

Offshore Wind in Japan

Current status & issues



17 Oct.2019

Japan Wind Power Association

Jin Kato

President

Table of contents



- 1. 5th Strategic Energy Plan**
- 2. Situation of ocean in Japan**
- 3. Domestic Offshore wind**
- 4. New Offshore Law**
- 5. Key to Success**



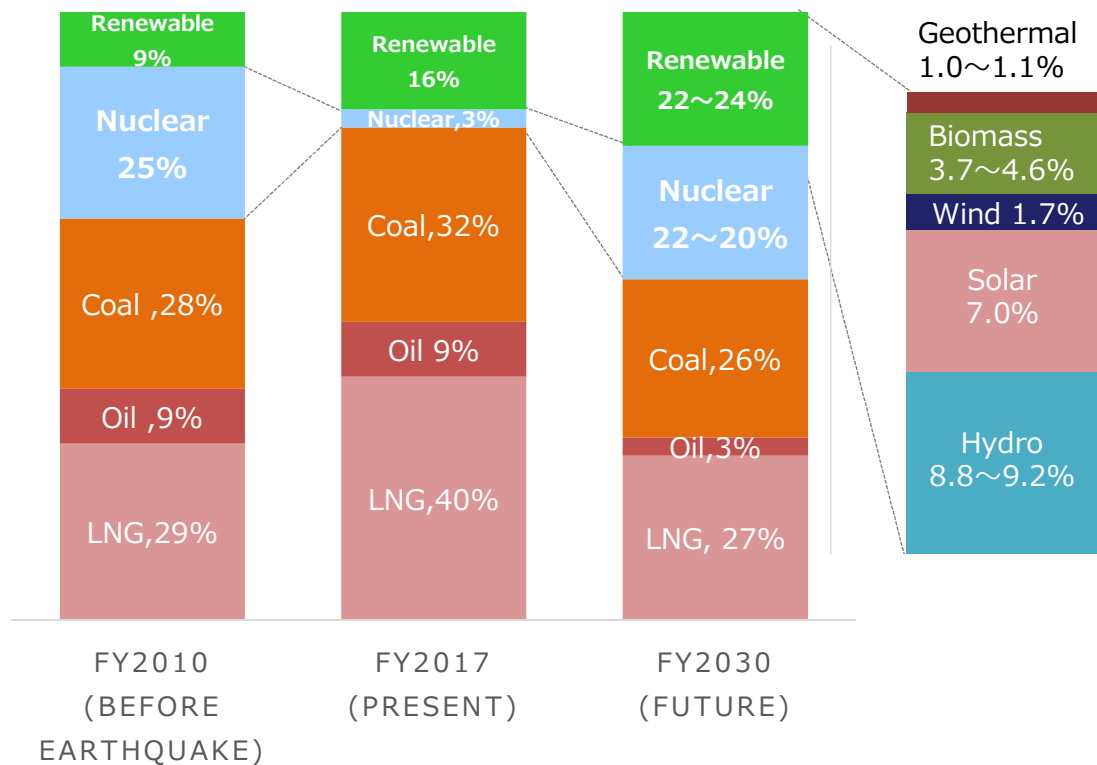
1. 5th Strategic Energy Plan

5th Strategic Energy Plan



Based on the 4th Strategic Energy Plan, Long-term Energy Supply and Demand Outlook energy Mix for 2030 was formulated in 2015. The energy mix has been followed in "5th Strategic Energy Plan" that was approved by the Cabinet in July 2018.

■ Energy Mix for 2030



[Total power generation]

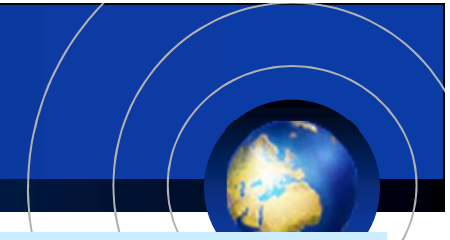
	Power generation	
	TWh	%
Oil	31.5	3%
Coal	281.0	26%
LNG	284.5	27%
Nuclear Power	231.7~216.8	22~20%
Renewable	236.6~251.5	22%~24%
Total	1,065.0	100%

[breakdown of Renewable]

	Power generation	
	TWh	%
Solar	74.9	7.0%
Wind (Onshore)	16.1	1.5%
Wind (Offshore)	22.0	0.2%
Geothermal	10.2~11.3	1.0~1.1%
Hydro	93.9~98.1	8.8~9.2%
Biomass	39.4~49.0	3.7~4.6%

Source : Comprehensive Resource and Energy Study Group Basic Policy Subcommittee (28th Meeting Materials From "Trends after Formulation of Basic Energy Plan and Future Directions (December 27, 2018)")

Projected 2030 Energy Mix



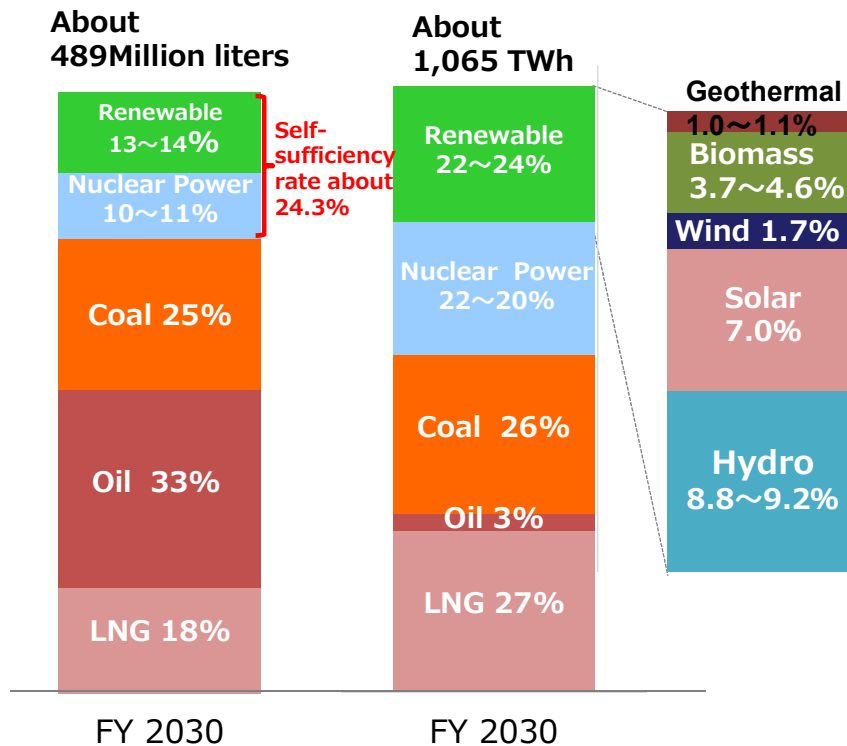
Looking at “Zero emission power ratio” and “Self-sufficiency rate”, it seems to be difficult to achieve projected Energy Mix for 2030 due to the situations where nuclear power plans have not been restarted yet.

Japan’s plan for nuclear power generation the country

⇒ “Reduce dependence, safety-first operation, Important power supply”

■ Projected Energy Mix for 2030

[Primary Energy Supply] [Composition of Power Sources]



Source :Long-term Energy Supply and Demand Outlook by Agency for Natural Resources and Energy (July 2015)

■ Progress toward Energy Mix for 2030

	Before Earthquake (FY 2010)	After Earthquake (FY 2013)	Present (Estimate for FY 2016)	Mix (FY 2030)
Zero-emission power ratio	36%	12%	17%	44%
	Renewable 10% Nuclear 26%	Renewable 11% Nuclear 1%	Renewable 15% Nuclear 2%	Renewable 22~24% Nuclear 22~20%
CO2 emissions (Energy oriented)	1.13 billion tons	1.24 billion tons	1.14 billion tons	0.93 Billion tons
Self-sufficiency Rate (Energy Origin)	20%	6%	8%	24%

Source: Agency for Natural Resources and Energy Basic Policy Subcommittee (25th Meeting) [Response to the realization of the energy mix for 2030-General arrangement] (March 26, 2018)

Nuclear issues in Energy Mix for 2030



The premise of Energy Mix for 2030 is about 20 to 22% of nuclear power (37.79 GW to 35.36 GW * in terms of installed capacity). Considering the current situations, there is a concern that the actual plants restarted will be lower than the original plan.

(※ 70% assumption of facility utilization)

■ Status for Nuclear Power Plants

[As of March 23, 2018]

	Units	Capacity
Restart	7	6.77 GW
Permitted for change in reactor installation	7	7.55 GW
in review for change in reactor installation	12	11.9 GW
No filed for change of reactor installation	17	17.5 GW
Total	43	43.27 GW
Decommissioning (Determined and under consideration)	17	11.37 GW

Decided to decommission 7 units in 1 year (One will be under review)

[As of February 23, 2019]

	Units	Capacity
In operation or Expected operation	9	9.13 GW
	6	6.29 GW
	12	12.17 GW
	9	9.63 GW
Total	36	37.22 GW
Decommissioning	24	17.42 GW

In operation or Expected operation

27.59 GW

※ 4 units (3.58 GW) are more than 50 years old as of 2030

9 of them have not been filed yet. Likely to be decommissioned.

Source: Resource and Energy Agency Basic Policy Subcommittee (25th Meeting) "Response to Realization of Energy Mix for 2030-General arrangement-(March 26, 2018)"

Source: Nuclear Safety Promotion Association website (as of February 13, 2019)

Alternative power source to replace nuclear power (10.19 GW to 7.76 GW)* is necessary.

※37.79 GW to 35.36 GW – 27.59 GW = 10.19 GW to 7.76 GW

Coal-fired power in Energy Mix for 2030



The premise of Energy Mix for 2030 is about 26% of coal-fired power (45.83GW * when converted to installed capacity) (※70% assumption of facility utilization)

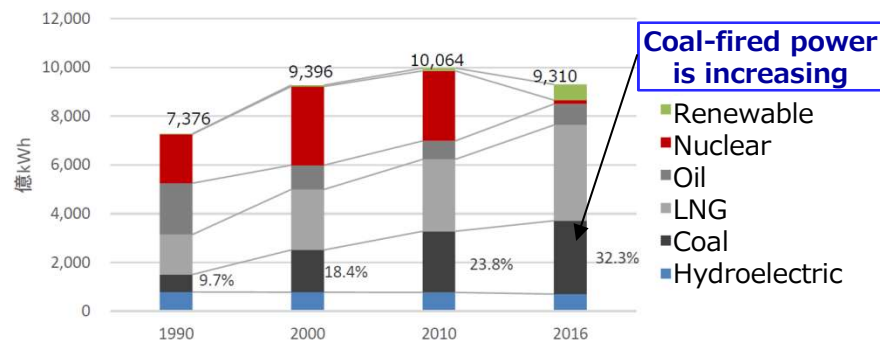
-UK, France, and Canada have a policy of zero coal-fired operation by 2030 based on the Paris Agreement-

Estimated operating capacity of coal-fired power in 2030

	Plants	Capacity
Operating	121	44.71 GW
under construction	15	8.58 GW
under EIA/after EIA	9	4.52 GW
passed 50 years as of 2030	▲23	▲4.56 GW
Total	122	53.25 GW
Scale of coal-fired power generation in the energy mix		45.83 GW (assumption of facility utilization)

Source : KIKO Network 「Coal power plant watch」

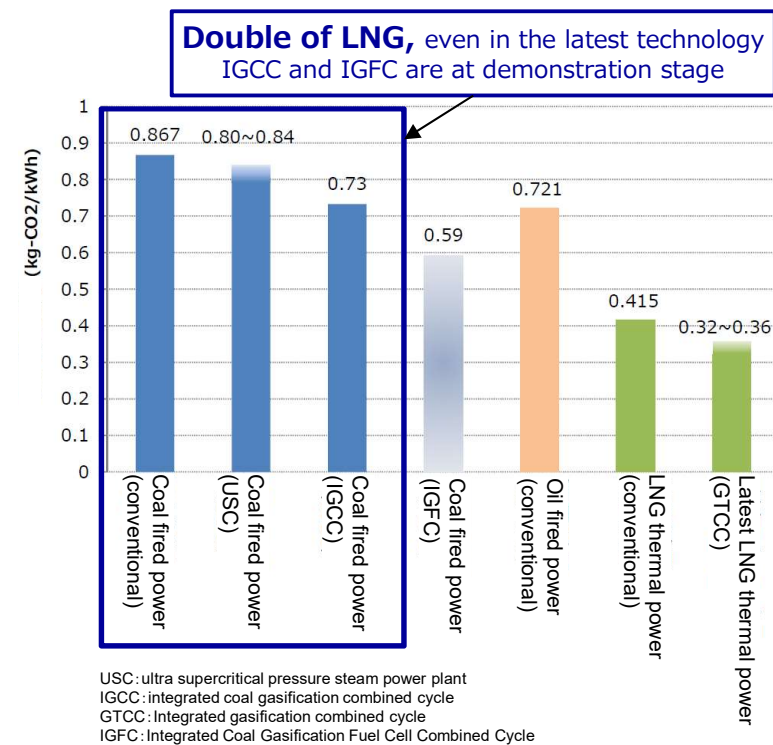
Trends in power generation



Source : Renewable Energy Institute 「Japan's global movement to withdraw from coal-fired power generation and Japan (July 2018) 」

Coal-fired CO₂ emissions

CO₂ emission factor for each fuel type (CO₂ emission per unit of power generation)



Source : Ministry of Environment 「Study group on the ideal way of carbon pricing (June 2, 2017)」

GTCC & Offshore Wind

GTCC & Offshore Wind are the only option to substitute the New Clear's deficit of 10GW~8GW power supply

<3E+S>

Energy Security

Economic Efficiency

Environment

+

Safety

Replacing the decrease in the assumed nuclear capacity of 10.19 GW to 7.76GW million kW with each power source .

Option we have

LNG(GTCC)

10.19GW ~ 7.76GW (capacity Factor : 70%)

Offshore Wind

23.78GW ~ 18.81GW (Capacity Factor : 30%)

■ Pro/Con LNG (GTCC)/Offshore Wind

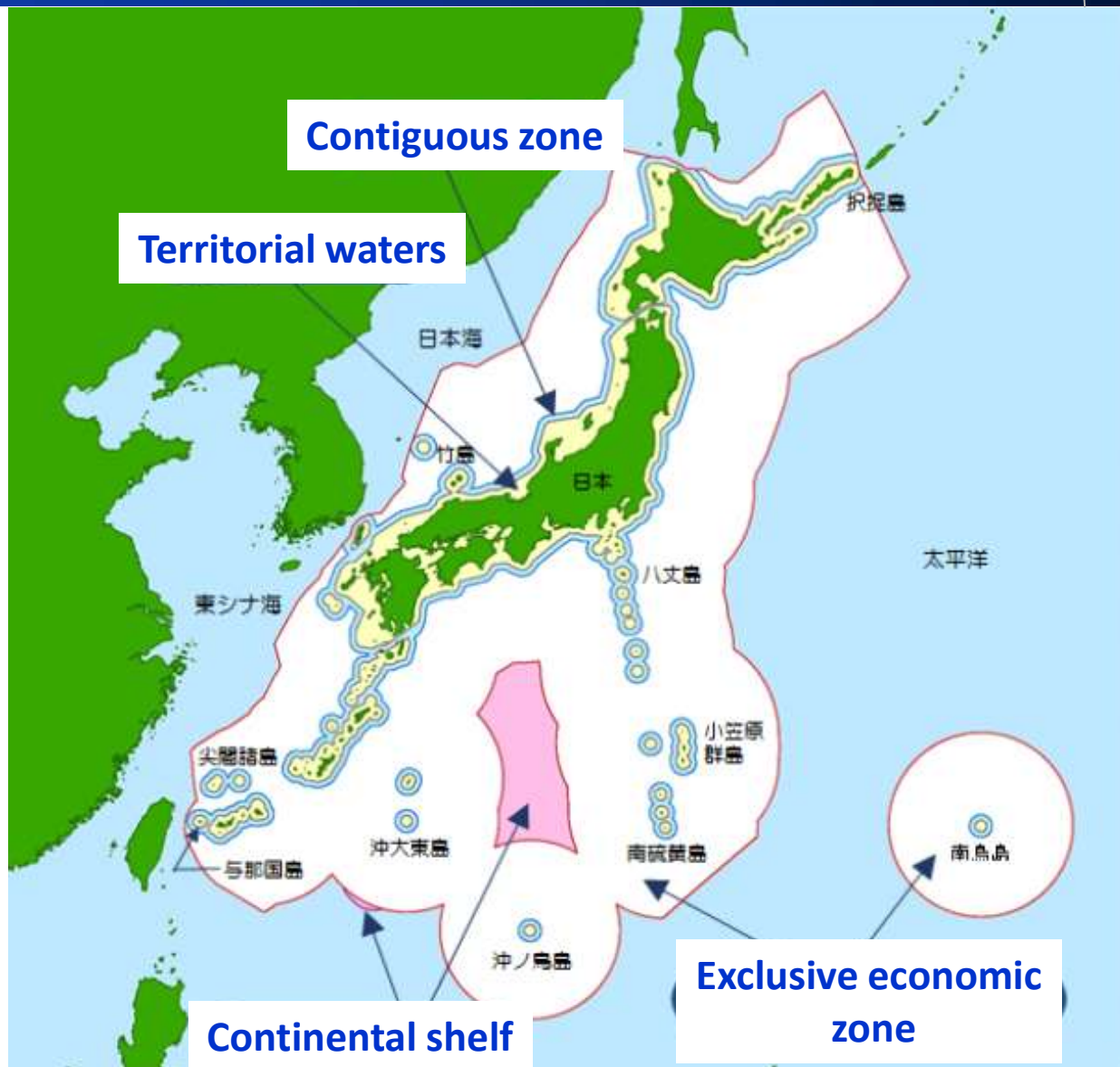
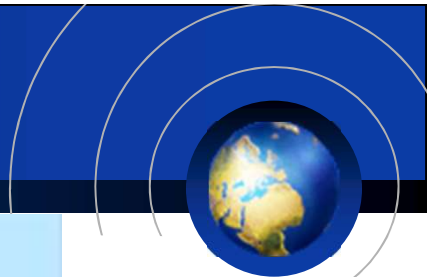
	Self-sufficiency Rate	Reduction in power generation costs	Risk of steep rise in oil price	Economic ripple effect	CO2 emissions	Location conditions	Output fluctuation
LNG (GTCC)	× DOWN	△ Remain the same even by mass introduction	×	△ Limited	△	△	○
Offshore Wind Power	○ UP	○ Could be reduced by mass introduction	○	○ Industry is expansive	○	△ Limited, but could be resolved by grid enhancement	× Could be resolved by cross-regional coordination of transmission

Energy Management including Nationwide Grid operation is the Key technology to achieve Best Energy Mix. @ 2030



2. Situation of ocean in Japan

Ocean area distinction



EEZ plus TIA area list

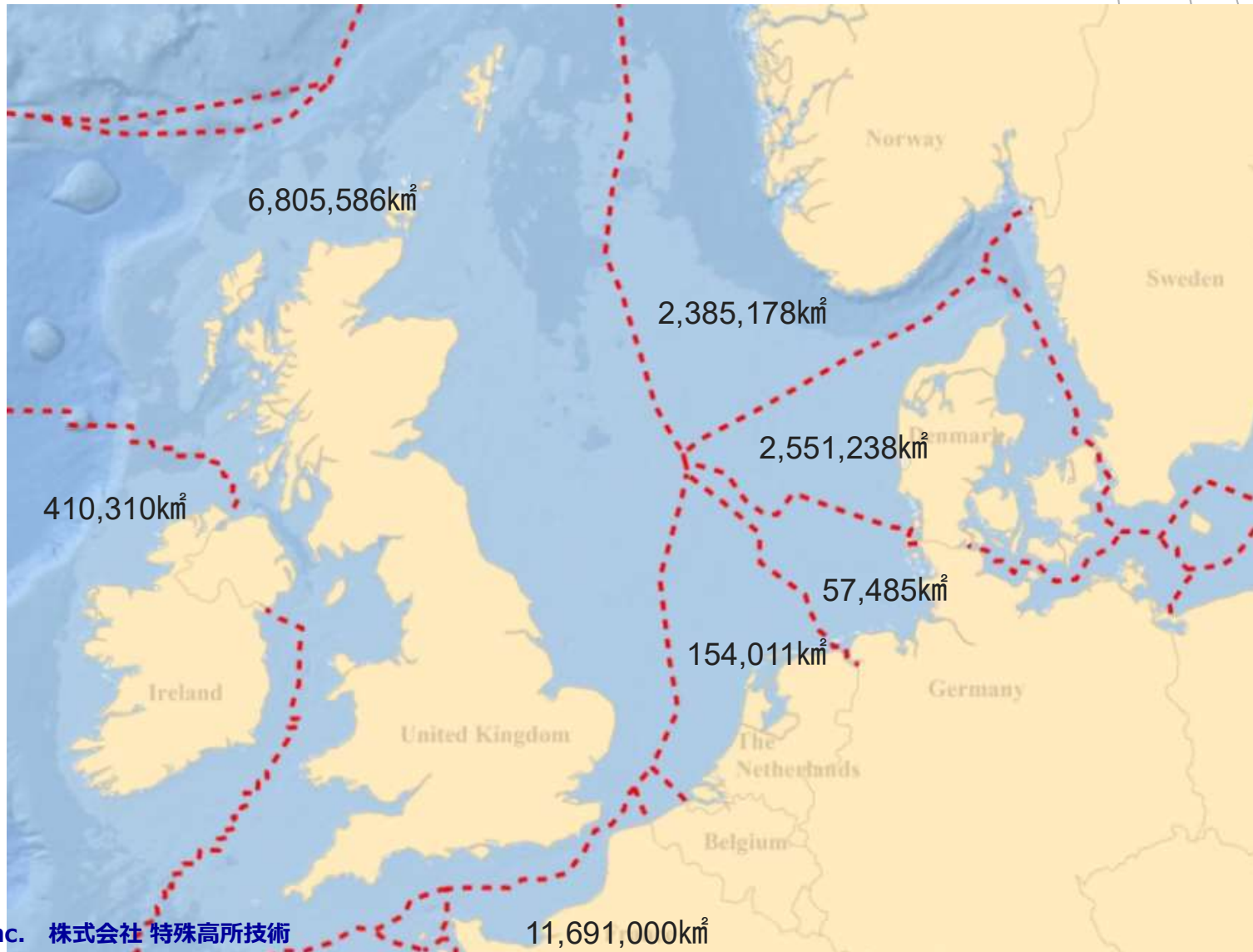


Rank	Country	EEZ km ² ^[64]	Shelf km ²	EEZ+TIA km ²
-	 European Union	25,000,000	1,346,878	30,000,000
1	 France	11,691,000	579,422	12,366,417
2	 United States	11,351,000	2,193,526	21,814,306
3	 Australia	8,505,348	2,194,008	16,197,464
4	 Russia	7,566,673	3,817,843	24,664,915
5	 United Kingdom	6,805,586	872,891	7,048,486
6	 Indonesia	6,159,032	2,039,381	8,063,601
7	 Canada	5,599,077	2,644,795	15,607,077
8	 Japan	4,479,388	214,976	4,857,318
9	 New Zealand	4,083,744	277,610	4,352,424
10	 Chile	3,681,989	252,947	4,431,381

Source; Wikipedia; Exclusive economic zone

This list includes dependent territories within their sovereign states (including uninhabited territories), but does not include claims on Antarctica. EEZ+TIA is exclusive economic zone (EEZ) plus total internal area (TIA) which includes land and internal waters

North Sea EEZ division



TKG Inc. 株式会社 特殊高所技術

Source: Own figure. Data from: Esri, DeLorme, GEBCO, NOAA NGDC.



3. Domestic Offshore wind

Early Demonstration in 2003-2004



Dec. 2003

At Setana port in Hokkaido

By Local government (Setana)

700m offshore, 13m in depth

Vestas 600kW x 2 turbines

Dolphin foundation

1st offshore wind power in Japan



Dolphin
foundation



Jan. 2004

At Sakata port in Yamagata pref.

By Sumitomo Co. (sold to JRE)

In the canal

Vestas V80 2 MW x 5 turbines

Dolphin foundation

(3 more turbines at onshore)

2nd offshore wind power in Japan

Two National projects for fixed bottom type

(by NEDO: New Energy and Industrial Technology Development Organization)



Mar. 2013

At **Choshi**, Chiba pref.

Mitsubishi 2.4MW

φ 92m, Hub 80m

Gravity foundation

12m depth

3km offshore



June 2013

At **Hibikinada/Kitakyushu** city,

Fukuoka pref.

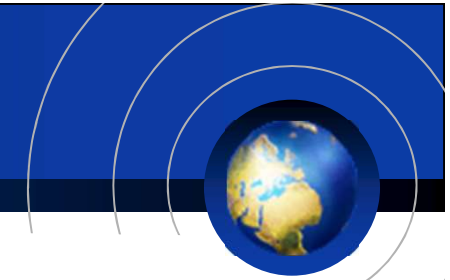
Japan Steel Works (JSW) 2MW, φ 82m

Jacket&Gravity hybrid foundation

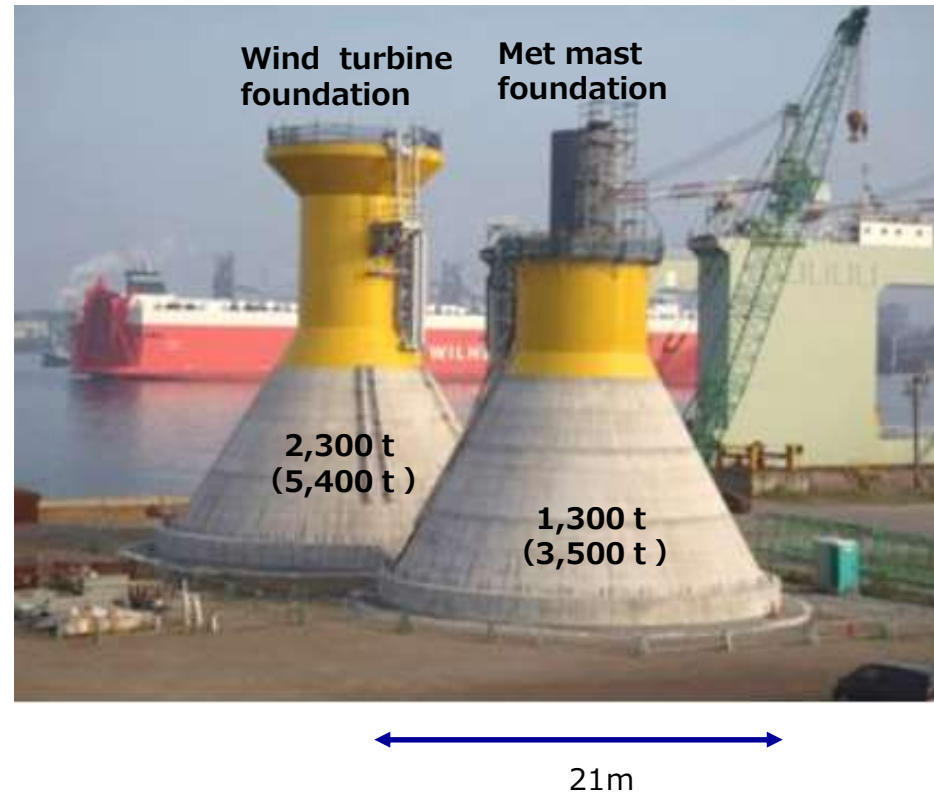
14.5m depth

1.4km offshore

Gravity Base Foundation



Choshi /NEDO Demonstration project



source : kajima Corporation

Hybrid Support Structure

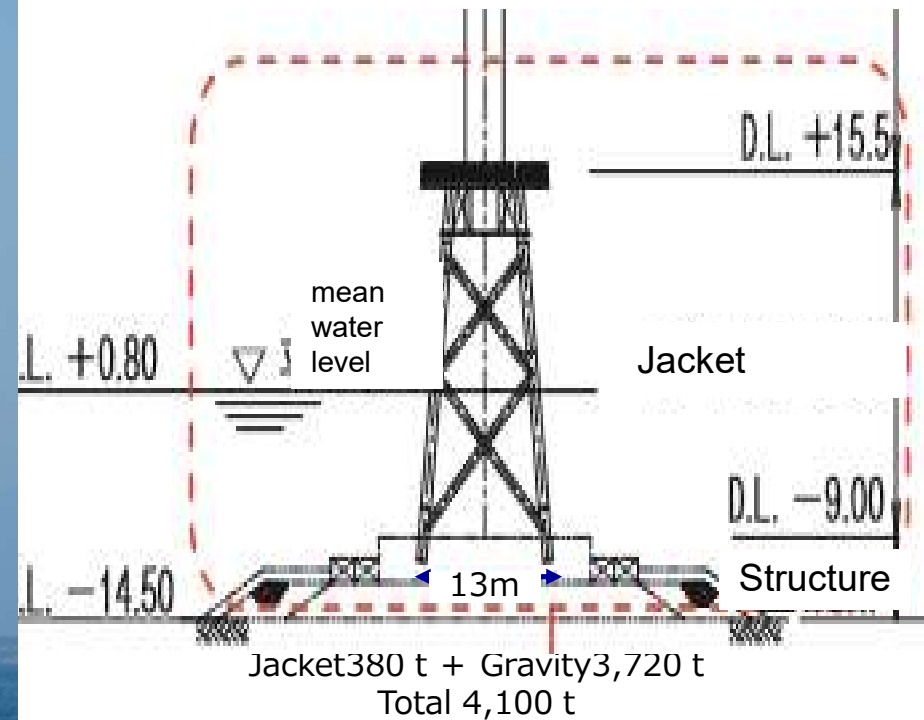


Hibikinada/Kitakyushu /NEDO Demonstration Project

Gravity + Jacket



source: NEDO

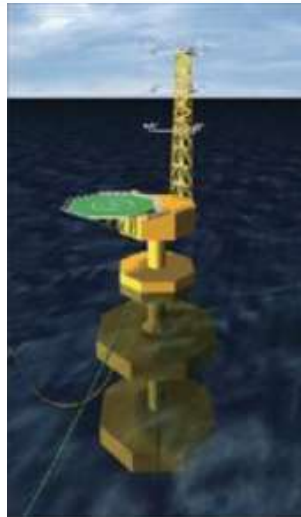


source :  **NIPPON STEEL**
Establishment of design technology for offshore wind foundation

National Project for Floating



Floating Substation



Compact semi-sub
2MW



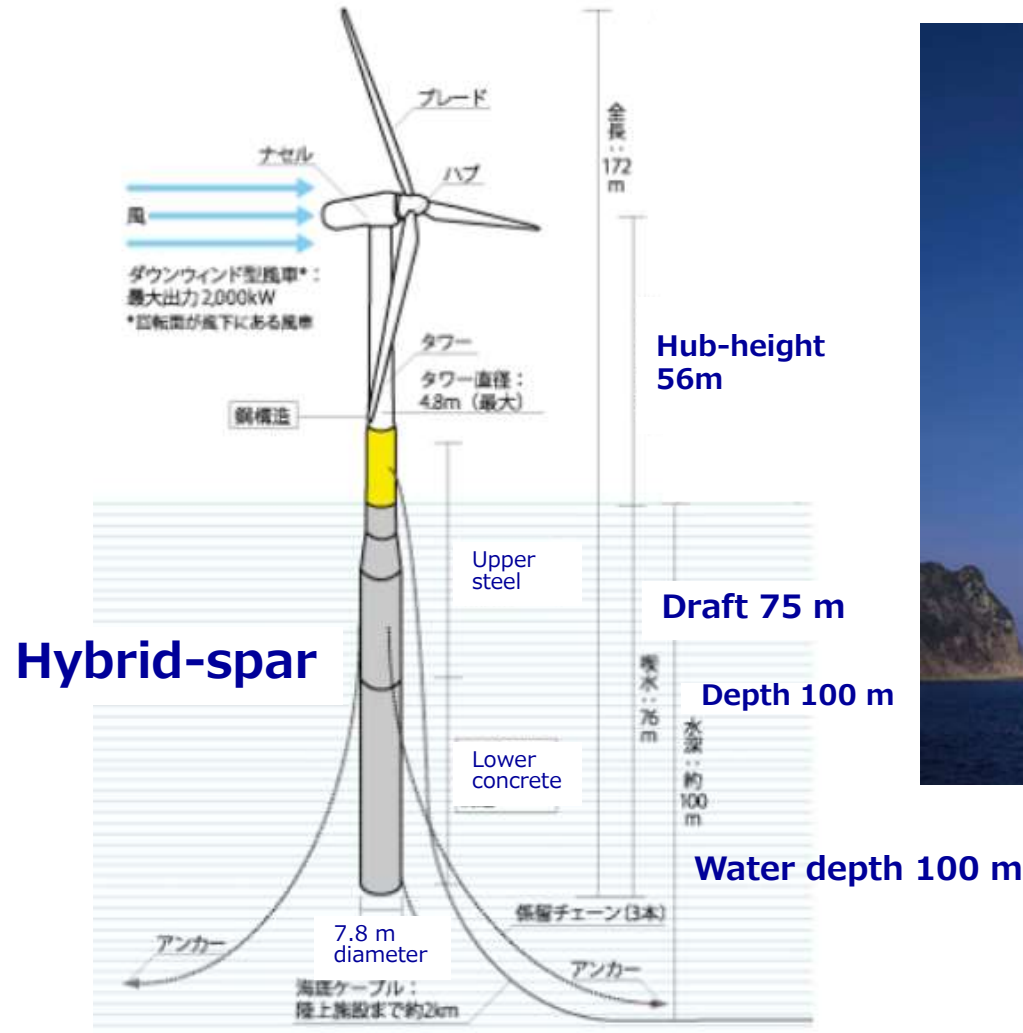
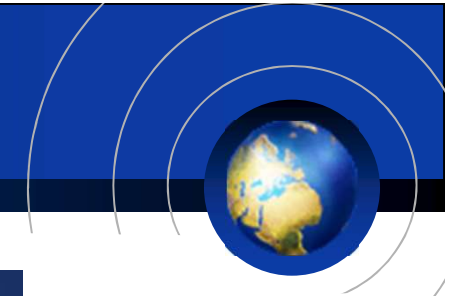
V-shape Semi-sub
7MW



Advanced spar
5MW



Hybrid Spar floating



source : TODA Corporation

Port Area Demonstration



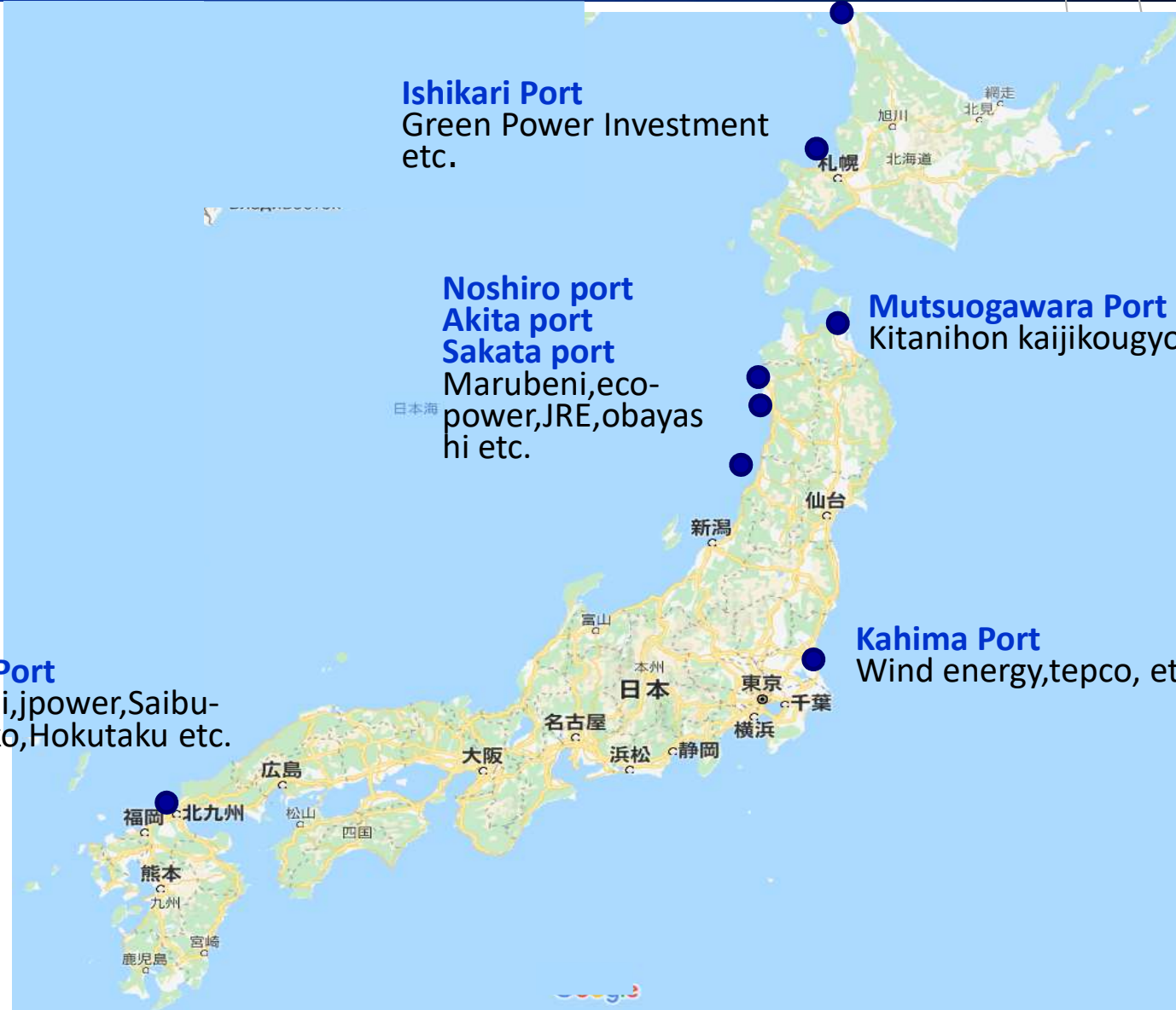
Kitakyushu Port
Kyuden mirai, jpower, Saibugus, Kyudenko, Hokutaku etc.

Ishikari Port
Green Power Investment etc.

**Noshiro port
Akita port
Sakata port**
Marubeni, eco-power, JRE, obayashi etc.

Mutsuogawara Port
Kitanihon kaijikougyo etc.

Kahima Port
Wind energy, tepco, etc.



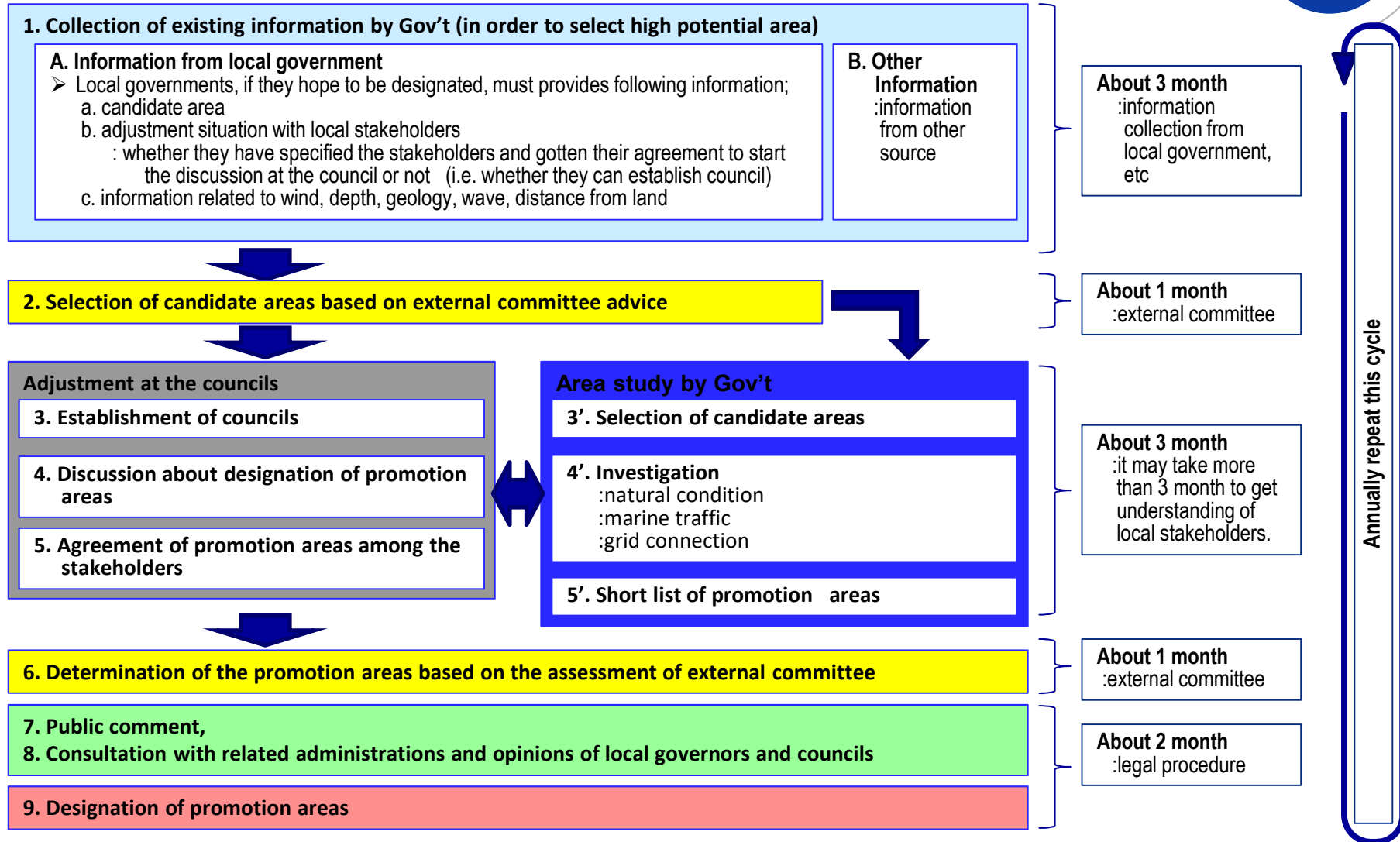


4. New Offshore Law

Selection of “promotion area”



Flowchart of the Areas Selection



source : PHAJ's unofficial translation based on "chukan seiri p.20 (2019.4, METI & MLIT)" which means interim report, conclusion of 2018 WG by METI & MLIT

Round 1 Candidate promotion area

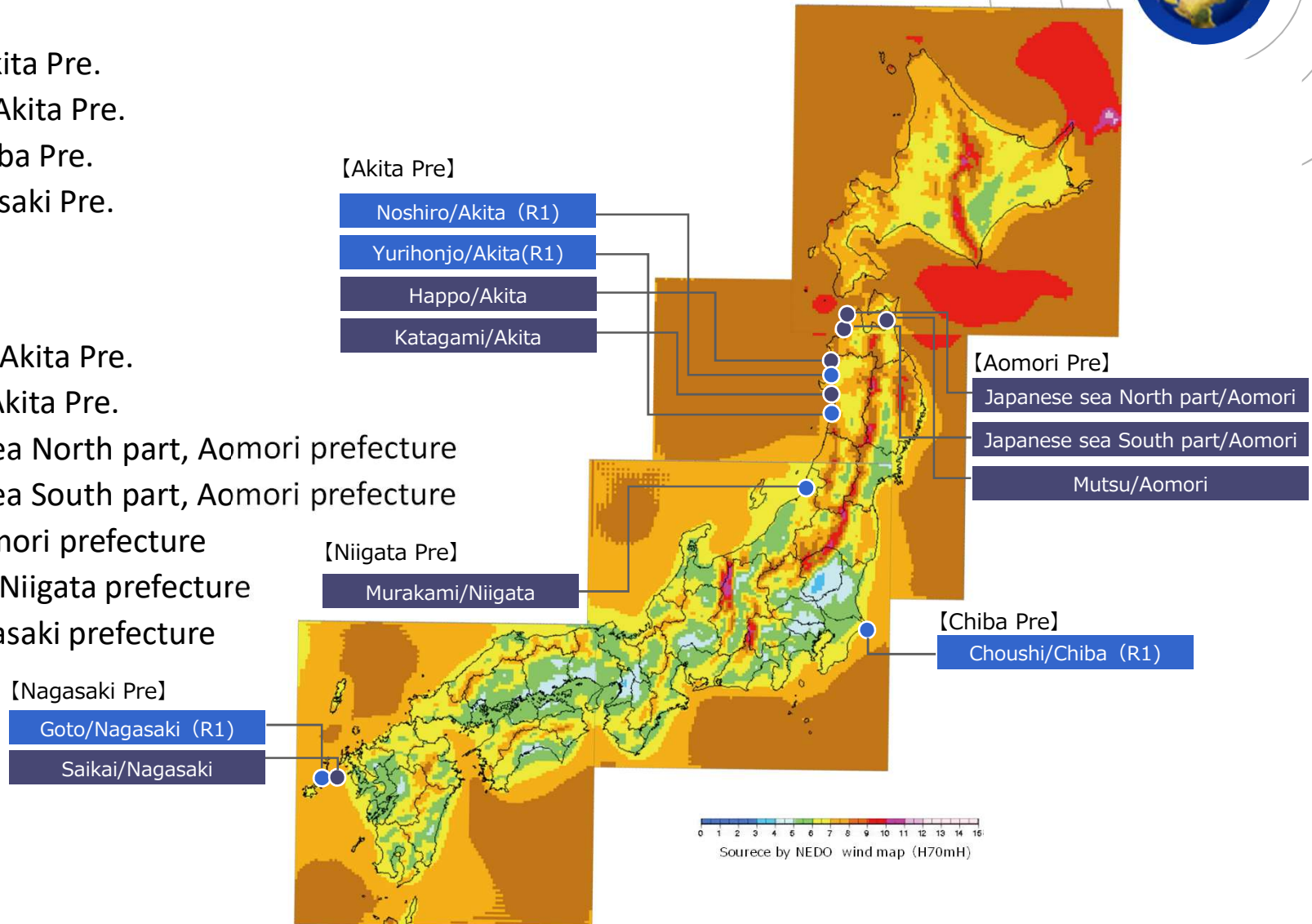


1st round

- 1) Noshiro, Akita Pre.
- 2) Yurihonjo, Akita Pre.
- 3) Choshi, Chiba Pre.
- 4) Goto, Nagasaki Pre.

1.5 round

- 1) Happocho, Akita Pre.
- 2) Katagami, Akita Pre.
- 3) Japanese sea North part, Aomori prefecture
- 4) Japanese sea South part, Aomori prefecture
- 5) Mutsu, Aomori prefecture
- 6) Murakami, Niigata prefecture
- 7) Saikai, Nagasaki prefecture





5. Key to Success

Clear Govt's Commitment



Japanese Govt. has not declared any Ambitious Target yet..

JWPA 's Proposal to Government

By 2030 10 GW by mainly Fixed bottom

By 2050 37 GW by Fixed & Floating

As we can see from the past European cases,



The government's ambitious Target will lead to *industrial development, investment promotion, Job creation, economic revitalization, LCOE reduction.*

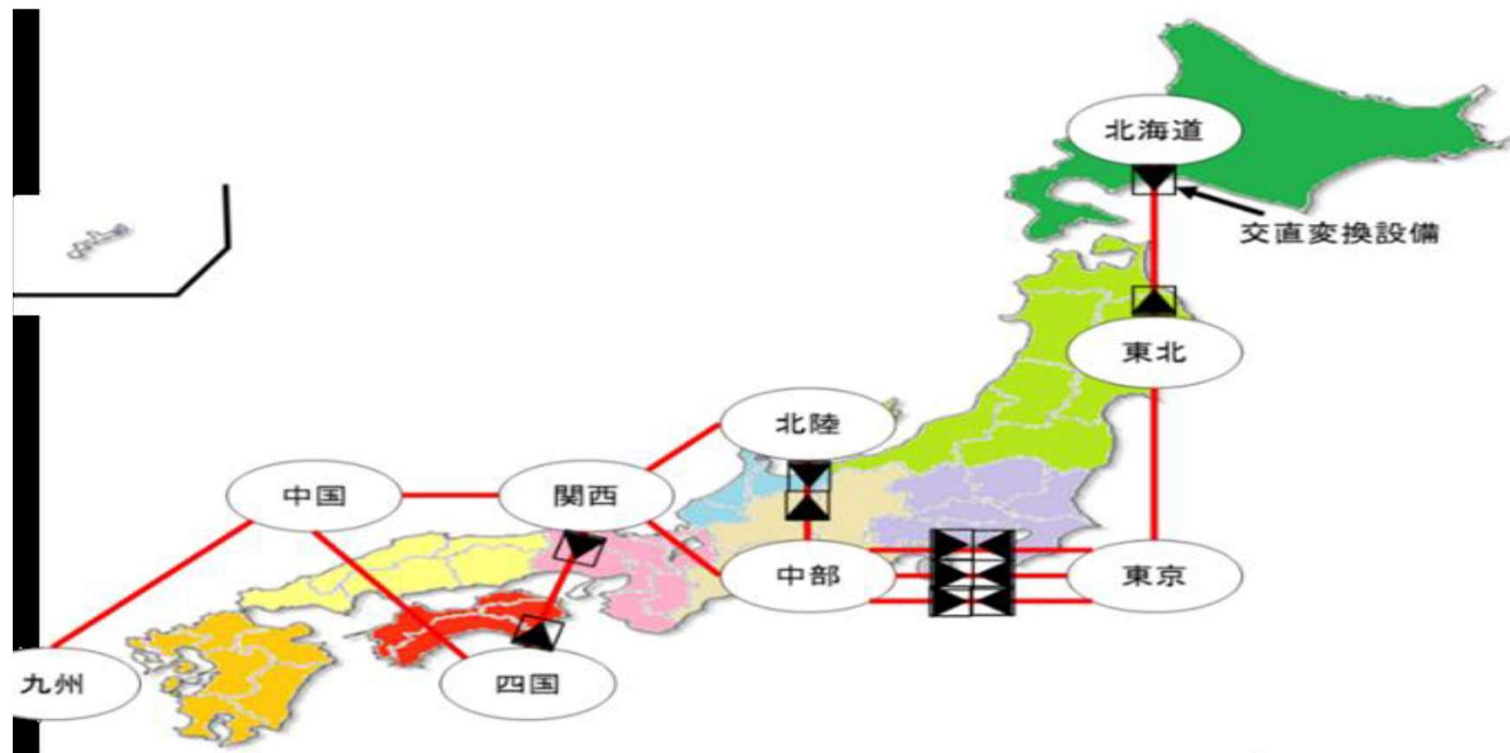
Securing Grid Connection



Grid capacity calculation: Assumed  Actual usage (Connect & Manage) 

Paradigm Shift of Grid Operation

- Independent Regional Grid operation  Cross Regional (Nationwide) Grid Operation 
- Increase Cross regional Transmission capacity



Source: Organization for Cross-regional Coordination of Transmission Operators

Paradigm Shift of Grid Operation



**Small Renewables
= Local Consumption**

**Large Power Plant
= Wide Area Consumption**

Small Wind



Large Hydro



Nuclear



Small PV



Small Hydro



Offshore Wind



Local Production Local Consumption



Nation-wide Consumption

Offshore Wind – Key to Success



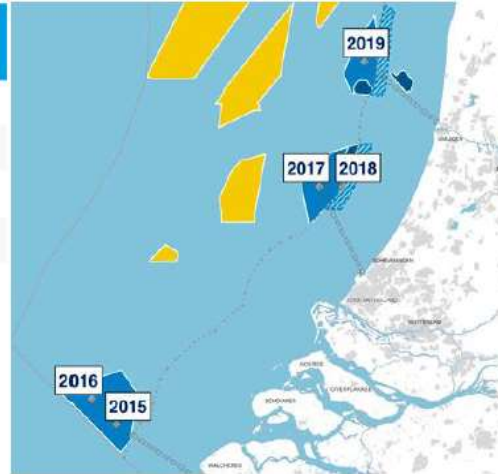
Grand Design by government initiative is required

- **Clear Commitment** by the government
(announcement of **Mid (2030) & Long Term (2050) Target**)
- **Aiming at effective competitive bidding system**
(adoption of so-called **Centralized System**)
- **Integrated planning** of designation of **Offshore Wind Promotion Area** and appropriate **Port Facility for Pre-Assembling**

Centralized Bid System

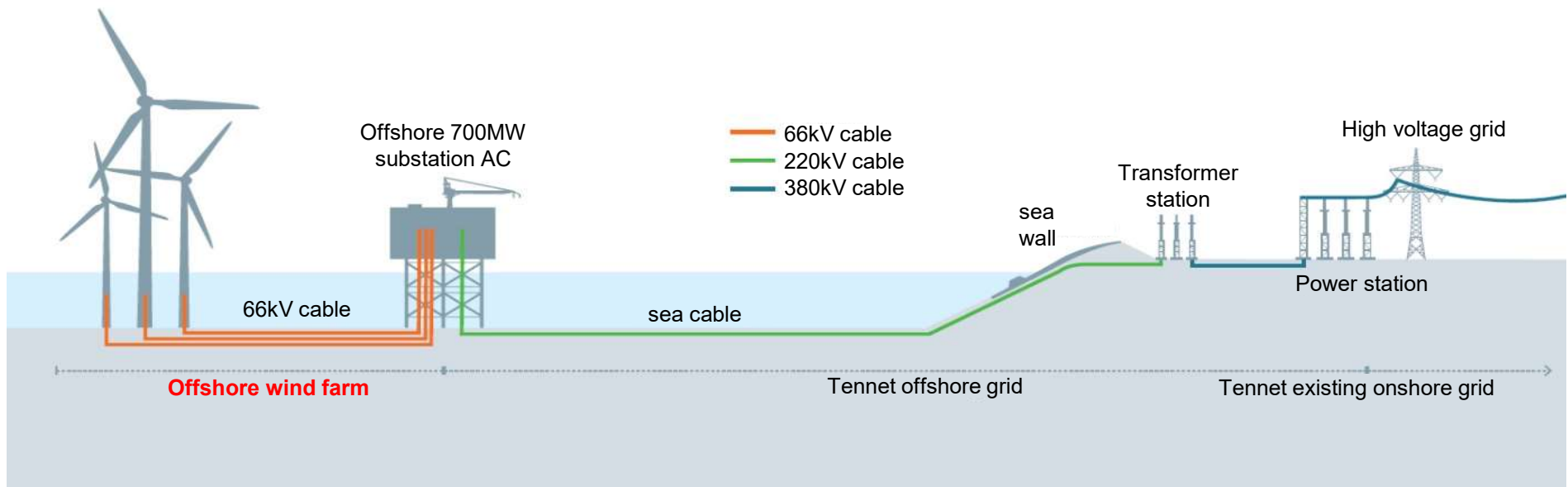


Year	Power	Wind Farm Zone
2015	700 MW	Borssele Wind Farm Zone, Wind Farm Site I and II
2016	700 MW	Borssele Wind Farm Zone, Wind Farm Site III and IV
2017	700 MW	Hollandse Kust ZH Wind Farm Zone
2018	700 MW	Hollandse Kust ZH Wind Farm Zone
2019	700 MW	Hollandse Kust NH Wind Farm Zone



Minimize the risk of developer

Source: MAKE, Netherlands Enterprise Agency



Base Port improvement

Kitakyushu Port



Kashima Port



Ground bearing capacity, Assembly yard, Customs, bonded area, administration building, training facilities, residential facilities, etc.

Bremerhaven;
Germany



source; **WORLD MARITIME NEWS**

Vlissingen;
Netherland



source; **offshoreWIND.biz**



Thank you for your attention !