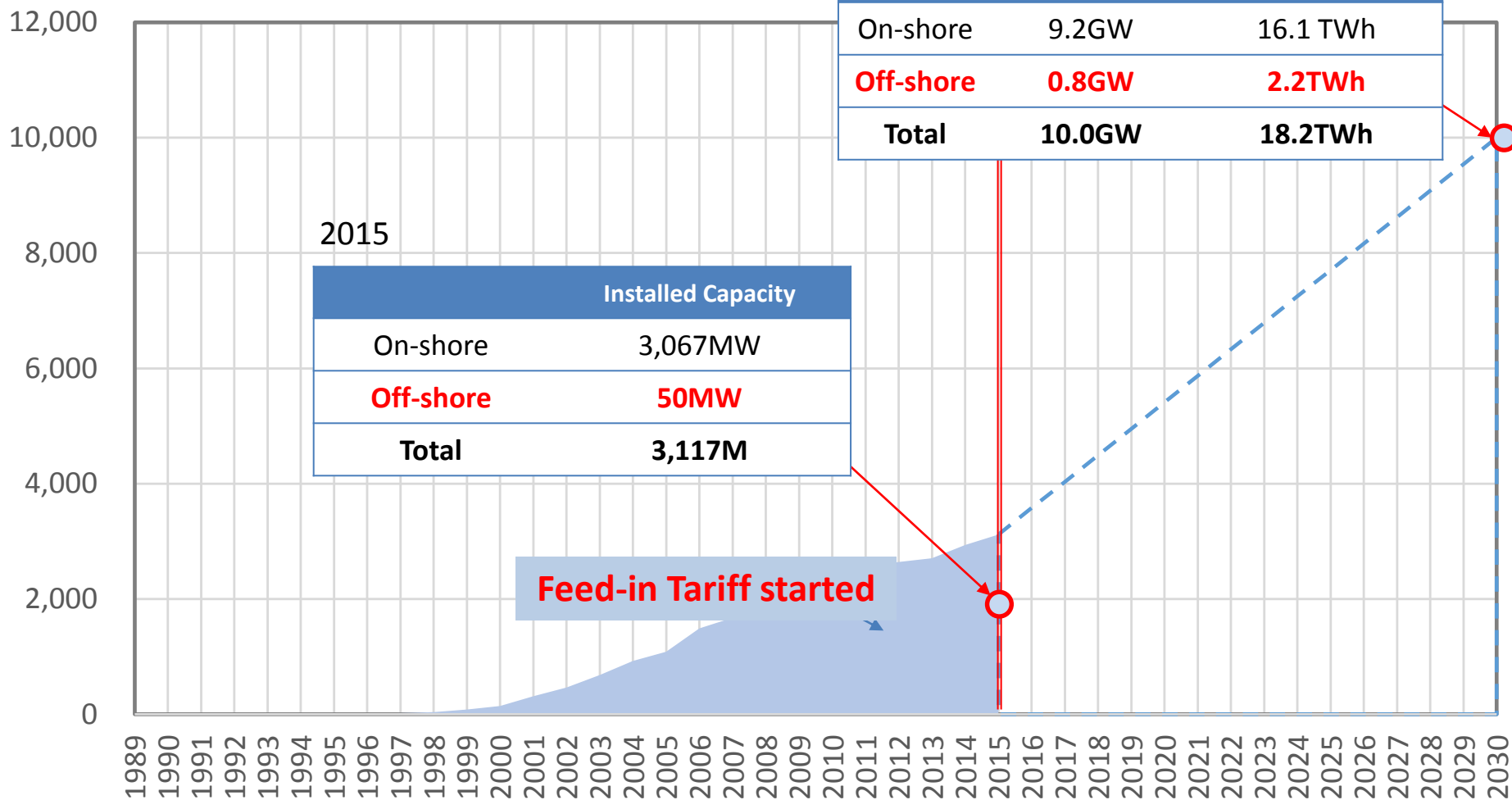
Target by METI in 2030

	Capacity	Power Generation
On-shore	9.2GW	16.1 TWh
Off-shore	0.8GW	2.2TWh
Total	10.0GW	18.2TWh

2015

Installed Capacity	
On-shore	3,067MW
Off-shore	50MW
Total	3,117M

Feed-in Tariff started



Source: NEDO data base and "Long-term Energy Supply-demand Outlook"(METI, 2015)

Challenges



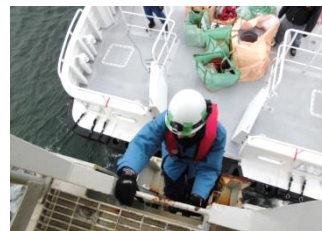
Preliminary survey

- Adjustment the issues regarding exclusive use of the sea areas with stakeholders
- Various procedures
- Finance



Design and installation

- Limits of port infrastructures/vessels/heavy machineries for construction of the large-scaled offshore wind turbines and foundations
- Completion Guarantee, risk of delay



Operation & maintenance

- Insurances
- Wake effect
- O&M infrastructure (maintenance ships, equipment etc.)



Decommission

- How to do the decommission

Cost and Risk reduction on offshore wind
Deep Water >> Floating

What are the barriers to deploying offshore wind in Japan

There are some barriers of offshore wind in Japan. Ministry of Economy Trade and Industry(METI) has considered measures for these barriers.

▪ Installation area:

- Ensuring of offshore wind farm Installation area

- (1) Setting guideline for installation offshore wind in coastal and port area.

- (2) NEDO created offshore wind conditions map.

▪ Cost

- Reducing the costs (CAPEX/OPEX)

- (1) Developing measures related with maintenance (R&D and human resources).

- (2) Enhancing accuracy of prospect and controlling of fluctuation..

- (3) Developing demonstration project(Bottom-fixed / floating)

▪ Infrastructure

- Developing the infrastructure such as port / construction vessel(SEP), etc

▪ Environment assessment

- Establishing the method of environment assessment, it will be shortened the period of assessment.

▪ Social Receptivity

- Coordinating with fisheries and local authorities building a consensus among parties concerned

Barriers to install offshore wind(Infrastructure)

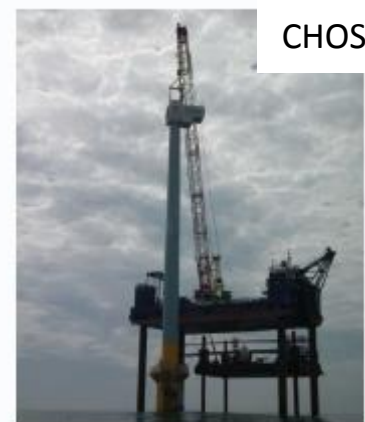
- In Europe, the ports and specialized vessels are in good condition so that it is possible to mass-produce of heavy / large structures and to convey / construction effectively.
- Japan is inferior as compared with Europe in quantity production and effective construction.



CHOSHI



KITAKYUSYU



CHOSHI

Players of the offshore wind demonstration projects

Goto, Nagasaki (Floating) by MOE



Toda Corporation
Hitachi, Ltd.
Kaiyo Engineering Co., Ltd.
National Maritime Research Institute.

Fukushima (Floating type) by METI



Marubeni Corporation
Mitsubishi Corporation
The University of Tokyo
MHI
Japan Marine United
MES
Nippon Steel & Sumitomo Metal Corporation
Furukawa Electric
Shimizu Corporation
Mizuho Information & Research
Hitachi

Kita-Kyusyu (Bottom-fixed) by METI, NEDO



J-Power
Itochu Techno-Solutions Corporation
Port and Airport Research Institute

Choshi (Bottom-fixed) by METI, NEDO



TEPCO
The University Tokyo

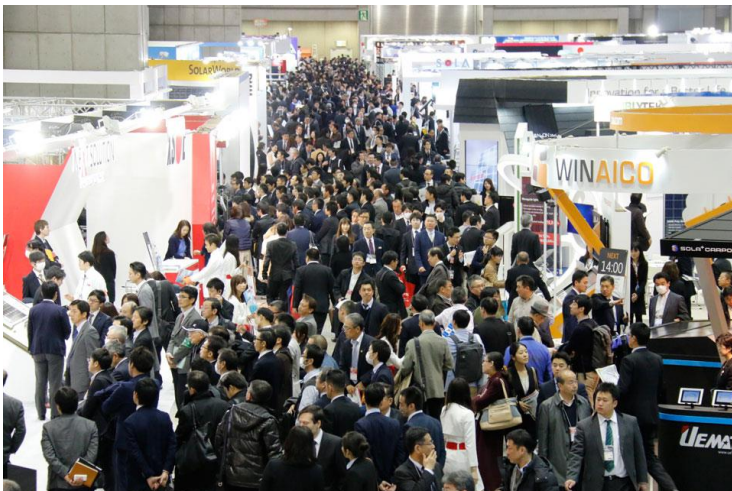
Who is the JWPA ?

- The Japan Wind Power Association (JWPA) has been founded in 2001.
- 302 companies (developers, turbine manufacturers, constructors, consultants, etc.) join JWPA at Oct.2016.
- JWPA's members own 85% of wind power installation in Japan.
- http://jwpa.jp/index_e.html



Wind expo 2017 in Japan

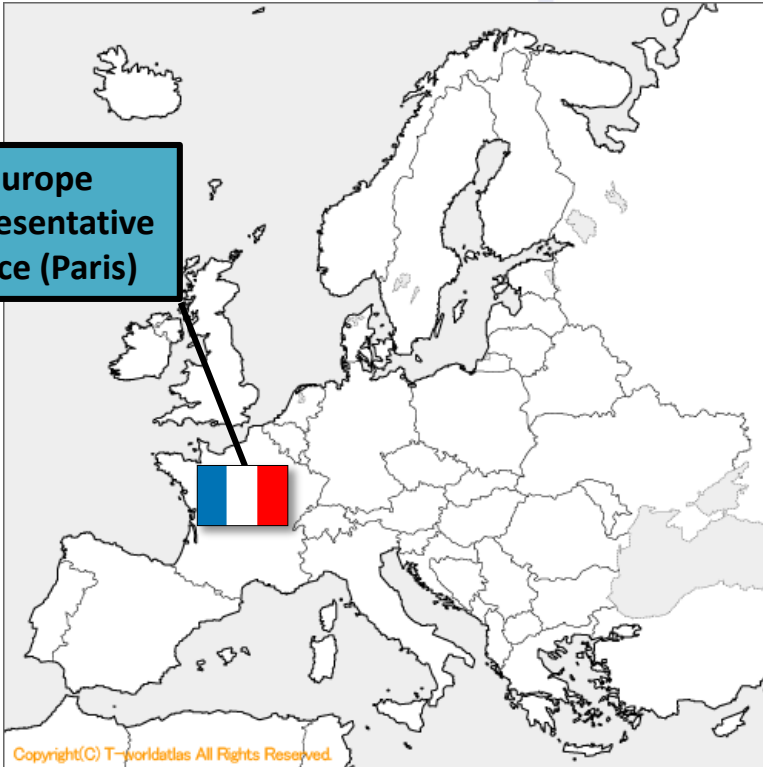
- Date: 01/03/2017-03/03/2017
- Venue: Tokyo Big sight exposition hall
- Exhibitor: 1,430 (Data of 2016)
- Participants: About 63,000 (Data of 2016)
(This number is total participants of battery, PV, Hydrogen exposition in same place)
- <http://www.windexpo.jp/en/>



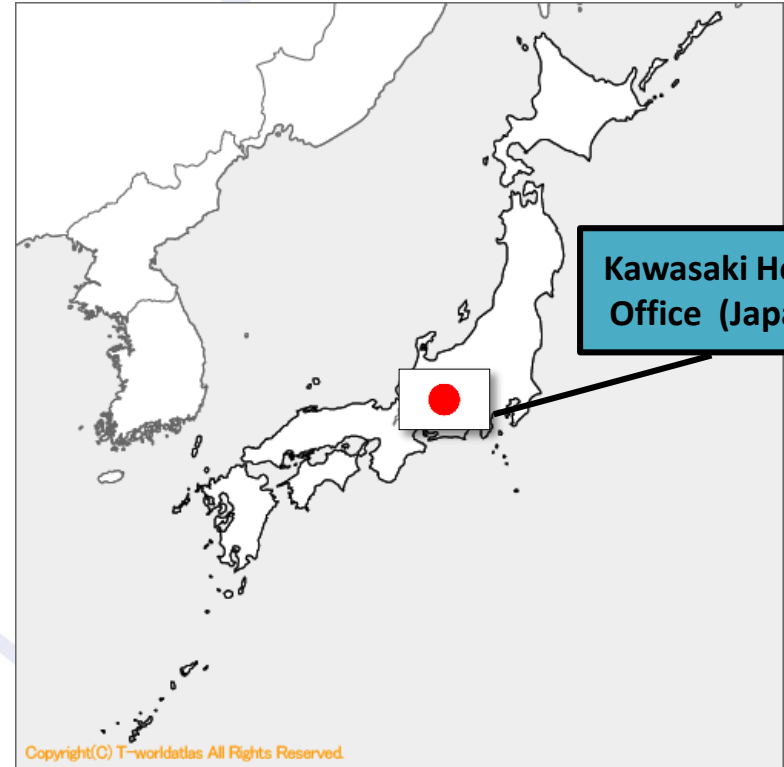
Gracias!



Europe
Representative
Office (Paris)



Kawasaki Head
Office (Japan)



NEDO website:

<http://www.nedo.go.jp/english/index.html>

NEDO Europe Representative Office:

10 rue de la paix, 75002 Paris ; tél : (+33-0) 1 44 50 18 28 ;
yamazakimth @ nedo.go.jp