Global Offshore Wind Summit Taiwan 2020

Initiatives to Make Offshore Wind Power the Primary Power Source

Oct. 13, 2020

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Japan Wind Power Association

http://jwpa.jp

JWPA 一般社団法人 日本風力発電協会
Japan Wind Power Association

Japan Wind Power Association (JWPA) is the representative of Japanese Wind Power Industry

■ **Brief History**

Dec. 17, 2001: Established as a voluntary organization
May. 27, 2009: Registered as a General Incorporated Association

■ **Composition of Members (as of 16 September, 2020)**

- ✔ Number of members: 439 companies and corporations
- ✔ Our members own and operate approx.85% of the wind farms in Japan.

■ **Board Members**

- ✔ JWPA board is managed by 20 directors and 2 auditors
- ✔ Those members constitute of developers, manufacturers, general contractors, law firms, financial institutions, etc.

Core Members of JWPA

- Japanese Developers

Eurus Energy

EcoPower Co.,Ltd.

J-POWER 電源開発

Energy for Tomorrow JWD Japan Wind Development Co.,Ltd. 日本風力開発株式会社

Japan Renewable Energy ジャパン・リニューアブル・エナジー株式会社

- Utilities

TEPCO 東京電力リニューアブルパワー

関西電力 power with heart

中部電力

九州電力グループ 九電みらいエナジー Kyuden Mirai Energy

- European Developers

Ørsted

CIP Copenhagen Infrastructure Partners

e·on

wpd think energy

WINDPAL Proven Offshore Wind Solutions

- Japanese General Contractors

鹿島 KAJIMA CORPORATION

OBAYASHI

Today's Work, Tomorrow's Heritage Shimizu Corporation SHIMZ

TODA TODA CORPORATION

WAKACHIKU

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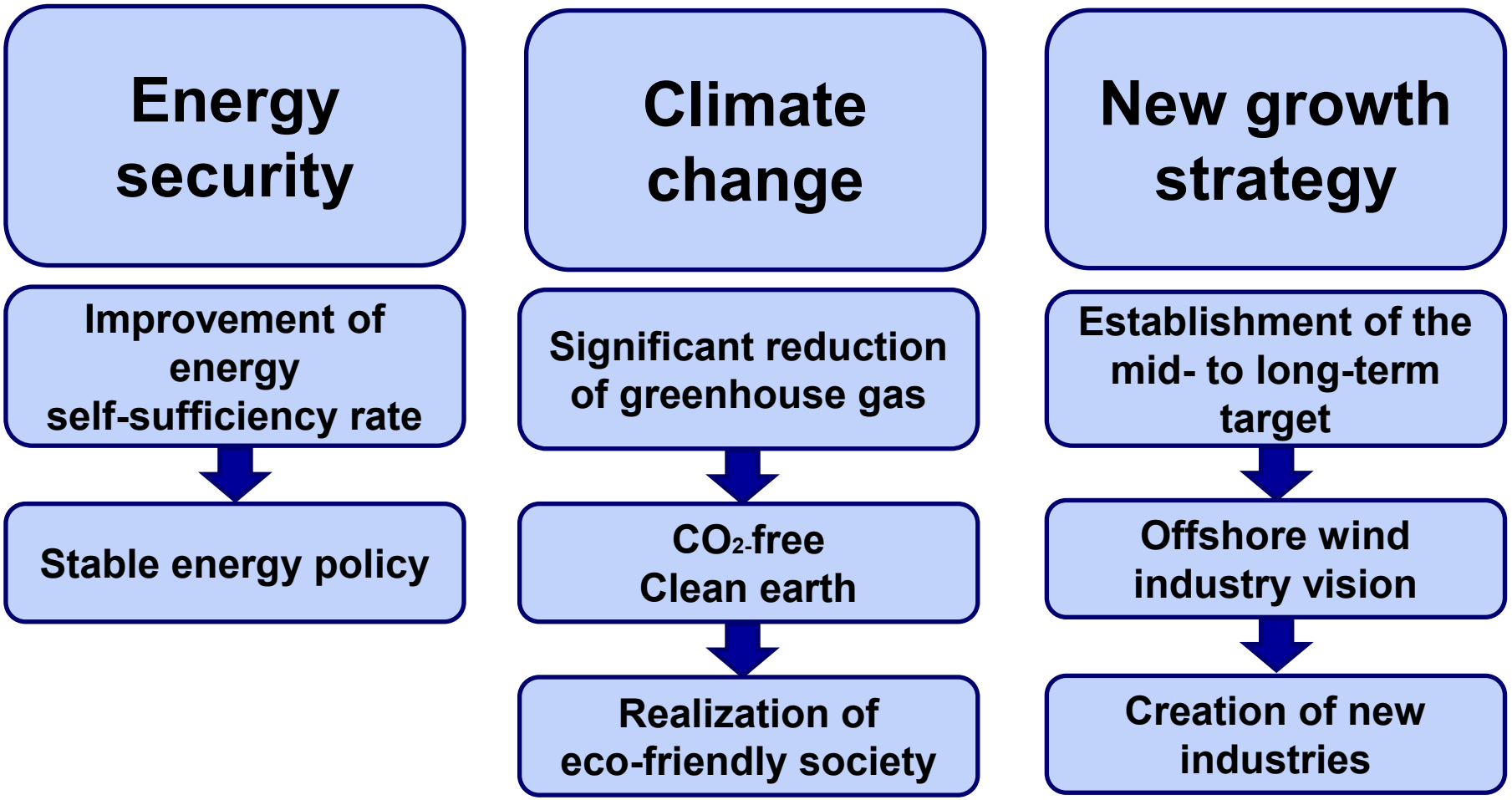
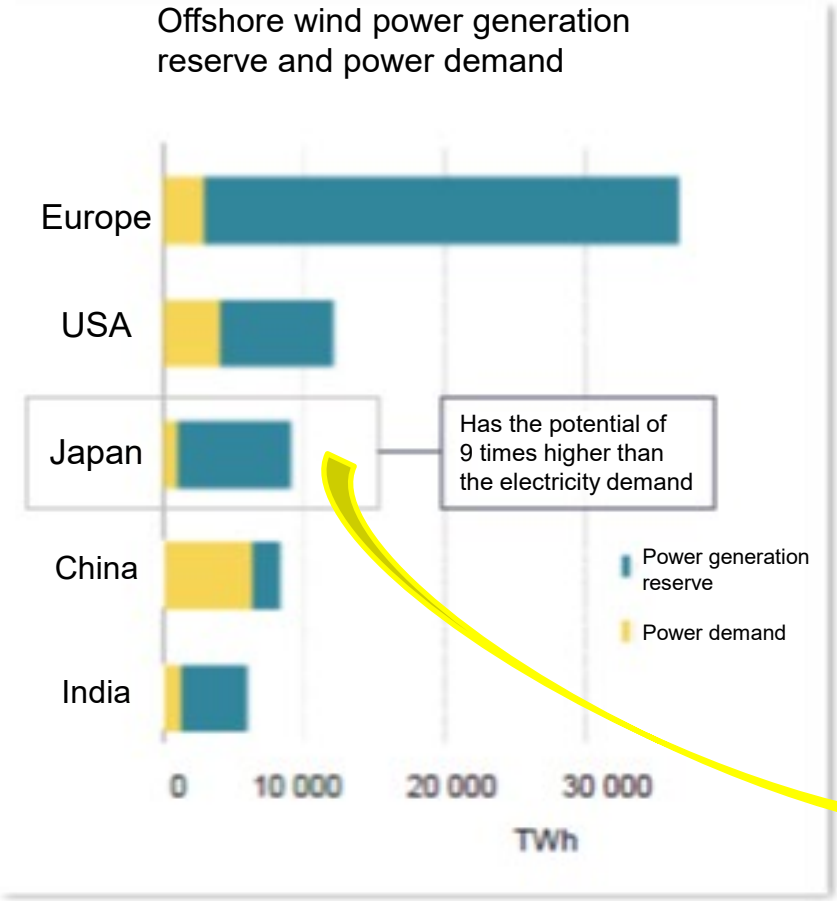
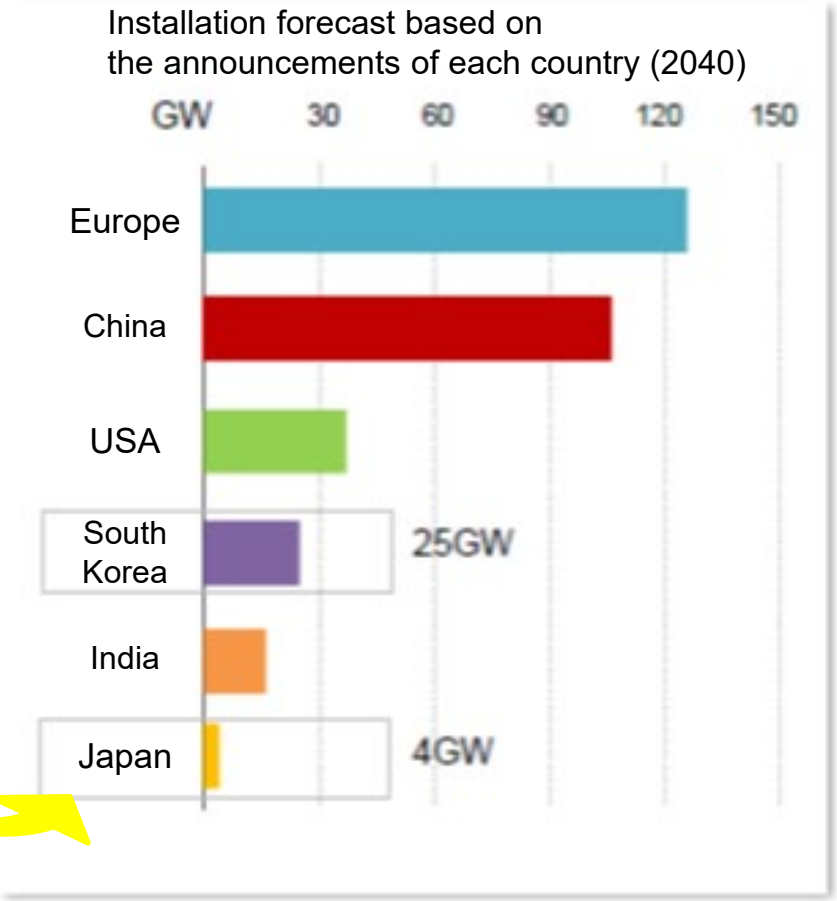


The outlook by IEA shows a gap between Japan's potential and global reputation.





Source: 'Offshore Wind Outlook 2019' by International Energy Agency, edited by MHI Vestas Offshore Wind A/S

Japan has huge Offshore Wind Power Potential

Potential of the bottom-fixed type: Approx. 128 GW
Potential of the floating type: Approx. 424 GW

[Note] A potential of the bottom-mounted type of approx. 91 GW announced by JWPA on February 28, 2018 was estimated based on the water depth of 10-40 m, but the potential this time is based on the water depth of 10-50 m.

[Bottom-mounted type]
Water depth 10-50 m

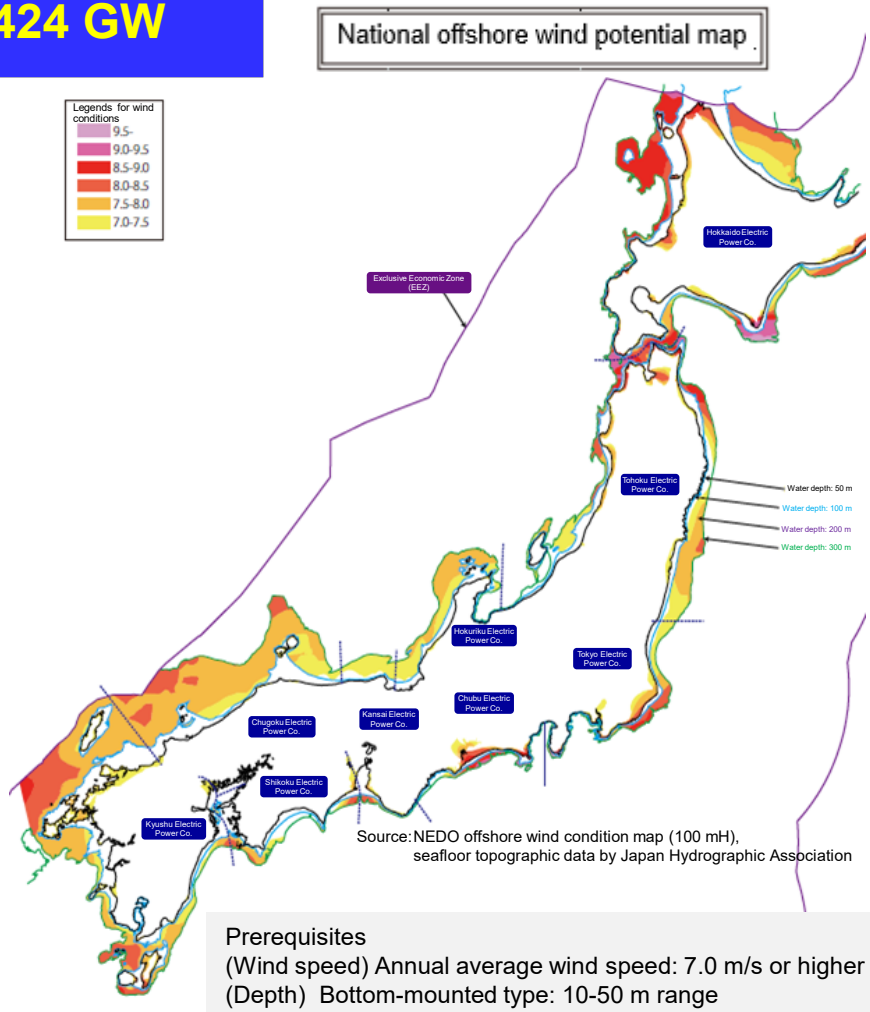
6MW/km²

Power service area	Total capacity	Capacity by wind speed (m/s) in GW					
	GW	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-
Nationwide	**128.8**	**55.1**	**42.8**	**22.5**	**7.0**	**1.3**	**0.0**
Hokkaido	41.0	10.0	15.0	11.3	3.8	0.9	0.0
Tohoku	22.7	9.4	8.3	3.8	1.1	0.1	0.0
Tokyo	14.8	6.1	5.8	2.6	0.1	0.2	0.0
Chubu	12.4	3.1	3.5	3.7	1.9	0.1	0.0
Hokuriku	1.2	1.2	0.0	0.0	0.0	0.0	0.0
Kansai	2.1	1.7	0.4	0.1	0.0	0.0	0.0
Chugoku	2.5	2.3	0.1	0.0	0.0	0.0	0.0
Shikoku	2.5	1.9	0.6	0.1	0.0	0.0	0.0
Kyushu	29.5	19.5	9.1	1.0	0.0	0.0	0.0

[Floating type]
Water depth 100-300 m

3MW/km²

Power service area	Total capacity	Capacity by wind speed (m/s) in GW					
	GW	7.0-7.5	7.5-8.0	8.0-8.5	8.5-9.0	9.0-9.5	9.5-
Nationwide	**424.5**	**86.4**	**197.8**	**84.7**	**43.3**	**9.7**	**2.6**
Hokkaido	93.2	13.4	19.1	21.8	31.0	5.6	2.2
Tohoku	51.7	17.3	19.1	7.5	5.2	2.6	0.0
Tokyo	13.3	4.5	2.0	4.5	2.0	0.2	0.2
Chubu	4.7	0.3	0.4	0.7	1.9	1.2	0.2
Hokuriku	30.2	13.0	17.2	0.0	0.0	0.0	0.0
Kansai	10.6	8.7	0.9	0.8	0.1	0.0	0.0
Chugoku	107.8	16.1	73.9	17.8	0.0	0.0	0.0
Shikoku	8.3	2.7	3.8	1.8	0.2	0.0	0.0
Kyushu	104.6	10.4	61.3	29.9	3.0	0.0	0.0



Source: NEDO offshore wind condition map (100 mH), seafloor topographic data by Japan Hydrographic Association

Prerequisites
(Wind speed) Annual average wind speed: 7.0 m/s or higher
(Depth) Bottom-mounted type: 10-50 m range
Floating type: 100-300 m range
(Minimum capacity) Approx. 120 MW or more per PJ

JWPA proposes to set an Ambitious and Clear Medium- to Long-term Introduction Target

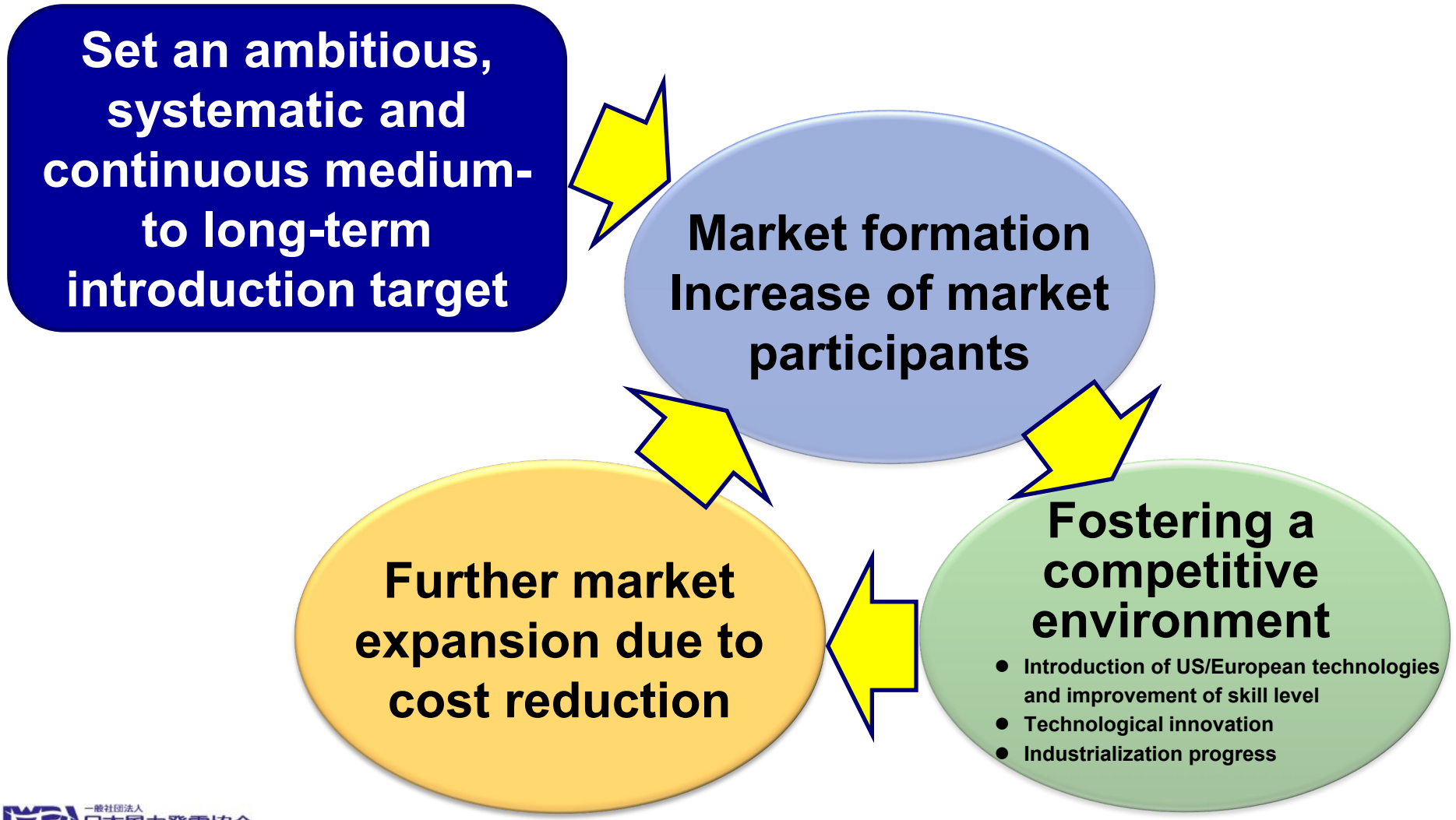
- **2030: Offshore wind power capacity of 10 GW**
  - Set as an intermediate target
  - Minimum market size required for investment decisions (Approx. 1 GW x 10 years)

- **2040: Offshore wind power capacity of 30-45 GW**
  - Market size which enables the industry to recover the investment (Approx. 2-4 GW/year)
  - Market size that can create a competitive environment on par with other countries across the world

- **2050: Offshore wind power capacity of 90 GW (+ 40 GW by onshore = 130 GW)**
  - Government target: Target value corresponding to achieving 80% reduction of GHG emissions
  - Supply more than 30% of the estimated total power demand by wind power generation in 2050

Formation of a virtuous cycle leading to the expansion of introduction

- **"Setting an Ambitious and Clear Medium- to Long-term Introduction Target" to trigger a virtuous cycle**

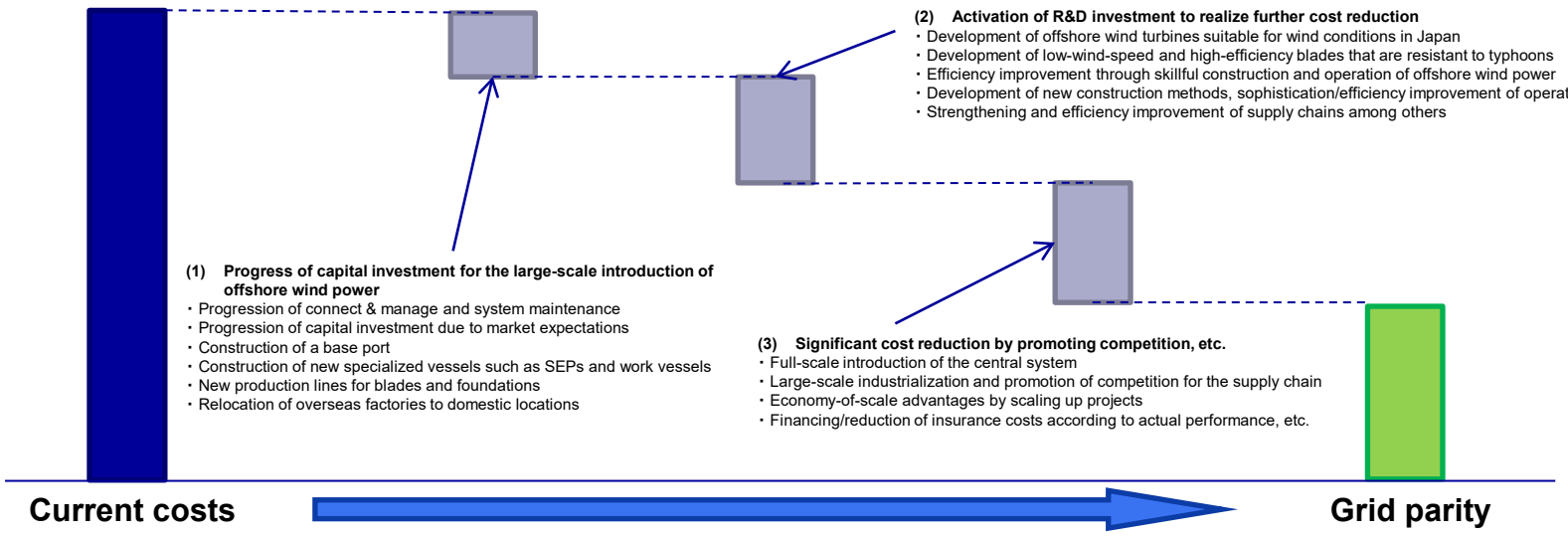


How to establish the Position as a "Cost-Competitive Power Source"

- **Aim for power generation cost (LCOE) of 8-9 yen/kWh**
  - Since Japan can obtain knowledge from the mature European offshore wind industry (based on their experience of approx. 30 years), cost reduction may be feasible in a shorter time period than in Europe.
  - **Large-scale introduction (scale economy), technological innovation, and maturity of the industry** are the prerequisites of power generation cost reduction.
  - The speed of cost reduction **depends on the stability of the appropriate system and the introduction target, etc.**

(Source: Some citations and additions from Orsted, an European power generation company, explanatory material at the 4th Round Table for Studying Energy Situations)

Image of achieving grid parity for offshore wind power generation costs (created by JWPA)



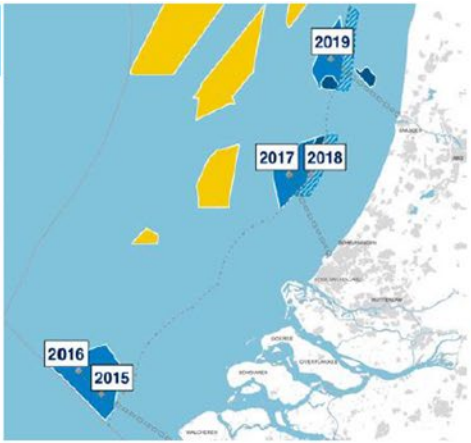
JWPA requests to introduce Central System which is first introduced by the Dutch Government

- **The government provides the most favorable conditions without risk to business operators.**

1. Clear long-term introduction plan
2. Guarantee of grid connection
3. Zoning by the government
4. Integration of construction permit and subsidies
5. Enormous project scale
6. Project standardization
7. Favorable project conditions

1. The Dutch government announced the introduction of large-scale offshore wind power (3.5 GW/700 MW x 5 years) by 2023.
2. Grid connection and equipment is supplied by TSO.
3. The state is responsible for the development and conducts wind condition observation, seabed survey, environmental assessment, etc.
4. The processes of the construction permit and subsidy grant are integrated.
5. The scale of projects is 350 MW x 2 for each bidding, which makes it easy to enjoy the advantage of scale.
6. Similar conditions are set for each project, which facilitates standardization.
7. Conditions such as water depth of 16-38 m and berthing distance of 22km can be sufficiently met by the current technologies.

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



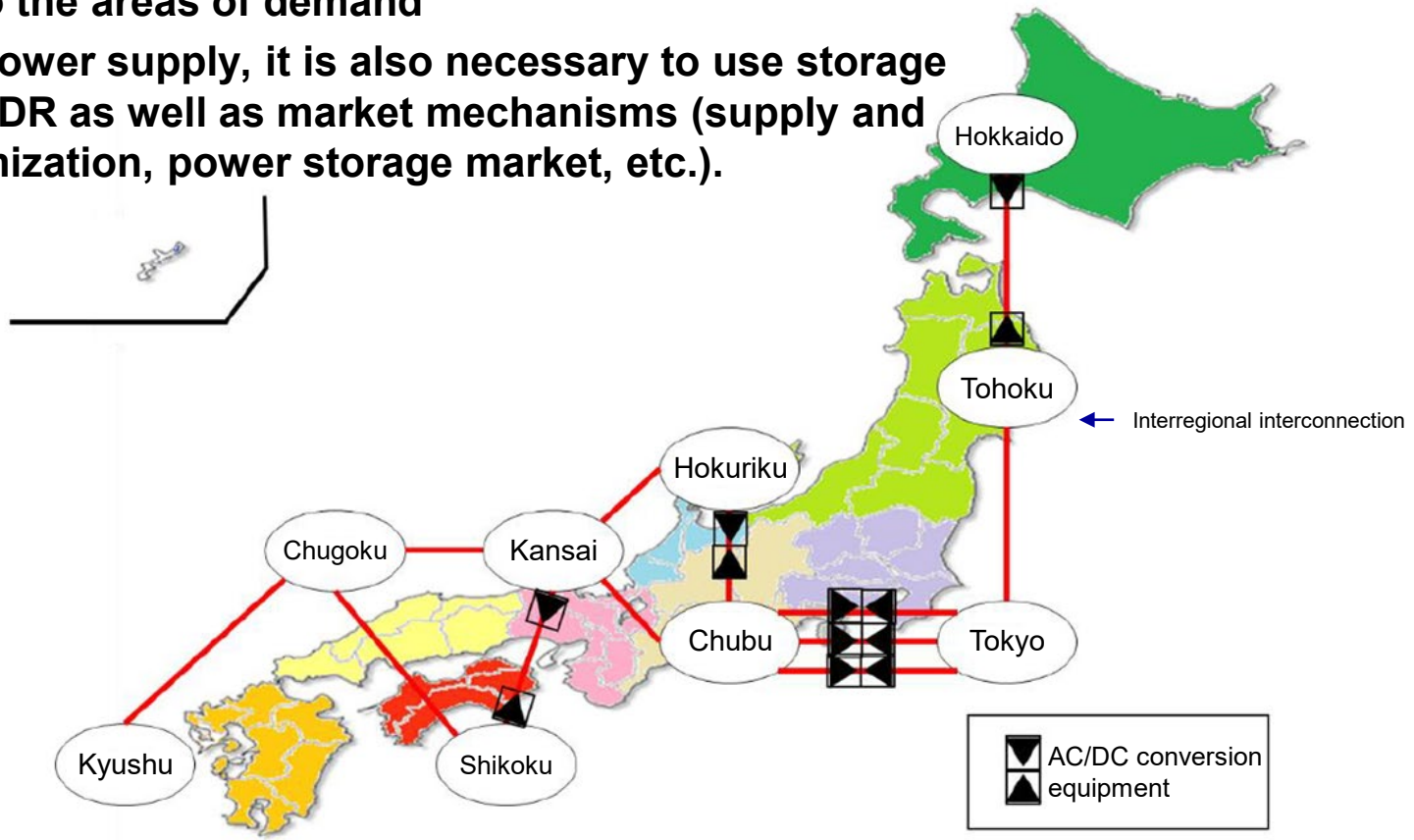
Minimize development risks for operators

Source: MAKE, Netherlands Enterprise Agency

Source: Study Group for Policy Issues in the Era of Large-volume Introduction of Renewable Energy (3rd meeting) June 14, 2017
European Offshore Wind Power Business Bidding Price Trends/Background and What Japan Can Learn from It
by Masato Yamada, Vice President, MVOW

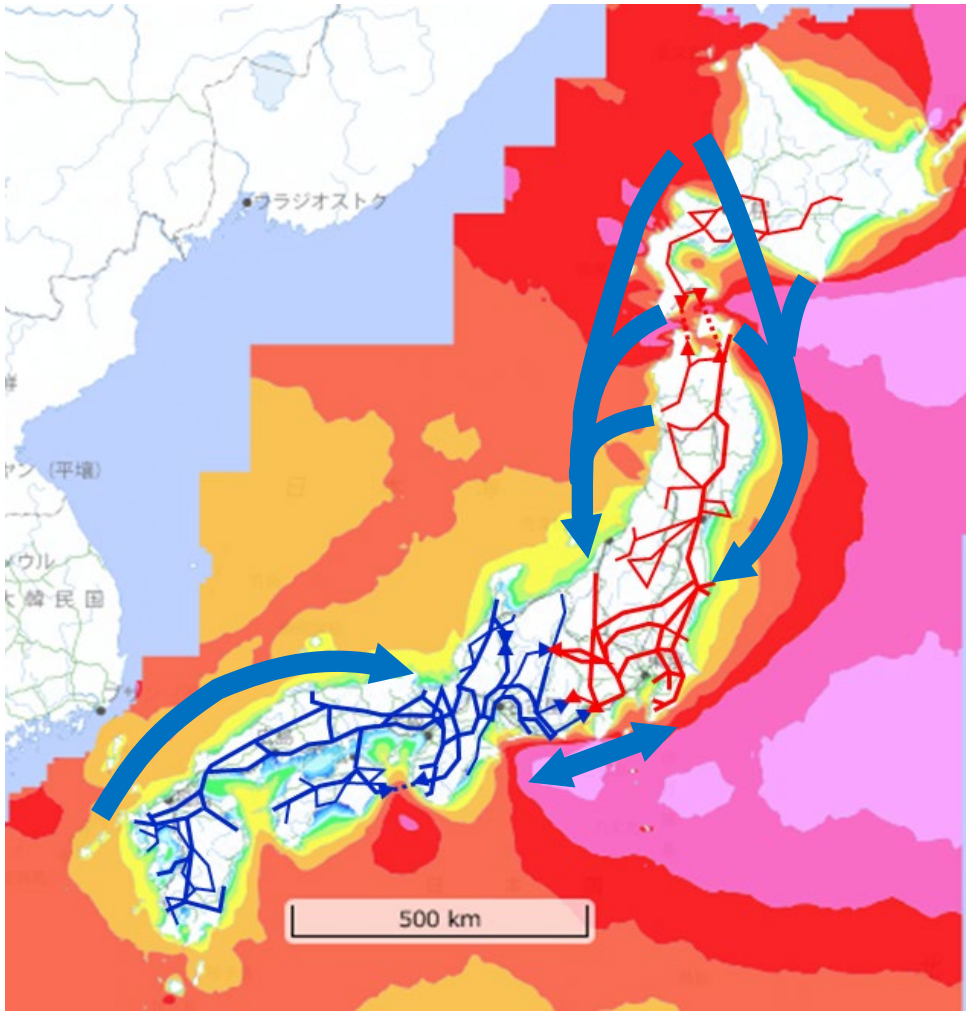
To modernize Japanese Power Network, suitable to make Renewable Energy the Primary Power Source

- **Review grid usage rules at an early stage**
- **Achieve grid interconnection at an early stage based on actual power flow similar to Europe and the US**
- **Master plan that enables offshore wind power to be transmitted to the areas of demand**
- **For a stable power supply, it is also necessary to use storage batteries and DR as well as market mechanisms (supply and demand optimization, power storage market, etc.).**



Source: Annual Report FY2019, Organization for Cross-regional Coordination of Transmission Operators, JAPAN

[Reference] Image of Japan Super Grid



Large power supply
= Wide area consumption

Dam

Nuclear power

Offshore wind power

- **Quick construction by using submarine cables**
- **Ideal for long distances with fewer losses due to DC power transmission**
- **Enable integrated operation of grids nationwide**

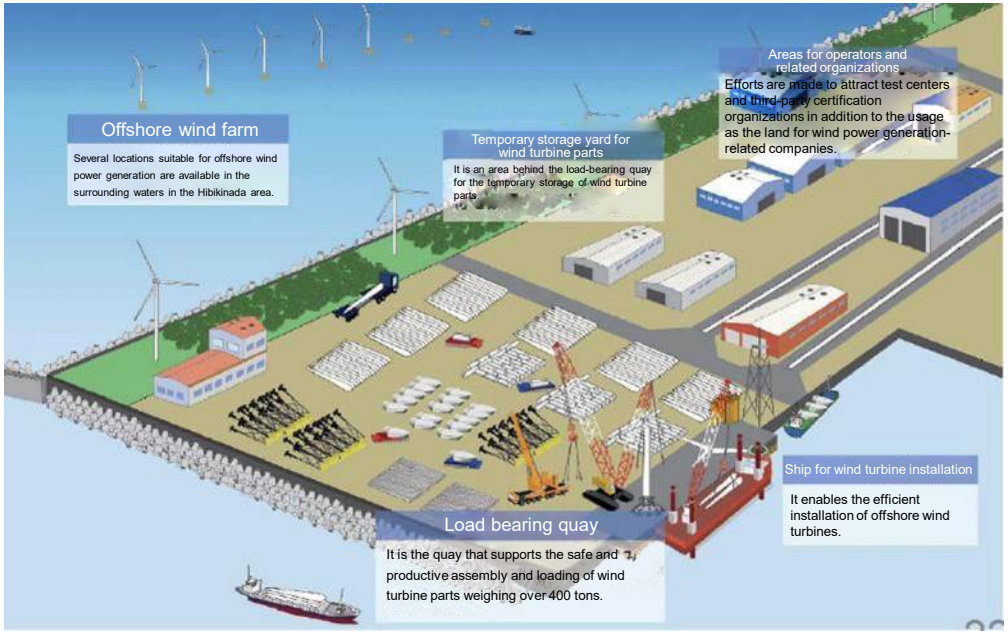
* Overview of the main power system (275 kV or more) overlaid on the NEDO offshore wind condition map (http://app10.infoc.nedo.go.jp/Nedo_Webgis/index.html)

Systematic Construction of Base Ports

- In the medium-term, **planned development of a large-scale base port** with a so-called pre-assembly function is essential to steadily introducing offshore wind power generation over a long period of time, proceeding with construction efficiently, and reducing costs.
- The base ports need to be **developed in line with the designation of the sea areas of installation promotion and the medium- to long-term introduction target**, considering efficiency in terms of the scale, location, etc.

European ports (example)

Image of the base port



Source: Aiming to become an “all-around base” for power generation related industries (Data by Kitakyushu City Port and Airport Bureau)

[Reference] Construction of the Base Ports/ Required Functions

◆ Location of the base port

Understanding of potential power generation areas

Selection based on future expandability

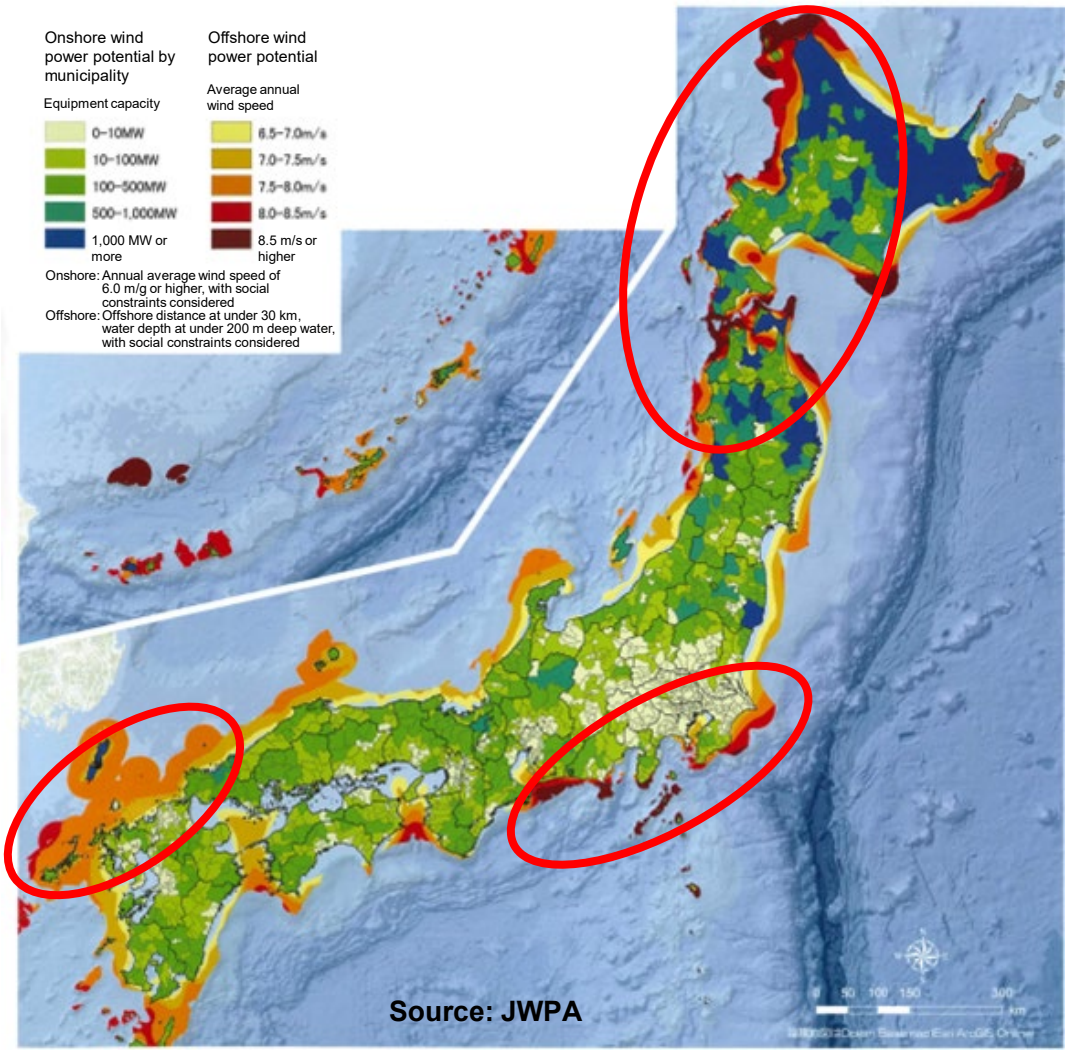
◆ Required functions

Multiple power generators are expected to use the pre-assembly in turns or in parallel to minimize offshore construction work.

Multiple projects are expected to be undertaken simultaneously in the surrounding area.

Usage of the floating type is also expected in addition to the bottom-mounted type.

Offshore wind condition map at 100m above sea level



Source: JWPA

Primary Issues to be Addressed in Each Field (1)

[Design and manufacturing of wind power generators, related equipment, and foundation structures]

- **Strengthening and rebuilding the domestic wind industry**
  - Attracting offshore wind power-related industries to Japan (wind turbines, towers, foundations including the floating body, etc.)
  - Promote new entry of domestic parts and equipment manufacturers
  - Encourage/promote domestic manufacturing of replacement/consumable parts for maintenance

- **Development of "next-generation Japan-original wind turbine" that can adapt to the environment of Japan and Asia**
  - Development and verification of wind turbine technology that is compatible with low wind speed and enables seismic isolation and turbulence resistance
  - Development and verification of technologies to ensure power generation cost reduction (blade optimization, foundation including the floating body, etc.)

- **Training and securing of new human resources including various professional engineers and specialists**
  - Establishment of wind power-related courses in collaboration with educational institutions including universities
  - Establishment of wind power engineering department in technical colleges and technical high schools

Primary Issues to be Addressed in Each Field (2)

[Transportation, construction (construction work), maintenance, and finance]

- **Reduction of development and construction costs**
  - Improving transportability and promoting reuse
  - Promotion/establishment of low-cost construction technologies (with overseas cooperation)
  - Improved efficiency of installation work vessels (innovative construction methods, domestic construction of vessels, etc.)
  - Lower costs for foundations and mooring devices (with overseas cooperation, attracting to Japan, utilization of shipbuilding technologies)
  - Relaxation of regulations regarding the use of construction vessels and work permits
  - Promotion of capital recycling (diversification of financing, development of financial scheme)

- **Development of human resources for marine civil engineering (including construction, installation and O&M)**
  - Establishment of a system to train human resources who are familiar with planning, design, and construction (offshore construction work, etc.)
  - Establishment of a technical training center for offshore wind power generation
  - Establishment of an O&M personnel training system and training center
  - Establishment of standards and qualification/certification systems that comply with international standards (to ensure safety)

Creation and Formation of a New Industry, "Offshore Wind Power Generation Industry"

- **A new comprehensive and sustainable industry**
  ⇒ Formulation of "Offshore wind power generation industry strategy"
  - One wind turbine requires 10,000-20,000 parts ⇒ A broad scale comparable to that of the automobile industry
  - Reactivate existing industries such as steelmaking, shipbuilding, and steel structures
  - Strengthen human resources, technologies, and industrial foundation (= competitiveness of the domestic industry) in cooperation with local communities
  - Form a new "clean heavy industry"

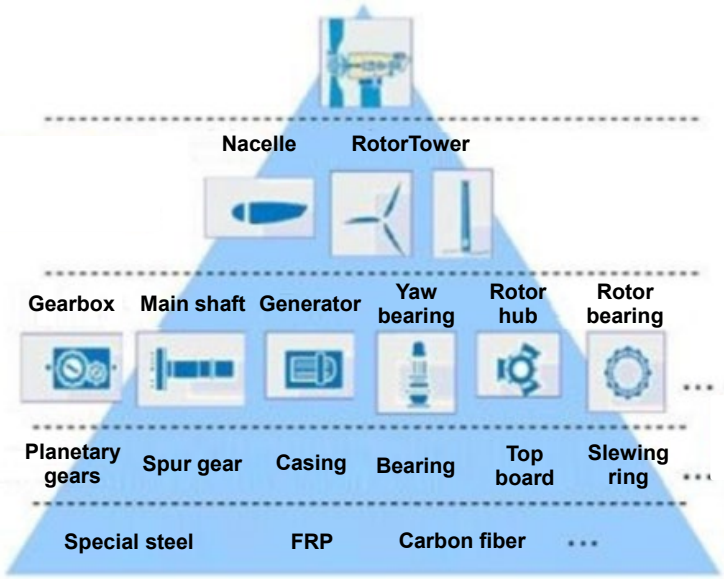
  [Example] The foundation of offshore wind turbines requires a large amount of steel (150,000 tons per year = 1 GW for the bottom-mounted type)

The foundation of a bottom-mounted type turbine (monopile) being built in the factory (in the Netherlands)

Current Status of Wind Power-related Industries in Japan : We have enough ability and potential.

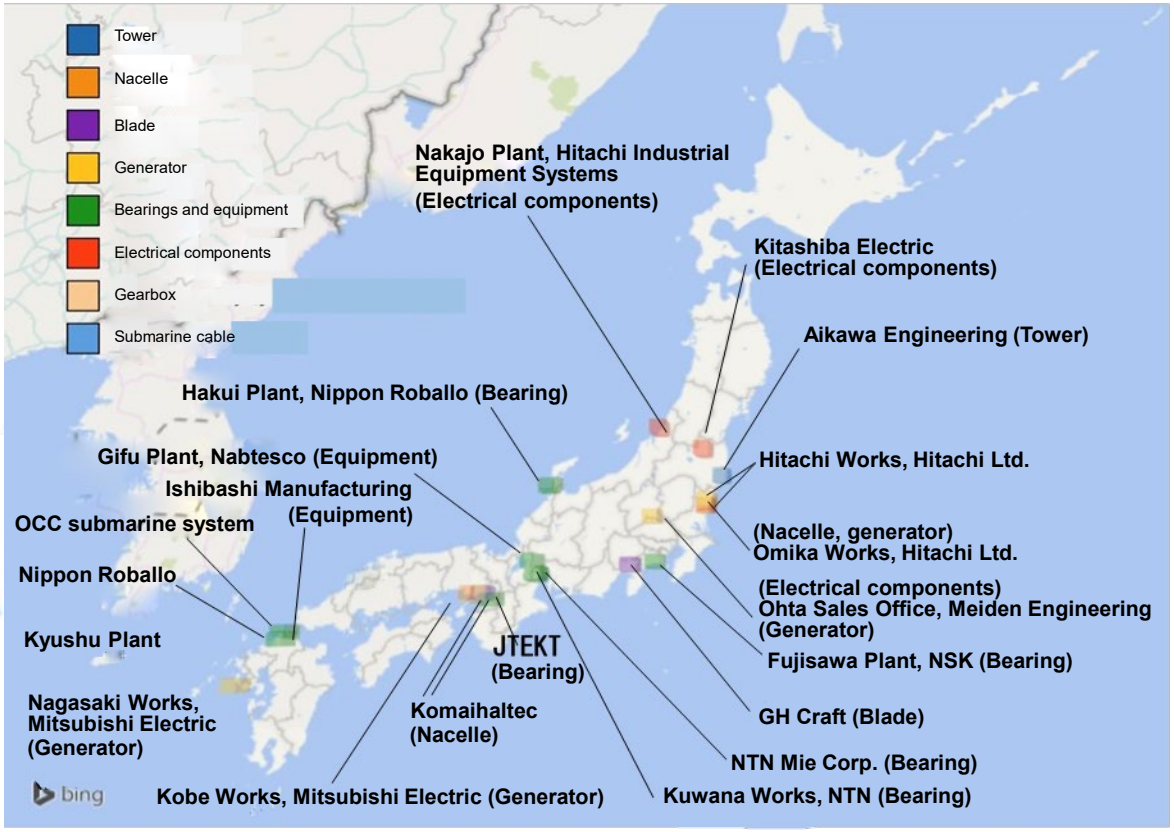
- Although manufacturing bases exist for generators, gearboxes, bearings, etc., appropriate investment is required for offshore wind power.
- Japan has the potential for industrial formation thanks to its potential technological capabilities and foundation for manufacturing.

⇒ A medium- to long-term introduction target should help promote capital investment in related industries resulting from expectations toward the market formation.



Examples of wind power supply chain

Source: Chart II-1, page 5 of "Expectations toward wind power generation from the perspective of industrial promotion—Restoration of the Tohoku area and observations for a review of the energy policies" (Mizuho Industry Focus Vol.99, July 20, 2011)



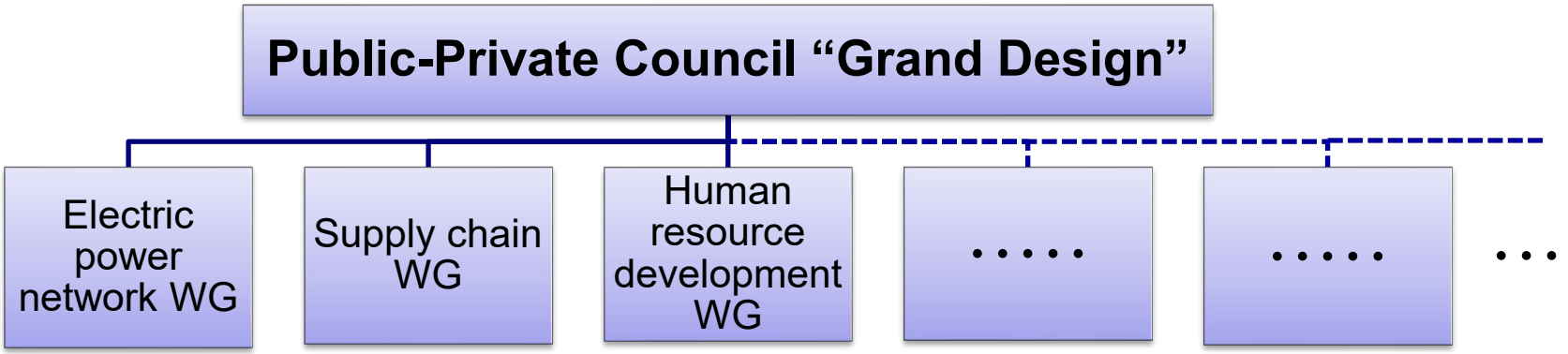
Distribution of domestic wind power-related industries

Source: "JWEA's views and directions regarding the domestic wind industry (industrial aspects)" Quoted from the presentation of Takashi Matsunobu at the Japan Wind Energy Association, the 41st Symposium on Wind Power Energy Utilization, December 4, 2019)

Wrap-up

- **To make offshore wind power the primary power source, we would like the industry to work together as one team to address and make strides on the matters that operators should address themselves, including the investment required for economic independence and construction of a wind power supply chain.**
- **On the other hand, to solve various accumulated problems and reduce risks, the public and private sectors need to work together continuously. Therefore, under the grand design initiative created by the Public-Private Council, we would like to establish working groups (WGs) for each theme and further explore the attempts to identify and resolve relevant problems (while maintaining opportunities for dialogues between the public and private sectors).**
- **Moreover, we would like to create and publish an action plan (and roadmap) for problem-solving in the working groups (WGs) so that both the public and private sectors can cooperate to implement the plan and periodical verifications.**

Examples of the deliberation system



Thank you for your attention！