provisional translation

Overview of the Vision for Offshore Wind Power Industry（1st)

December 15, 2020

Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation

Overview of proposed "Vision for Offshore Wind Power Industry（1st）"

Significance & challenges in offshore wind power generation

- Offshore wind power generation is expected to be **(1)introduced on a large-scale, (2)reduce costs, and have (3) economic ripple effects**, and holds the key to making renewable energy a main power source.
- **As introduction of wind power gains momentum worldwide**, with a focus on Europe, **rapid growth is expected in the Asian market in the future,** especially in China, Taiwan, and South Korea.
  (**Total global capacity** is expected to **increase from 23GW in 2018 to 562GW in 2040 (24-fold increase)**)
- Currently, most **offshore wind power manufacturers are located overseas, but there are potential suppliers in Japan as well.**

Basic Strategy on the Enhancement of Industrial Competitiveness for Offshore Wind Power Generation

1. Attractive domestic market creation
2. Investment promotion and supply chain establishment
3. Next-generation technology development and cross-border collaboration

Target setting by public and private sectors

(1) Clear introduction of targets set by GOJ

・10GW by 2030

・30-45GW by 2040

(1) Setting of targets by the Industry

・Increase Japan content to 60% by 2040
・Reduce cost of fixed-bottom offshore wind turbine-generated power to 8-9 yen/kWh by 2030-2035

(2) Acceleration of offshore wind project development

・Introduce a GOJ-led push-type project scheme (Japan Centralization)

(3) Systematic establishment of infrastructure

・Detail-out first draft of Grid Master Plan

・Consider options for DC power transmission

・Systematically develop ports and harbors

(2) Strengthening of supplier competitiveness

・Evaluate initiatives that contribute to stable power supply in public tender

・Support capital investment through subsidies, tax breaks, etc. (under review)

・Promote matching of overseas and domestic companies (via JETRO, etc.)

(3) Establishment of business infrastructure (review regulations/standards)

(4) Offshore wind power talent development program

(1) Development of next-generation technologies for floating offshore wind, etc.

・Formulate "Technology Development Roadmap"

・Support technological development through use of a fund

(2) International standardization, bilateral dialogue, etc.

・Standardize rules globally

・Engage in bilateral dialogue for future markets

・Provide public financial support

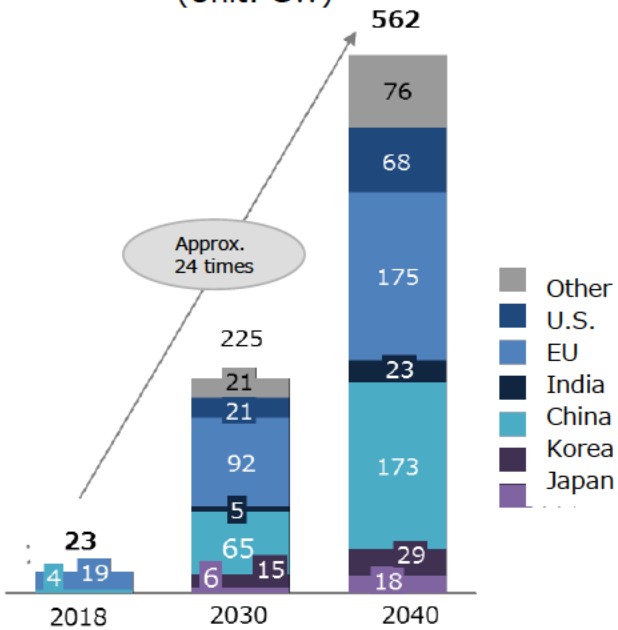
【Ref.】 Significance of introducing offshore wind power generation

- Offshore wind power generation is expected to be **(1)introduced on a large-scale, (2)reduce costs, and have (3) economic ripple effects**, and holds the key to making renewable energy a main power source.

①Large-scale introduction

○**Introduction of wind power gaining momentum worldwide, mainly in Europe**
○**Asian market** expected **to grow rapidly**
○Future expansion of wind power in Japan, which is surrounded by sea, also expected

IEA market outlook
(Unit: GW)



(Source) IEA Offshore Wind Outlook 2019
(Sustainable Development Scenario)

②Cost reduction

○ In Europe, a leader in offshore wind power, **costs have fallen as a result of larger wind turbines**, incl. cases where **winning bid price is less than 10 yen/kWh or market price (unsubsidized)**

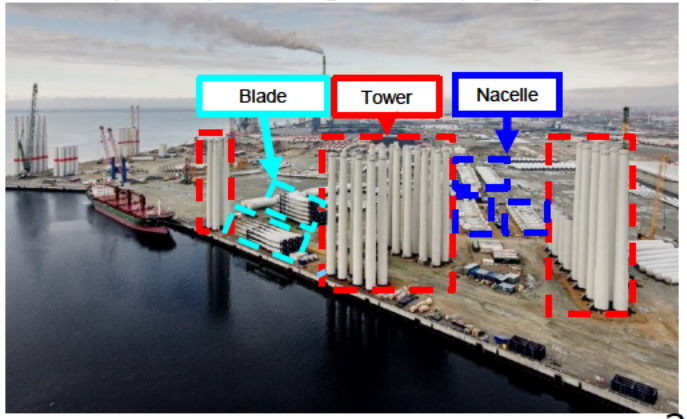
Country	Project name	Price (€=123.6 yen) ※2019 average rate
Nethe-rlands	Hollande Kust Zuid 3 & 4	Market price **(unsubsidized)**
France	Dunkirk	44 EUR/MWh **(5.4 yen/kWh)**
U.K.	Sofia	44.99EUR/MWh **(5.6 yen/kWh)**
U.K.	Seagreen Phase 1 - Alpha	47.21EUR/MWh **(5.8 yen/kWh)**
U.K.	Forthwind	44.99EUR/MWh **(5.6 yen/kWh)**
U.K.	Doggerbank Teeside A	47.21EUR/MWh **(5.8 yen/kWh)**
U.K.	Doggerbank Creyke Beck A	44.99EUR/MWh **(5.6 yen/kWh)**
U.K.	Doggerbank Creyke Beck B	47.21EUR/MWh **(5.8 yen/kWh)**

③Economic ripple effects

○ Offshore wind power facilities have a **large number of pieces of equipment and parts (tens of thousands), with project scale of several hundred billion yen**
○Despite many potential suppliers in Japan, **related industries are located overseas**

Example of port city in Europe (Esbjerg Port, Denmark)

- Many industries, incl. wind farm construction, operations, and maintenance, have strong local ties, and contribute to regional revitalization
- Esbjerg City successfully attracted companies, creating about 8,000 jobs



【Ref.】 U.K. Offshore Wind Sector Deal

- In the U.K., the government and offshore wind power sector entered a partnership, and in March 2019 formulated the **Offshore Wind Sector Deal, with the aim of increasing productivity and competitiveness of the U.K. offshore wind power supply chain.**
- The U.K. government and offshore wind power sector agreed on the **goal of installing offshore wind power capacity of 30GW by 2030 on the condition of cost reduction**. **Key initiatives to achieve this goal are as follows.**

1. **Disseminate information** on future **Contracts for Difference (CFD) rounds** involving investment of up to **£557 million**
2. **Sector commitment to increasing domestic parts sourcing to 60% by 2030**, including increasing sourcing during the capital expenditure phase
3. Raise **proportion of women in offshore wind power workforce to at least one third** by 2030
4. Set high target of increasing **value of exports to £2.6 billion by 2030, five times current level**
5. Sector will **invest up to £250 million** to build a stronger U.K. offshore wind power supply chain and **establish the Offshore Wind Growth Partnership (OWGP)** to sustain productivity and enhance competitiveness

1. **Attractive domestic market creation**
2. **Investment promotion and supply chain establishment**
3. **Next-generation technology development and cross-border collaboration with a view to expansion into Asia**

1 (1) Presentation of introduction targets set by GOJ

- Important for **GOJ to commit to creating** an attractive **domestic market and to attract investment from both home and abroad.**
- With this in mind, GOJ sets the following offshore wind power introduction targets.

Introduction targets

GOJ will **continue to designate promotion zones to generate approx. 1GW of wind power per year for 10 years**, awarding capacity of **10GW by 2030 and 30-45GW**, including floating wind turbines, **by 2040**

※For 2040, raise introduction target to 45GW, the level set by the Industry as requiring an investment decision, and create the world's third largest offshore wind power market

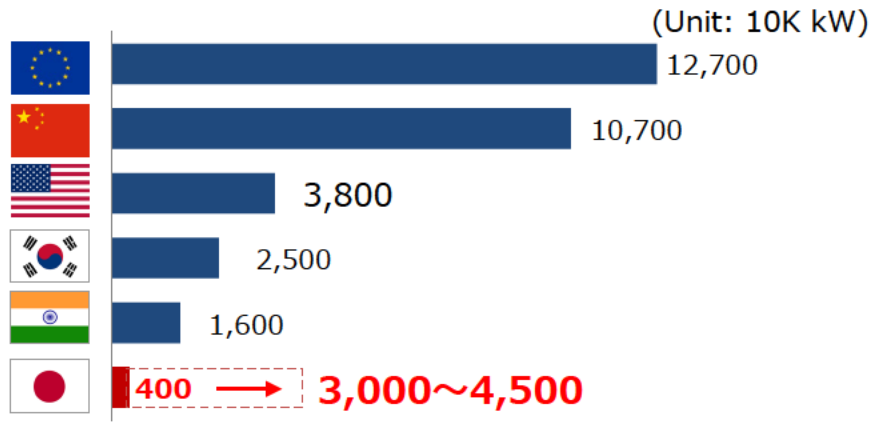
※To achieve capacity of 45GW, the cost of floating wind turbines must be significantly reduced through technology development and mass production

Government-set offshore wind power generation targets by country

Region/ Country	Target
EU	60GW (2030) 300GW (2050)
Germany	40GW (2040)
U.S.A.	22GW (2030)
China	5 GW (2020)
Taiwan	5.5GW (2025) 15.5GW (2035)
South Korea	12GW (2030)

(Source) IEA Offshore Wind Outlook 2019, Data added by Agency for Natural Resources and Energy based on information published by government of each country

IEA-forecasted offshore wind power introduction based on government targets in each country (2040)



(Source) IEA Offshore Wind Outlook 2019 (Public Policy Scenario)

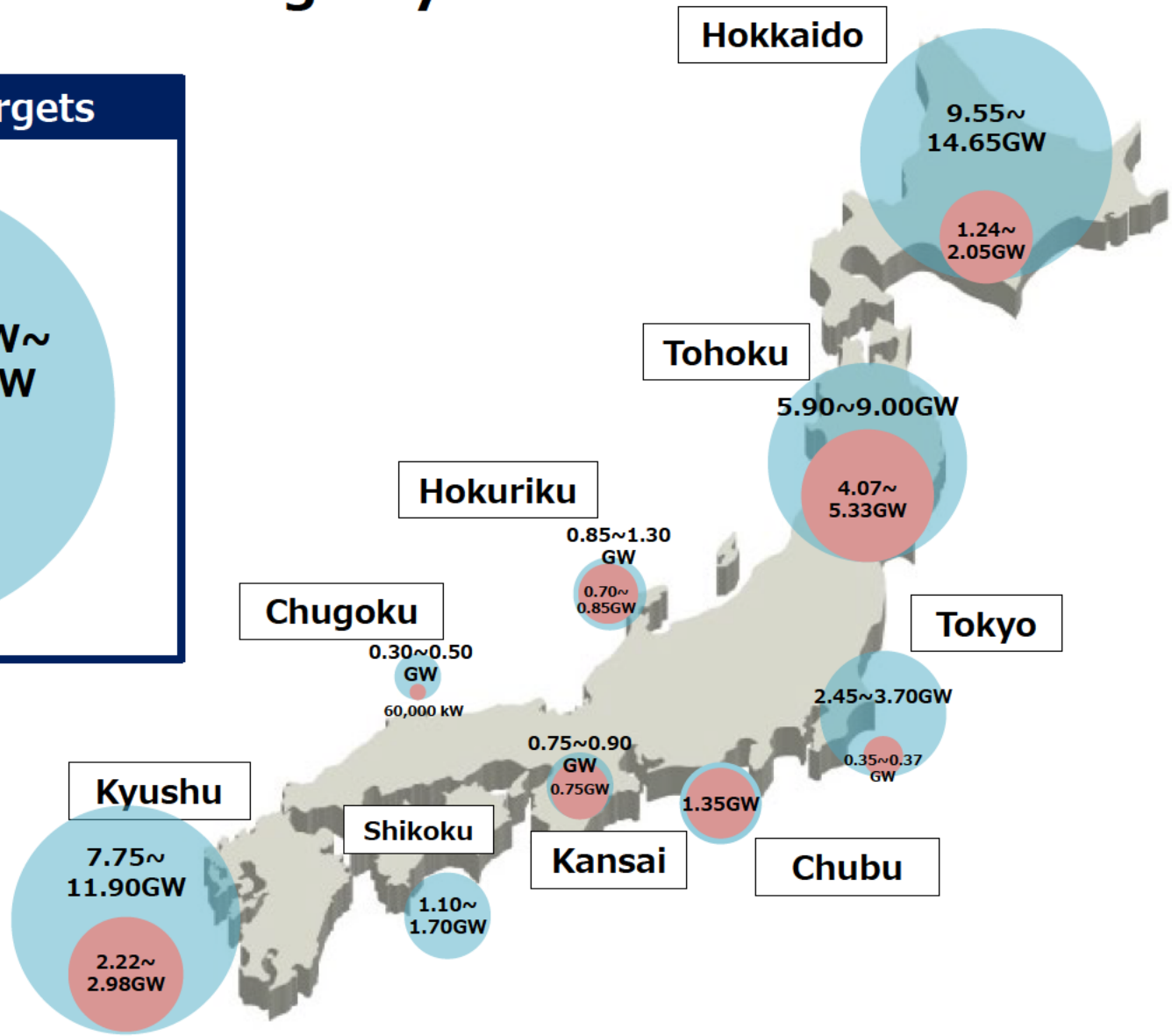
【Ref.】 Introduction image by area

Introduction targets

2040

Approx. 30GW~
Approx. 45GW

2030
Approx.
10GW



*Figures for 2030 are based on projects that are undergoing environmental assessment (as of end of October 2020, including some projects for which environmental assessment has been completed) .

*Figures for 2040 are based on LCOE (Levelized Cost of Energy) and other data from the NEDO Report on the Support Project for the Development of Floating Wind Farms (Study of Offshore Wind Power Generation Costs), reviews by experts, and the status of environmental assessments by power producers. In preparing this map, the potential of floating wind power farms was not factored in.

1（2）Introduction of GOJ-led push-type project scheme (Japan version of a centralized model)

- In order to achieve introduction targets, **continuous project development** is dispensable. When undertaking projects, it's also necessary to simultaneously conduct **(1)wind condition and geological surveys, (2)environmental assessments, (3) regional coordination, (4) grid-related measures.**
- The Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities ("Act on Promoting Utilization of Sea Areas for Renewable Energy Generation"), which came into effect last year, establishes a framework for carrying out these measures, including **establishment of a council for regional coordination**. On the other hand, **grid operators continue to carry out early-stage basic surveys and secure power grids**, and it has been pointed out that in some regions, **work carried out by multiple operators has led to inefficiencies and hinders regional coordination.**
- **GOJ will be involved in projects from an early stage, and will accelerate project development** by launching demonstration projects toward establishment of a scheme (Japan version of a centralizedmodel) **to more quickly and efficiently conduct wind and other surveys and secure power grids in a timely manner.**

Project development flow

・Grid operators will **conduct basic surveys (wind conditions/ geological, etc.), secure power grids, and coordinate with local fishermen**
→**Inefficiencies as a result of overlap in work by operators have been pointed out**

Local governments provide information to GOJ on matters of certain maturity

Promising zone

Wind condition and geological surveys carried out by GOJ

Establishment of **council for regional coordination**

Promotion zone

Selection of grid operators through public tender
Renewable Energy Act accreditation, 30-year occupancy permit

New policy

Establish GOJ-led **project scheme** through **demonstration project**

※ Based on various case examples in Europe (Denmark, Germany, UK, etc.), study the shape of the "Japan version of a centralized model)

Bring forward **survey start timing**

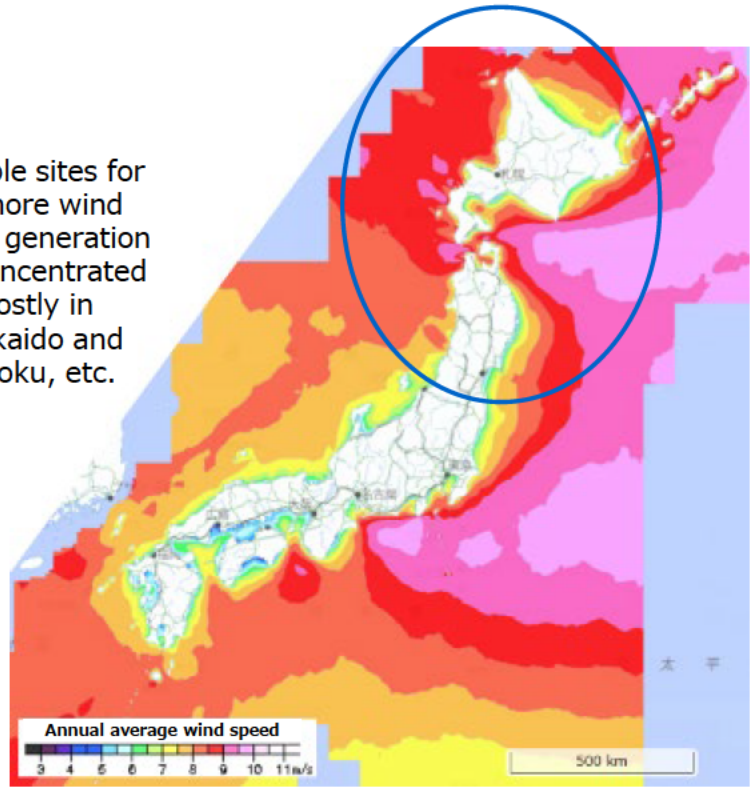
Act on Promoting Utilization of Sea Areas for Renewable Energy Generation, will accelerate project implementation through necessary **operational improvements (scheme for temporary securement of power grid, etc.)**

1 (3) Establishment of power grid infrastructure

- **First draft** of the Power Grid Establishment Master Plan, which will contribute to the realization of introduction targets, **will be detailed out and announced by next spring.**
- To harness the potential of offshore wind power, it is important to have a large power transmission network to bring power from suitable locations to high demand areas. To achieve this end, commence **concrete considerations toward the introduction of DC power transmission**, including technical issues and costs.

Suitable sites for offshore wind power generation (wind condition map)

Suitable sites for offshore wind power generation are concentrated mostly in Hokkaido and Tohoku, etc.



(Source) NeoWins (NEDO) wind condition map

Approach to consideration of DC power transmission

Significance

・Sites suitable for offshore wind power and high demand areas are located far apart, and DC power transmission, which is less expensive than AC power transmission, is desirable for efficiently transmitting power over long distances

Challenges

In considering routes, GOJ will sort out the following issues, with reference to precedents in the U.K., Germany, and other countries

①**Economically efficient introduction of grid**
・List-up of factors to be taken into account when considering route
・Study of cost of laying the grid, etc.
②**Overcoming technical challenges** of DC power transmission
・**Technology to connect a large number of offshore substations** scattered across the ocean **through DC power transmission**
・Development of submarine cables that **can be used in deep water, etc.**

Approach

Establish a new forum for intensive discussion on DC power transmission issues, and **leverage results of discussions to formulate a master plan**

1(3) Establishment of port infrastructure

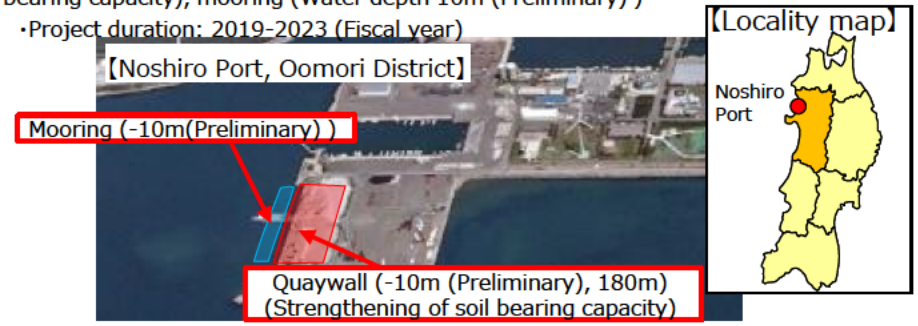
- Base port **construction is underway at four locations throughout Japan to strengthen soil bearing capacity necessary for installation and maintenance of large wind turbines.**
(Akita Port site scheduled for completion before end of current fiscal year)
- **Review functions required of Japan's future base ports, considering schedule for power grid development and designation of promotion zones, as well as trend toward larger wind turbines.**

○Noshiro port

【Business overview】

・Constructed facilities: Quaywall (Water depth 10m (Preliminary)), (Strengthening of soil bearing capacity), mooring (Water depth 10m (Preliminary))

・Project duration: 2019-2023 (Fiscal year)



○Akita port

【Business overview】

・Constructed facilities: Quaywall (Strengthening of soil bearing capacity)

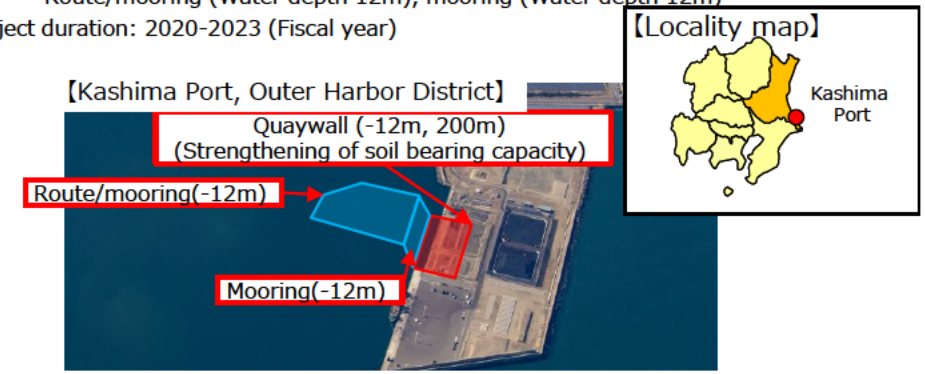
・Project duration: 2019-2020 (Fiscal year)

○Kashima port

【Business overview】

・Constructed facilities: Quaywall (Water depth 12m), (Strengthening of soil bearing capacity), Route/mooring (Water depth 12m), mooring (Water depth 12m)

・Project duration: 2020-2023 (Fiscal year)

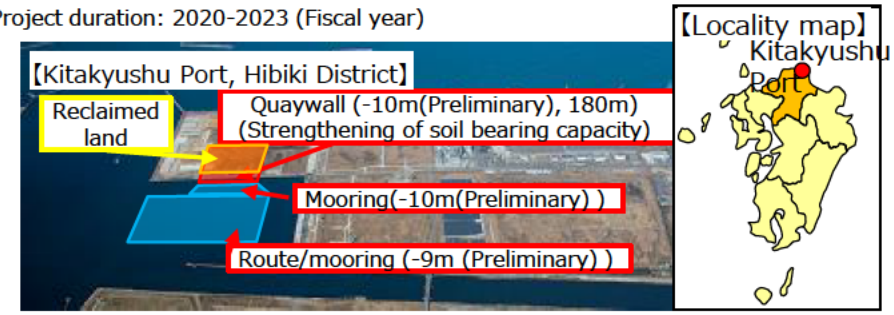


○Kitakyushu port

【Business overview】

・Constructed facilities: Quaywall(Water depth 10m(Preliminary)), (Strengthening of soil bearing capacity), mooring(Water depth 10m(Preliminary)), Route/mooring (Water depth 9m (Preliminary)), reclaimed land

・Project duration: 2020-2023 (Fiscal year)



1. Attractive domestic market creation
2. **Investment promotion and supply chain establishment**
3. Next-generation technology development and cross-border collaboration with a view to expansion into Asia

2(1) Setting of Japan content/cost reduction targets by the Industry

- In addition to targets set by GOJ, **the Industry sets the following targets** in order to attract domestic and foreign investment, and to create a **competitive and resilient supply chain.**

Japan content targets

The Industry will **increase Japan content to 60% by 2040**

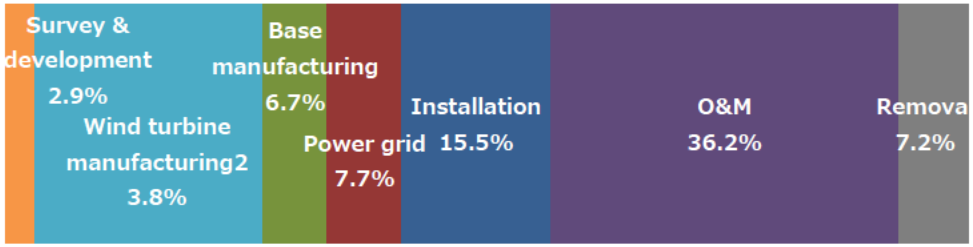
Cost reduction targets

The Industry will **reduce cost of fixed-bottom offshore wind turbine-generated power to 8-9 yen/kWh by 2030-2035**

*Promote establishment of a resilient supply chain by setting the Industry targets

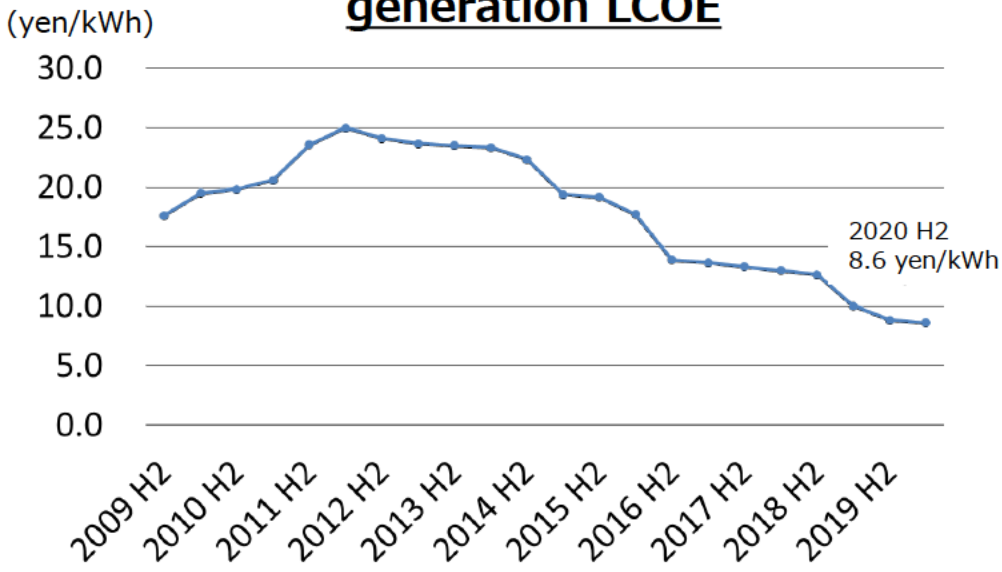
*Continue to study specific measures for each sector

Overview of offshore wind power supply chain (fixed-bottom turbine example)



(Source) First Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation meeting materials 3

Global trend in offshore wind power generation LCOE



(Source) The Calculation Committee for Procurement Prices, etc. materials 1

2(2) Evaluation of initiatives that contribute to stable power supply in public tender (domestic procurement or similar initiative)

- When assessing public occupancy plans related to the Act on Promoting Utilization of Sea Areas for Renewable Energy Generation, **confirm the "Supply Chain Development Plan Outlining Initiatives to Strengthen the Supply Chain" and evaluate it from the perspective of whether it is effective for (1) stable power supply and (2) reducing power prices in the future**

Excerpt from Guidelines on Public Occupancy of Offshore Renewable Energy Power Plant Development Promotion Zone offshore Choshi City, Chiba Prefecture (Nov. 2020)

Evaluation item	Evaluation point
Stable electricity supply	From the perspective of ensuring a stable supply of electricity, are measures in place to ensure rapid restoration in the event of a breakdown? Is early recovery possible, especially in terms of the supply chain?(Has a plan been developed for the formation of a domestic supply chain with early recovery capability or other equivalent supply chain?)
	Are there measures to reduce the price of electricity in the future? Has the company prepared a supply chain formation plan that contributes to price reduction in particular?

2) Supplementary explanation related to evaluation of Supply Chain Development Plan to Secure Stable Power Supply

i) Matters in Supply Chain Development Plan

The supply chain to be developed shall be evaluated from the perspectives of whether it is effective for (1) stable power supply and (2) reducing power prices in the future

Examples of specific evaluation perspectives are shown below, and specific rationale for these perspectives described in the public occupancy plan shall be confirmed

① Stable power supply perspective

・How quickly can parts be procured in case of failure or emergency? (manufacturing and storage sites, number of parts, etc.)

・How is the supply chain being diversified, multi-tracked, etc., and how is it being strengthened?

・Has a system been established to develop technology that meets the needs of the natural environment of Japan, the region where the project will be implemented, including partnerships with component manufacturers?

② Future power price reduction perspective

・In forming the supply chain, has a competitive environment been established that doesn't inhibit new entrants?

・Have initiatives been undertaken to reduce future costs by reviewing the existing supply chain, such as reducing transportation costs?

・Has a system been established to develop technologies for cost reduction, including tie-ups with parts manufacturers?

2(2) Capital investment support towards supply chain development

- Offshore wind power generation facilities comprise a large number of pieces of equipment and parts (tens of thousands), and the **supply chain is broad.**
- **In order to encourage investment in the supply chain**, GOJ is currently coordinating **capital investment support through subsidies and tax breaks, etc.**

Overview of offshore wind power supply chain (fixed-bottom type example)

Survey & Development

Work	Vessel
Environ-mental assess-ment	Weather & marine observation ship
Environ-mental surveys	Geographical survey ship
Wind condition surveys	Etc.
Ground surveys	
Etc.	

Nacelle

Nacelle assembly
- Generator
- Speed increaser
- Main bearing
- Main shaft
- Nacelle base
- Nacelle covers
- Control system
- Yaw system
- Yaw bearing
- Brake system
- Cooling system
- AC system
- Anemometer/ anemoscope
- Fire prevention system
- Etc.

Hub

Hub casting
- Blade bearing
- Pitch drive system
- Etc.

Power converter

Convertor
- Switch gear
- Cables
- Etc.

Blade

Blade mfg.
- Structural composite
- Blade route
- Lightening conductor
- Etc.

Tower

Tower mfg.
- Steel for use in towers
- Bolt
- Flange
- Lift/ladder
- Control system
- Etc.

Base

Base mfg.
- Steel for use in base
- Monopile
- Transition piece
- Jacket
- Etc.

Electrical equipment
- Cables
- Offshore substations
- Offshore substation base
- Onshore cables
- Onshore substation
- Etc.

Installation work

Work	Vessel
Wind turbine installation	Floating crane
Base installation	SEP vessel
Offshore aubstation installation	Cable layer
Laying of submarine cables	CTV (Crew transfer vesse)
Etc.	Patrol boat
	Etc.

Operations & operations & maintenance

Work	Equipment	Vessel
Wind turbine operations & management	UAV Unmanned aeral vehce	Floating crane
Base operations & management	AUV Autonomous underwater vehce	SEP vessel
Submarine cable operations & management	ROV Remotely ope ated vehce	SOV (Service operations vessel)
Offshore Substation operations & management	Etc.	CTV (Crew transfer vessel)
Safety inspections Etc.		Etc.

Removal

Work	Vessel
Wind turbine removal	Floating crane
Base removal	SEP vessel
Submarine cable removal	Cable layer
Offshore substation removal	CTV (Crew transfer vessel)
Etc.	Patrol boat

※Figures (%) represent the percentage of LCOE as calculated by Mitsubishi Research Institute based on "Guide to an Offshore Wind Farm" (BVG Associates, 2019)

(Source) First Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation meeting materials

2(2) Promoting business matching with companies home and abroad (via JETRO, etc.)

- **Business matching of overseas companies with Japanese companies** is essential to form supply chain
- The Industry will promote **voluntary efforts** in addition to **supports provided by organizations such as JETRO**

<Example of Offshore Wind Investment Seminar/Networking Event by JETRO>

Outline of Seminar/Networking Event

Seminar venue

■Date & Time: Thursday, September 5, 2019 13:30 - 17:00 (Networking Event from 17:00)
■Venue: JETRO Head Quarter (Tokyo)
■Organizer: Japan External Trade Organization (JETRO)
Co-organizer: Japan Wind Power Association
■Participants: Approx. 100 people (companies home and abroad, municipal governments, etc.)
■Program:
・Keynote speech 1: Current Situation and Outlook for Japan Offshore Wind Power Generation Market
・Keynote speech 2: Introduction to the Examples of Global Cases and Policies to Attract Industries (Denmark, Netherlands)
・Projects of the Overseas Companies Interested in the Japanese Market (Denmark, Netherlands)
・Networking event

Voices of Participants

■*"I was reminded of just how broad the offshore wind power business is in terms of supply chain and industry."*
■*"I had the impression that Japanese companies in the field of offshore wind power were stagnant, but I now feel that they can thrive by drawing on the experience of European companies."*
■*" Through the comparisons with European cases, the seminar provided me with a clear picture of what needs to be addressed for offshore wind power to spread in Japan. "*

2(3) Examination of offshore wind power regulations/standards

- In response to requests from The Industry to review regulations, GOJ will conduct a **comprehensive assessment of regulations and standards in cooperation with government ministries and agencies.**
- As a first step, (1) streamline the safety inspection process based on the Electricity Business Act, and (2) establish as common MLIT and METI screening process

Main requests from the Industry

	Related legislation	Details of review requests	Governing ministry
Survey & development	Electricity Business Act	**Screening items overlap** between third-party certification body authority accreditation and METI's construction plan submission. **As the screening period is prolonged** due to duplicate reviews, a request was made to **omit expert meetings for review of submitted construction plans**	METI
	Electricity Business Act/Port and Harbor Act/Ship Safety Act	In the past, **complex documents had to be submitted and reviewed multiple times** based on the Electricity Business Act, the Port and Harbor Act, and the Ship Safety Act before operations could commence, so a request was made for a **single common screening process**	METI MLIT
	Environmental Impact Assessment Act	**Expedite** environmental assessment **procedures** and **review target project size requirements**	MOE METI
	Building Standards Law	Expedite procedures related to **temporarily installed observation towers** for wind condition observation surveys	MLIT
Manu-facturing	Civil Aeronautics Act	**Relax conditions for installation of aircraft warning lights** on middle section of wind turbine towers, temporarily installed wind turbines at ports, etc. and **revise the definition of a group of wind power generators**	MLIT
	Japanese Industrial Standards (JIS)	**Identify components that require establishment of JIS standards,** such as monopile steel and tower bolts for offshore wind turbines, and **establish domestic standards to enable mutual accreditation based on European standards**	METI
Installation	Ship Law	Clearly define requirements for patentability related to **cabotage regulations (restrictions on foreign-flagged vessels calling at ports)** in order to address the shortage of vessels for construction work and transportation	MLIT
	Industrial Safety and Health Act	Clarify **criteria for determining when to suspend work during strong winds in offshore wind power crane operations** and **relax conditions that prohibit** mobile cranes from **traveling with suspended loads**	MHLW
Removal	Marine Pollution Prevention Law	**Clarify criteria for granting permission to leave in place** bottom-fixed **wind turbines**, for which sea area is in principle required to be **restored to their original state once wind turbines are removed**	MOE

To be reviewed

【Ref.】Establishment of common screening process

① **Regarding safety review based on the Electricity Business Act, eliminate overlap in third-party certification authority** accreditation and **METI** construction plan submission-related reviews

② On top of that, **standardize screening documents for MLIT (Port and Harbor Act, Ship Safety Act) evaluates and Wind Farm Certification by third-party certification authority** and establish a common screening process

②Establishment of common screening process

① Rationalization of safety reviews

Third-party certification authority
(Wind Farm Certification)
A third-party certification authority (Nippon Kaiji Kyokai (ClassNK)) will confirm in advance that wind power generation facilities are appropriately designed, taking into account local site conditions (soft ground, etc.).

METI (construction plan submission)
- ✓ Verification of wind farm compliance with the Electricity Business Act is cleared in principle by attaching the Certificate of Wind Farm Certification.
- ✓ Continue to confirm verification of electrical equipment compliance, and validity of construction plan.

Documents necessary for screening

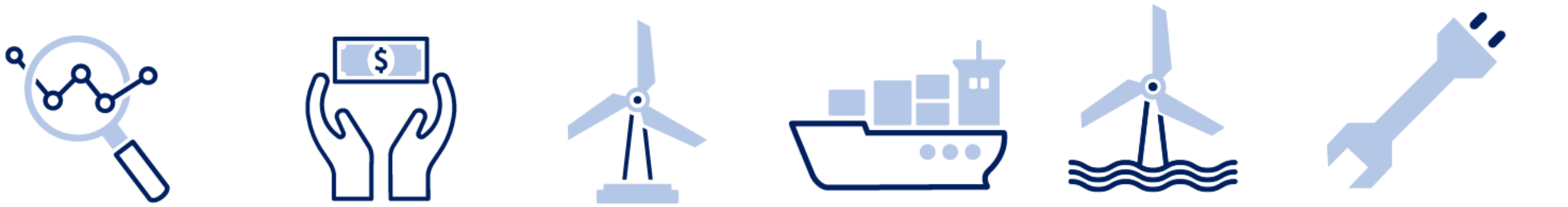
MLIT
In accordance with the Port and Harbor Act, the registered verification agency (Coastal Development Institute of Technology) will confirm that mooring facilities are properly designed in consideration of various sea and other conditions. (*In the case of floating turbines, an evaluation shall be conducted based on the Ship Safety Act. This has already been integrated with **Wind Farm Certification**)

Legend
- Third party certification
- Legal procedures

2(4) Offshore wind power talent development program

- In the U.K., we listed up the skills required across the offshore wind supply chain
- In Japan, we will also take **inventory of skill and labor requirements** for offshore wind power generation and **explore ways to acquire these skills through collaboration between industry, government and academia**

Examples of offshore wind power-related skills in the U.K.



Project development	Finance & legal	Wind turbine design & manufacturing	Base/cable design & manufacturing	Installation	O&M
• Degree in environmental science, economics, engineering, etc. • Graphic design skills	• Experience in financial modeling • Experience in technical/ business risk assessment for offshore wind projects • Legal knowledge of all project-related contracts	• Degree in mechanical engineering, physics, etc. • Technical skills such as welding, plating, electrician, fitter, etc.	• Degree in ship-building, marine engineering, mechanical engineering, high pressure design engineering, geo-physics, environ-mental science, etc.	• Degree in shipbuilding, marine engineering, mechanical engineering, etc. • Professional qualifications in explosive ordnance disposal, etc. • Construction and marine related training or certification	• Specialized training in high voltage work, working at height, SCADA operations, etc.

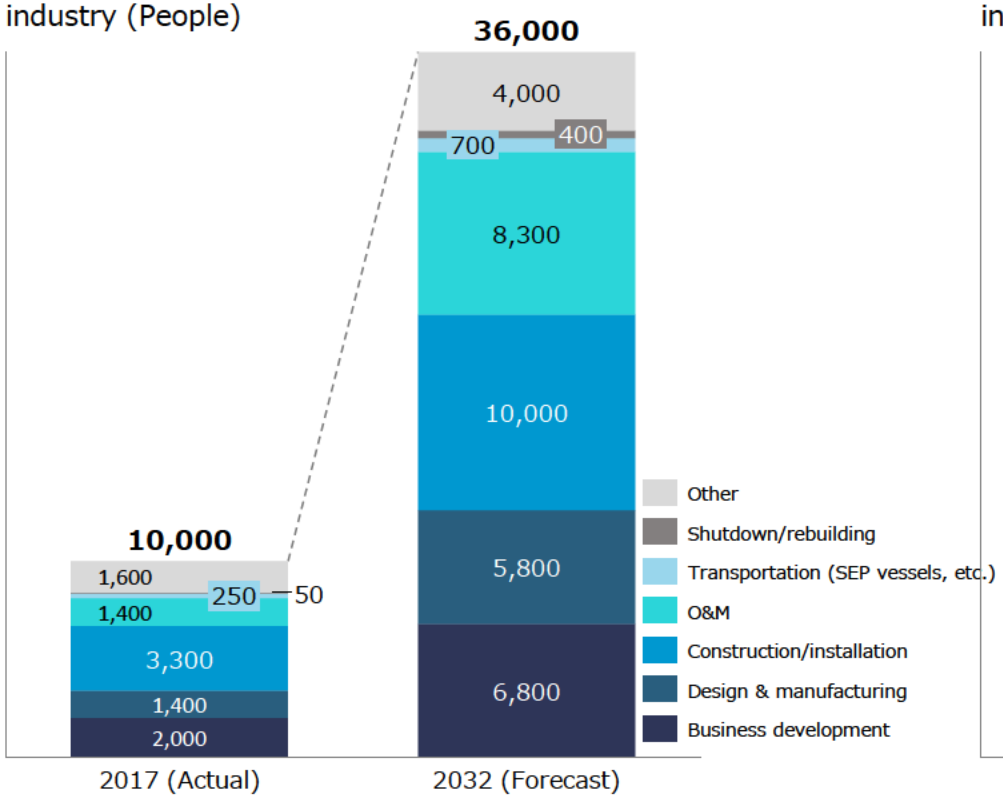
(Source) Energy & Utility Skills "Skills and Labour Requirements of the UK Offshore Wind Industry (October 2018)", BCG analysis

【Ref.】 Offshore wind power-related employment in Europe

- **<u>In Europe, approx. ten to twenty thousand people currently work in the offshore wind power industry,</u>** and this is expected to **<u>increase going forward.</u>**
- In particular, **<u>Germany is home to R&D, design, and manufacturing sites</u>**, which has created many related jobs.

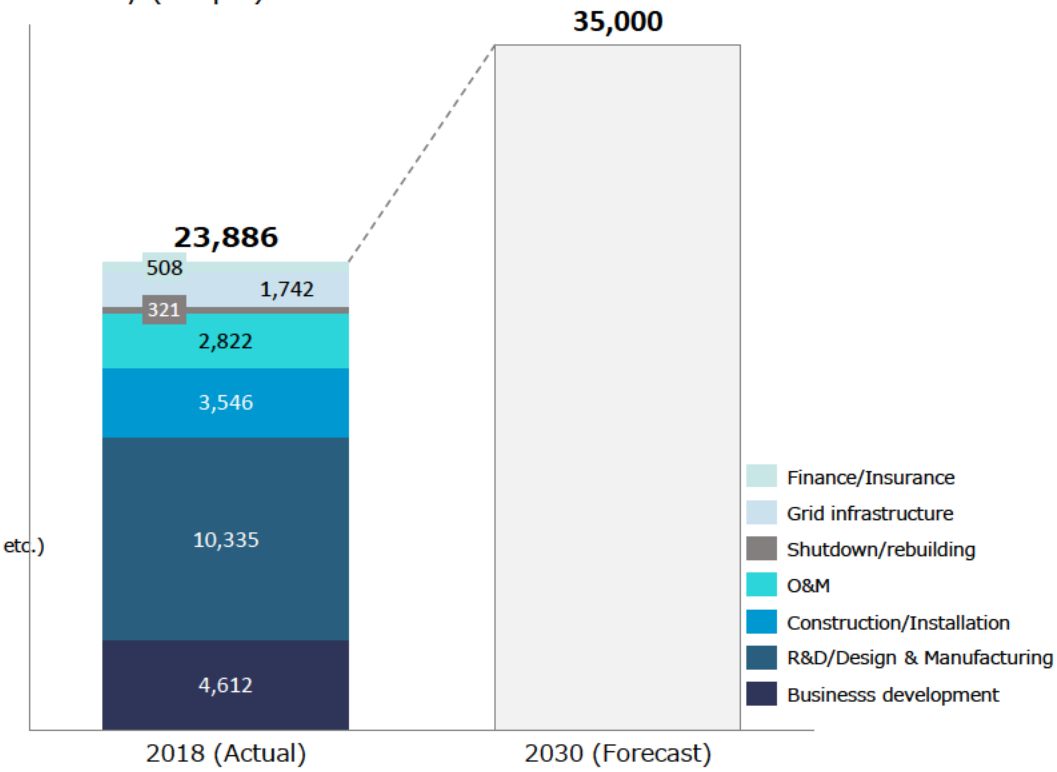
U.K.

No. of people working in offshore wind power industry (People)



Germany

No. of people working in offshore wind power industry (People)



(Source) Energy & Utility Skills, "Skills and Labour Requirements of the UK Offshore Wind Industry 2018 to 2032", p32,33, (2018)
Wind research, "Wertschöpfung der OffshoreWindenergie in Deutschland", p10, BCG analysis

1. Attractive domestic market creation
2. Investment promotion and supply chain establishment
3. **Next-generation technology development and cross-border collaboration with a view to expansion into Asia**

3 (1) Next-generation technology development and cross-border collaboration

- While enhancing competitiveness through development of the supply chain, **aim to expand into Asia in the future, where weather and sea conditions are similar, and market is expected to grow**
- In addition to identifying the necessary elemental technologies to strengthen industrial competitiveness and **formulating a "Technology Development Roadmap" by the end of the current fiscal year**, **establish a fund** to promote innovation toward the realization of carbon neutrality by 2050 to **accelerate development of technologies for commercialization of floating offshore wind power generation**, which are expected to increase in size in the future.

Example elements of technology development

Wind turbine/base development

- Response to further increase in wind turbine size
- Commercialization of floating offshore wind
- Strength according to natural environment of Asia (typhoons, earthquakes, tsunamis, lightning, etc.)
- High performance parts (lightweight materials, etc.)

Maintenance

- Smart maintenance (AI/big data-driven malfunction prediction, inspections using drones)
- Floating offshore wind maintenance method

Other

- Establishment of wind condition survey methods, etc.
- Maximization of use of surplus electricity generated by hydrogen
- Grid optimization
- Development of methods to shorten construction period

List-up elements and prepare a "Technology Development Roadmap" by end of current fiscal year

3 (2) International cooperation, standardization etc.

- With an eye on **future overseas expansion**, GOJ **will engage in bilateral energy dialogues and international demonstration projects** to **build cooperative relationships among governments** and **promote cooperation among domestic and foreign enterprises**
- In addition, GOJ will **lay the groundwork for overseas deployment of floating offshore wind** through **international standardization** of floating offshore wind safety assessment methods

Promotion of international cooperation

Bilateral energy dialogue

◆ Promote overseas expansion and strengthen international cooperation through policy dialogue with the foreign governments, considering their situation and needs

◆ **Bilateral energy dialogue toward overseas expansion**
Propose and implement win-win initiatives (capacity building, institutional development, etc.) based on energy policy issues and needs of other countries.

◆ **Bilateral energy dialogue to strengthen international cooperation**
Engage in concrete means of cooperation (knowledge sharing, joint R&D, third country cooperation, etc.) that takes advantage of one another's strengths

NEDO international demonstration projects

◆ By utilizing the results of the domestic technological development and verification by domestic component manufacturers of wind turbine, GOJ aims to conduct **joint development of large-scale wind turbines with European and U.S. wind turbine manufacturers and overseas demonstration of offshore wind power generation**, which will lead to participation in the supply chain outside Japan.

International standardization

Floating offshore wind safety evaluation methods

Establishment of domestic safety assessment method

Establish method to assess requirements for simplification of floating structure

Established ・・Damage Stability Criteria
Ongoing ・・Concrete floating structure
Synthetic fiber rope mooring line

International standardization initiatives
Working towards IEC international standardization for established assessment method (preparing proposal on alternative requirementsfor Damage Stability)

Reference materials

Results of First Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation

- At the First Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation meeting (July 17, 2020), we heard from the Industry, grid operators and experts, with GOJ presenting the issues at hand. Representative opinions are as follows

Key issues	Opinions from the Industry & business operators	Opinions from experts
① Analysis of mid-to long-term wind power generation potential and challenges	○Important to ensure predictability ○Market size required for investment decisions is **1GW capacity x 10 years through 2030, and 30-45GW capacity by 2040**	○**1GW per year (2～3 zones per year) is reasonable** ○ Based on learnings from solar power, **expansion of introduction should proceed according to cost reduction maturity**
②Analysis of challenges by sector	○Necessary to **attract offshore wind power-related industry (wind turbine manufacturing plants, etc.)** ○ **Necessary to establish technology to reduce cost** of base construction and installation, etc.	
③ Establishing infrastructure environment for systematic introduction	○Want GOJ to appropriately establish a power grid, including for DC transmission. ○ Systematic development of ports and harbors in accordance with introduction prospects is necessary	○ **Necessary to create a system that is compatible with designated promotion areas,** because unused ports **increase perspectives on effective use of taxes and usage fees**
④ Business (the Industry) investment and cost reduction initiatives, etc.	○**Aim for** power generation cost of **8 to 9 yen/kWh**.	○ **Having operators provide specific figures and schedules for cost reduction** in accordance with introduction prospects would be effective ○ Need to also consider U.K. sector deal
⑤Other	○Would like to see working groups established for each theme and a process created to develop action plans	

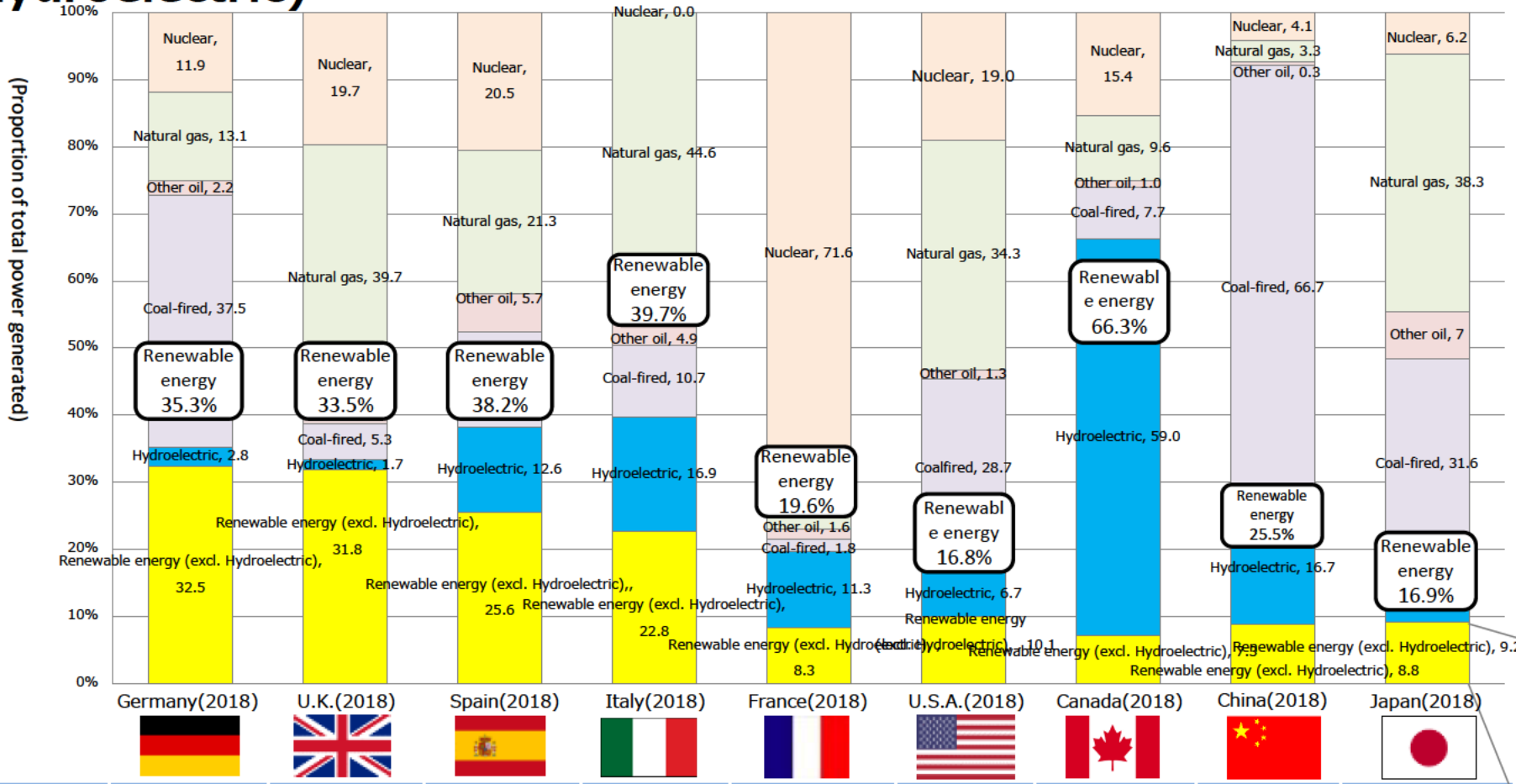
Closing remarks by Mr. Hiroshi Kajiyama, Minister of Economy, Trade and Industry

If the scale of projected capacity exceeds 1GW/year for the next 10 years and 30GW by 2040, we will be able to make a drastic investment, and we would like to continue discussions by the Council. Discussions on DC power transmission and ports (as mentioned today) will also be necessary in the future.

Opening remarks by Mr. Kazuyoshi Akaba, Minister of Land, Infrastructure and Transport

We would like to contribute to the improvement of Japan's energy self-sufficiency ratio by steadily enforcing the "Act on Promoting Utilization of Sea Areas for Renewable Energy Generation" and "The Amended Port and Harbor Act." In addition, the expansion of offshore wind power generation will promote the development of local industries and employment and is expected to contribute to a virtuous cycle of regional economic growth.

International comparison of renewable energy introduction status (excl. hydroelectric)



Major renewable energy types ※Excl. hydroelectric	Wind 17.3%	Wind 17.2%	Wind 18.7%	Solar 7.9%	Wind 5.0%	Wind 6.2%	Wind 5.1%	Wind 5.1%	Solar 6.0%
Target year	2030	2030	2030	2030	2030	2030 (Not set at national level)	– (Not set at national level)	2020	2030
Target renewable energy introduction ratio	65% % of total power generated	60.6%(※) % of total power generated	74% % of total power generated	55% % of total power generated	40% % of total power generated	32%	– (Not set at national level)	15% % of non-fossil-fuel energy to total primary energy	22～24% % of total power generated
Output	637.0 bil. kWh	330.9 bil. kWh	272.0 bil. kWh	288.0 bil. kWh	576.6 bil. kWh	4,433.9 bil. kWh	654.3 bil. kWh	7,185.5 kWh	1,051.2 bil. kWh

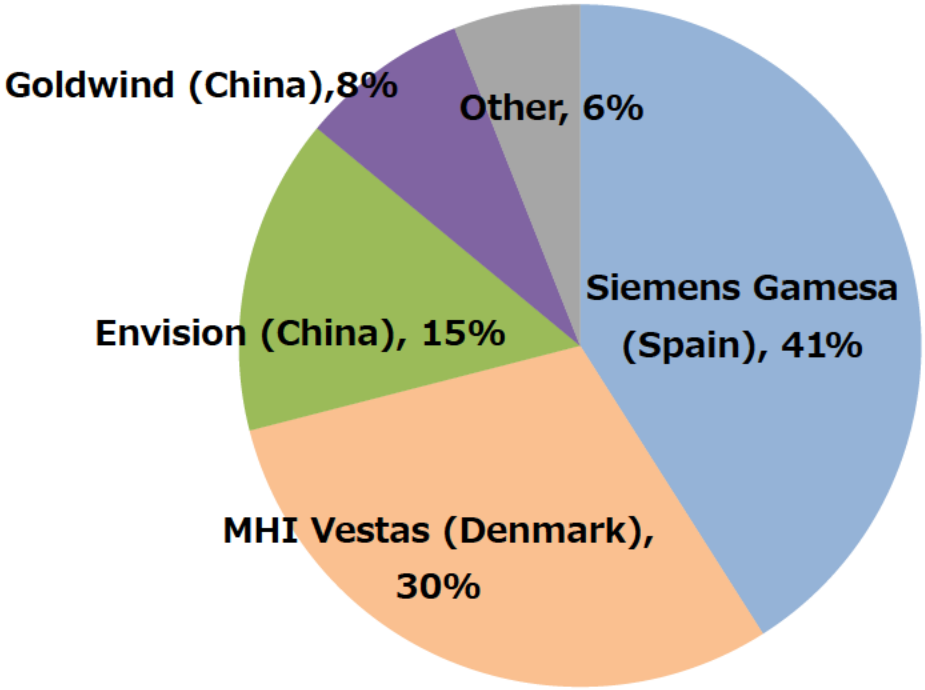
(※) One of multiple scenarios

Source) IEA "Data Services", created based on public information in each country

Economic ripple effects of offshore wind power generation

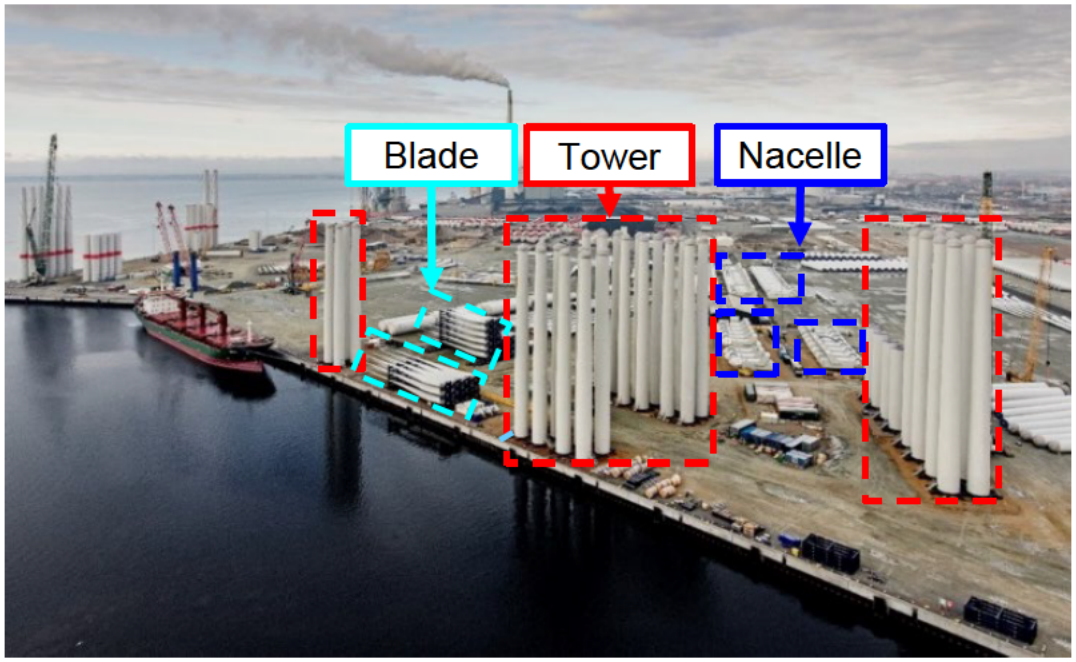
- Offshore wind power generation facilities **comprise a large number of pieces of equipment** and **parts (tens of thousands), and with a project scale of several hundred billion yen in some cases**, **which has a large ripple effect on related industries while contributing to regional revitalization.**
- On the other hand, **many industries are currently located outside Japan**.

Global offshore wind power turbine manufacturer share (2018)



Example of port city in Europe (Esbjerg Port, Denmark)

・Many industries, incl. wind farm construction, operations, and maintenance, have strong local ties, and contribute to regional revitalization
・ Esbjerg City successfully attracted companies, creating about 8,000 jobs

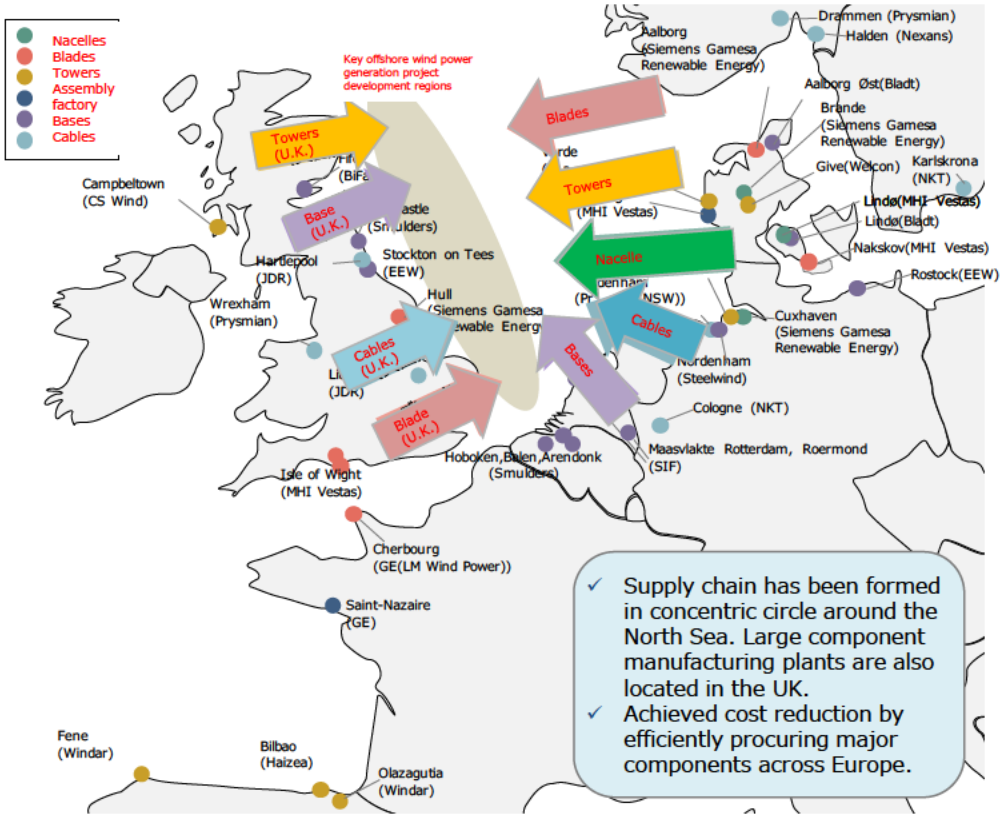


Source: IEA analysis based on BNEF (2019)

Current state of wind power supply chain in Europe

- In Europe, a **supply chain for key components** has been established **mainly in the North Sea.**
- The U.K. is home to blade, tower, cable, and base manufacturing plants, while Germany has a strong manufacturing industry and a comprehensive supply chain that includes nacelle interior parts.

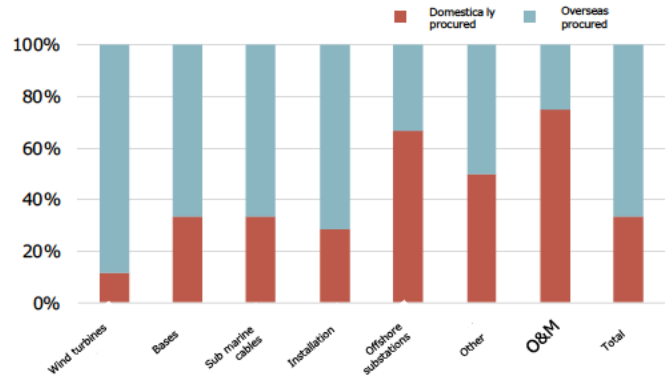
Status of large component supply chain formation in U.K. and neighboring countries



- ✓ Supply chain has been formed in concentric circle around the North Sea. Large component manufacturing plants are also located in the UK.
- ✓ Achieved cost reduction by efficiently procuring major components across Europe.

Source) BVG associates, "Norwegian supply chain opportunities in offshore wind"(2017), BVG associates, "Guide to an offshore wind farm"(2019), BVG associates, "Building an Industry"(2013), Wind Europe, "Regional map"(https: //windeurope.org/about-wind/campaigns/local-impact-global-leadership/), Created by Mitsubishi Research Institute with reference to company websites (See p64 for source details)

U.K. Ratio of domestically procured wind power in U.K. market (2016 sales basis)



※ UK procurement ratio: Percentage of procurement from UK-based companies
Source) Created by Mitsubishi Research Institute based on Offshore Wind Industry Council's "OFFSHORE WIND INDUSTRY PROSPECTUS", p.14 Figure 7 (Oct. 2018)

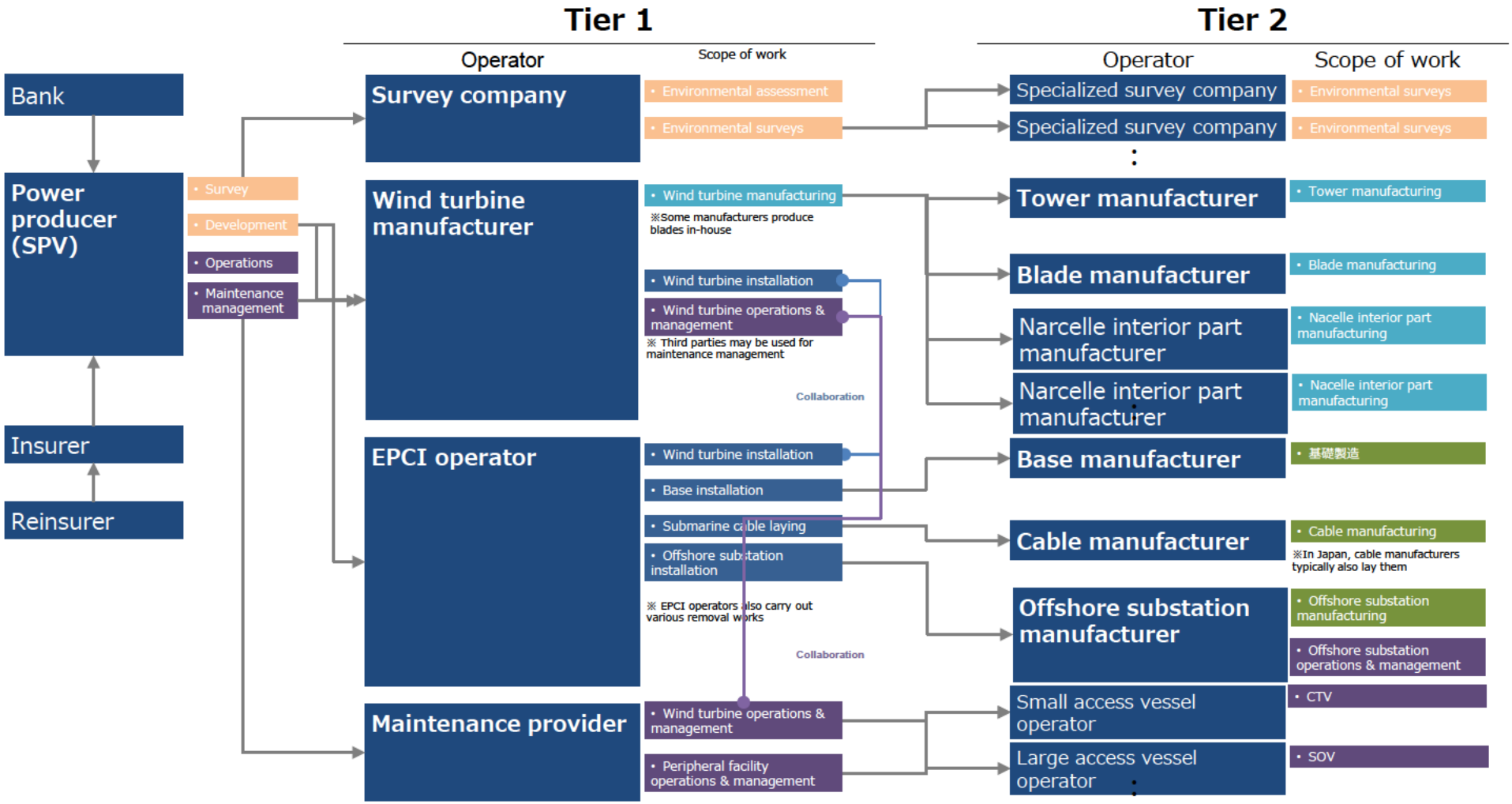
Germany Countries that produce parts for German offshore wind power farms

Key component	Manufacturing country	Key component	Manufacturing country
Generator	Finland	Housing/deck	**Germany**
Speed increaser	**Germany**	Hub	**Germany**
Main shaft	**Germany**	Blade	**Germany**, Denmark
Invertor/convertor	**Germany**, Switzerland	Tower	**Germany**
Transformer	**Germany**, Belgium	Base	**Germany**, Netherlands, Norway, U.K.

Source) Created by Mitsubishi Research Institute based on Alpha Ventus pamphlet, "Ein Offshore-Windpark entsteht - Alpha Ventus" p.18

(Source) FY2019 Research Project on Measures to Improve Energy Supply and Demand Structure (Research to examine on how the public and private sectors should collaborate on offshore wind power (study on mechanisms toward formation of a supply chain, etc.))

Example of offshore wind power generation contact structure



※ Although contract type patterns differ for each project, this section shows the relationship between each stakeholder in the case of an EPCI contract, in which EPCI operator handles design, procurement, and installation of components, except for wind turbines.

(Source) Edited by Agency for Natural Resources and Energy based on materials created by Mitsubishi Research Institute, Inc. based on FY2019 Research Project on Measures to Improve Energy Supply and Demand Structure (Research to examine on how the public and private sectors should collaborate on offshore wind power (study on mechanisms toward formation of a supply chain, etc.)), BVG Associates, and FY2019 Guide to an Offshore Wind Farm Updated and Extended

Enactment of Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities

- It was pointed out that Japan needs to establish rules on the use of sea areas for offshore wind power generation
- In light of this, the "Act of Promoting Utilization of Sea Areas in Development of Power Generation Facilities Using Maritime Renewable Energy Resources ("Act on Promoting Utilization of Sea Areas for Renewable Energy Generation")" came into effect on April 1, 2019 to establish the necessary rules

July 2018 - Strategic Energy Plan (Cabinet decision)

○ Further introduction of offshore wind power is indispensable for Japan where appropriate places in which onshore wind power can be introduced are limited. (omitted) GOJ will refer to Europe's measures regarding offshore wind power generation while **taking measures to promote the introduction of offshore wind power generation** that combines the development of rules for ocean use that achieve coexistence with the regions with power grid constraints, measures for base ports, making the related procedures faster, and price bidding.

December 2018 - Enactment of the Act

【Key challenges in offshore wind power generation】

Challenge① Rules on use of seas areas not unified

・**No unified rules** on sea area utilization (occupancy)

(Prefectural **permits are typically for short term of 3-5 years**)

Challenge② Unclear framework for coordinating with preceding users

・**No framework for coordination with local preceding users** such as shipping companies and fisheries industry

Challenge③ High costs

・FIT price is **high at 36 yen/kWh** compared to Europe

・**Lack of** experienced **offshore wind power producers** in Japan

【Response】

・GOJ **designated promotion zones** where offshore wind power generation can be carried out. Established a **system to allow long-term occupancy** by selecting power producers through public tender

→**Assures sufficient occupancy period (30 years) and stability of project**

・Established a **council comprising stakeholders to facilitate smooth regional coordination**

・**Consults relevant ministries and agencies when designating zones**. Confirms **alignment** with other **public interests**.

→**Improves predictability and reduces burden on power producers**

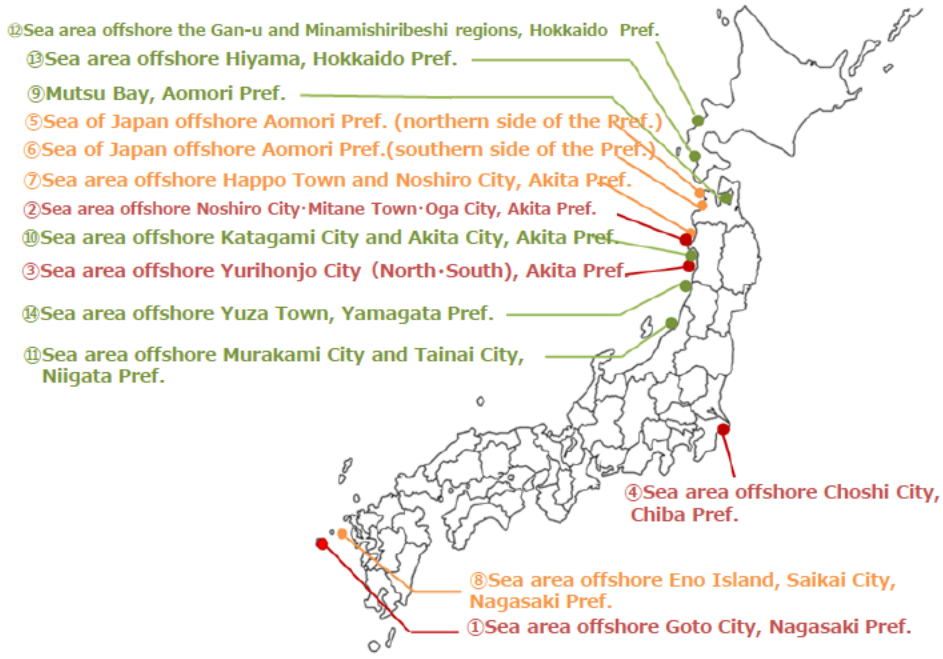
・**Recruits and selects operators** based on **price and other factors through public tenders**

→ Encourages competition to reduce costs

Realize under the Act

Current status on designation of promotion zones and selection of promising zones

- **Based on aforementioned Act on Promoting Utilization of Sea Areas for Renewable Energy Generation, GOJ designated zone off Goto, Nagasaki as Japan's first offshore wind power generation promotion zone in December 2019; started to accept bids from operators in June 2020.**
- **Also, designated the zones off Noshiro City, Mitane Town and Oga City in Akita Prefecture, off Yurihonjo City (north and south sides) in Akita Prefecture, and off Choshi City in Chiba Prefecture as promotion zones in July 2020; started to accept bids from operators in November 2020.**
- **In July 2020, GOJ announced four new promising zones, including the zone off Happo Town and Noshiro City in Akita Prefecture;** started preparing for establishment of a council and wind condition and geological surveys by GOJ.



Category Last year	
Promotion Zone	
①Sea area offshore Goto City, Nagasaki Pref.	
②Sea area offshore Noshiro City･Mitane Town･Oga City, Akita Pref.	(Promising Zone)
③Sea area offshore Yurihonjo City (North･South), Akita Pref.	
④Sea area offshore Choshi City, Chiba Pref.	
Promising Zone	
⑤Sea of Japan offshore Aomori Pref. (northern side of the Pref.)	
⑥Sea of Japan offshore Aomori Pref.(southern side of the Pref.)	(Preparation Zone)
⑦Sea area offshore Happo Town and Noshiro City, Akita Pref.	
⑧Sea area offshore Eno Island, Saikai City, Nagasaki Pref.	
Preparation Zone	
⑨Mutsu Bay, Aomori Pref.	
⑩Sea area offshore Katagami City and Akita City, Akita Pref.	(Preparation Zone)
⑪Sea area offshore Murakami City and Tainai City, Niigata Pref.	
⑫Sea area offshore the Gan-u and Minamishiribeshi regions, Hokkaido Pref.	(Add new)
⑬Sea area offshore Hiyama, Hokkaido Pref.	
⑭Sea area offshore Yuza Town, Yamagata Pref.	

[Process]

Aomori⑤/⑥, Nagasaki⑧ → Akita⑦ → Nagasaki①, Akita②/③, Chiba④

①Gather information from prefectures, etc. → ②Announce **promising zone** officially → ③Form **council conduct wind condition/ geographical** surveys → ④Designate **promotion zone** → ⑤**Select operator** through public tender → ⑥**Get FIT Accreditation/** 30-year **occupancy permit** → ⑦**Start project**