Potential Sea Areas for Offshore Wind in Japan

Toward the formation of a virtuous cycle that co-creates the future of offshore wind, and the fishing industry

Mitsubishi Research Institute

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About the author

Mitsubishi Research Institute

The Mitsubishi Research Institute (MRI) is a leading comprehensive think tank and consulting firm in Japan. By bringing together a high degree of expertise, knowledge, and know-how, we address complicated and diverse issues faced by society and customers and strive to provide value by solving those issues.

In the field of offshore wind, we have provided an abundance of research, analysis, and consulting services for the central and local governments, industry groups, and private companies. By covering a wide range of themes, including policies, markets, industrial strategies, technologies, costs, marine spatial analyses, and human resource development, we contribute to the development of a sustainable offshore wind market and industry.

MRI will continuously envision a desirable future, resolve societal issues, and lead change in society to co-create a sustainable and abundant future.

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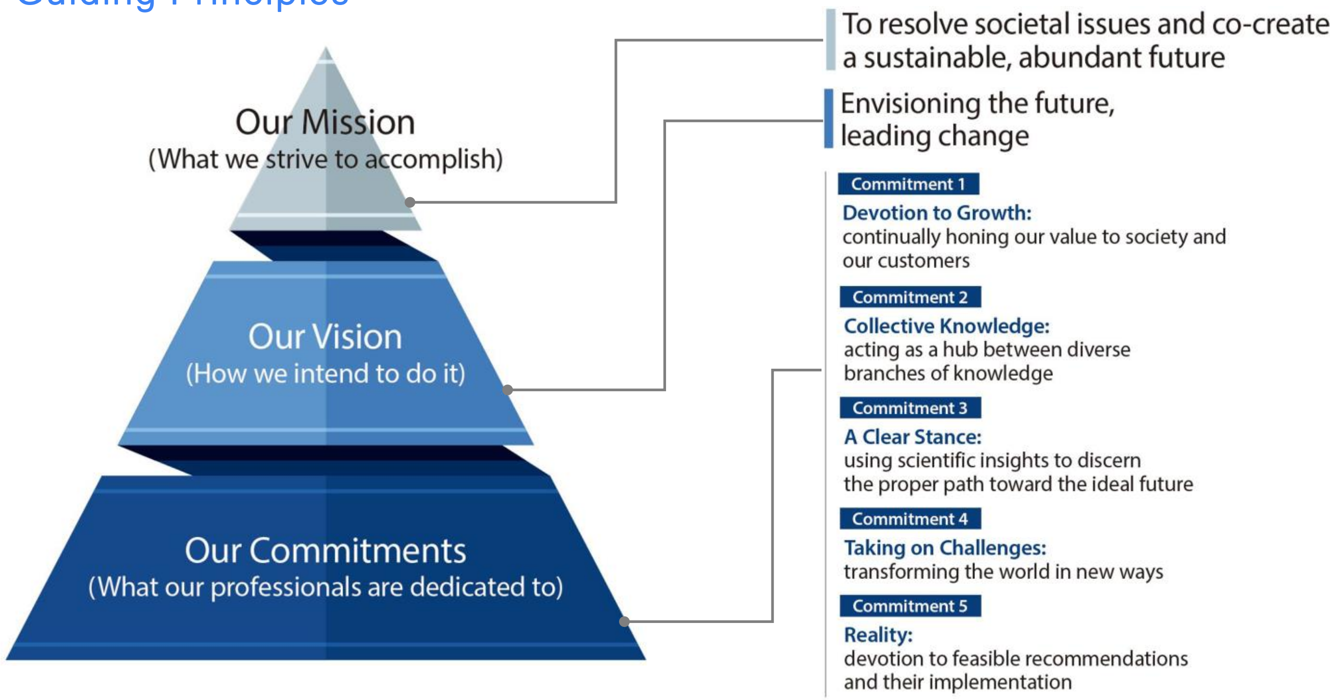
Our Guiding Principles



Collaboration partners

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

The Japan Wind Power Association (JWPA) is a wind power generation industry group representing Japan, with over 500 members, including wind power generation companies, manufacturers, construction companies, financial institutions, consultants, and various research institutes. The JWPA carries out activities based on the mission, vision, and value outlined below to adapt to the ever-changing environment and times and contribute to realizing a sustainable society as a core power source.

<JWPA's mission, vision, and value>

- Through the spread and expansion of wind power generation, provide a secure and stable life for people and aim to realize a sustainable society
- Bring together the knowledge, experiences, and consensus of every sector of society to realize a decarbonized society, and lead the way in maximizing the introduction and operation of wind power generation
- Make wind power generation an economically independent core power source, and aim to build an internationally competitive wind power generation industry
- Responsibly implement the measures and policies needed to utilize wind power energy from a long-term and national perspective without favoring short-term profits of individual companies and industries

Website: https://jwpa.jp/
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BVGAssociates

BVG Associates (BVGA) provides strategy consulting to the global wind industry. BVGA integrates practical thinking and knowledge across business, economics and technology to help its clients succeed in a sustainable global electricity system founded on renewables. BVG Associates was formed in 2006 and plays a key role globalising offshore wind:

- It has a global client base, including customers of all sizes across Europe, North America, South America, Asia and Australia.
- It has published many landmark reports on the future of the industry, cost of energy and supply chain.
- It has been active in offshore wind in Japan since 2020 by creating a report to demonstrate to the Government how industry could deliver offshore wind at its target cost and shaping the volume vision to 2040, together with the Mitsubishi Research Institute.

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List of terms and abbreviations

Term	Explanation
Act on Promoting Utilization of Sea Areas for Renewable Energy Generation	A short form of the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities
AIS	An abbreviation of Automatic Identification System. It is a system that automatically transmits and receives safety information, including the position, course, and speed of the ship, and is required to be installed on ships that meet certain criteria.
Bottom-fixed offshore wind	The method in which wind turbines are installed on the foundation anchored to the seabed. It is referred to as "Fixed" in this report.
Capacity density	The capacity of wind turbines that can be installed per unit area (MW/km^2)
EEZ	An abbreviation of Exclusive Economic Zone. It denotes the sea areas outside territorial waters that do not extend beyond 200 nautical miles from the baselines of the territorial sea.
Floating offshore wind	The method in which wind turbines are installed on a floating structure on the sea. It is referred to as "Floating" in this report.
Japan Version Centralized Auction System	A system for achieving efficient project formulation by having the government take the initiative in conducting wind condition surveys, seabed / oceanographic phenomena surveys, securing of grid connections, environmental impact assessments, and surveys on the actual activities of the fishing industry, which are necessary for project formulation.
kW・MW・GW	Units of electrical power. 1,000 kW = 1 MW. 1,000 MW = 1 GW
O&M	An abbreviation of Operations and Maintenance.
Power generation cost / LCOE	The average power generation cost obtained by dividing the total cost of the development and operation of the power generation facility by gross generation over the entire project lifetime. Generally, the discount rate and the cost of raising funds are taken into account. It is also expressed as Levelized Cost of Electricity (LCOE).
Promotion sea areas	The areas within the general sea area excluding the port and harbor area that meet requirements, such as natural conditions, the impact on the fishing industry, and grid connection. They are designated for offshore wind development with occupancy permits for up to 30 years

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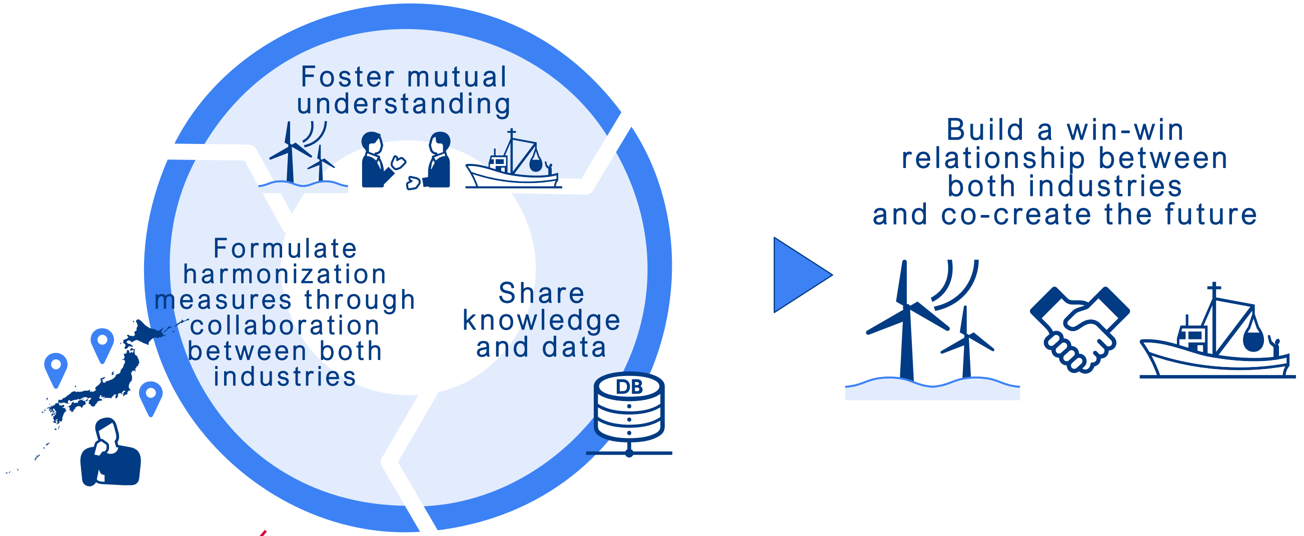
1. Introduction: Objective of this report

1. Introduction: Objective of this report

Analyze potential sea areas for offshore wind as fundamental information to accelerate discussions between offshore wind and the fishing industry

- Offshore wind is an essential source of power to achieve net-zero greenhouse gas emissions by 2050, energy and economic security, and industrial development and economic growth.
- To develop Japan's offshore wind market and industry, it is essential to create a highly predictable market by specifying a concrete market size and development plan.
- The key to this is specifying sea areas that can be developed on the premise of harmonization between offshore wind and the fishing industry, and sharing information on potential sea areas is essential as a basis for acceleration of discussions between both industries.
- With this understanding, this report tried to extract potential sea areas for offshore wind on the basis of data on the natural environment, use of sea areas, and power generation cost (LCOE).
- We aim to contribute to achieving harmonization between offshore wind and the fishing industry while deepening discussions with stakeholders by using this analysis as a starting point.

Formation of a virtuous cycle to accelerate discussions between offshore wind and the fishing industry and co-create the future



Important measures for the development of Japan's offshore wind market and industry

Increase investment value of Japanese market	• Set an ambitious offshore wind target • Create a highly predictable market by specifying sea areas for development • Expand the project scale
Create system for EEZ development	• Create laws and systems related to EEZ development • Create processes for identifying stakeholders and building consensus
Strategic industrial policy	• Support supply chain formation linked to a commercial project • Operate FIT/FIP systems in coordination with industrial policy • Incentives for the development of domestic industry for developers
Sophisticate the auction system	• Operate the Japan Version Centralized Auction System as early as possible and expand it to EEZ • Ensure the predictability of FIT/FIP systems
Promote human resource development	• Develop a road map for human resource development • Support specialized training facilities and education programs • Disseminate information and increase awareness of offshore wind

Achieve harmonization between the offshore wind and fishing industry	• Foster mutual understanding between both industries • Sharing of knowledge and data of both industries (promising sea areas, fishing industry's actual activities, etc.) • Harmonization measures through collaboration between both industries
Expansion of floating offshore wind	• Set concrete targets for floating offshore wind • Develop large-scale commercial projects as early as possible • Maintain FIT system that ensures feasibility
Thoroughly streamline the permits and licenses systems	• Build certification systems / permits and licenses systems aligned to the global market • Improve systems to help shorten the time for licensing procedures and reduce business risk
Systematically develop port/grid infrastructure	• Steadily implement the grid master plan • Develop a port / grid infrastructure development plan consistent with promising sea areas for offshore wind
Decarbonize the supply chain / Promote a circular economy	• Reduce carbon emissions from the supply chain by technical innovation of production and construction processes. • Establish recycling technology for blades, etc.

Source: Mitsubishi Research Institute

Limitations of this analysis and points to note regarding its use

- In this analysis, since the potential sea areas has been calculated mechanically from public data and certain preconditions, not reflecting all the natural conditions, social conditions, actual conditions of ocean use such as fishing activities, and availability of grid connection, and there are many uncertainties about the market environment and technological advances in the future, there are various issues and points for improvement, as listed below.
- Toward identifying sea areas that can be developed, it is essential to promote discussions among the central government, local governments, and relevant industries, continue to collect information, and improve and refine the analysis.

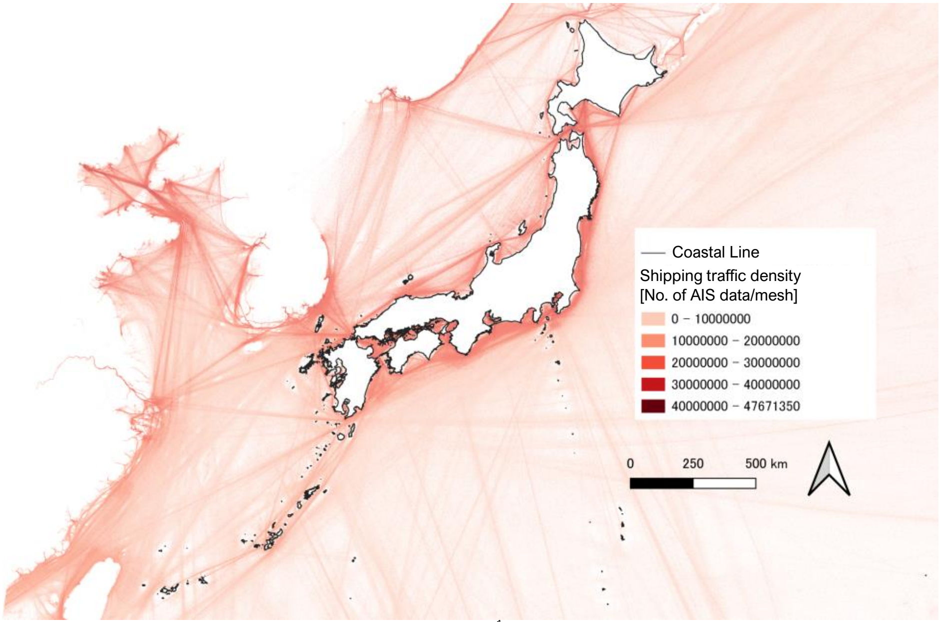
  - This is the result of mechanical analysis based on certain preconditions, and may not indicate the actual sea areas that can be developed.
  - This result only shows the potential and does not show the installed capacity required to achieve net-zero greenhouse gas emissions by 2050.
  - Regarding natural conditions, detailed oceanographic conditions (e.g., wave height, tidal currents) and seabed conditions (e.g., submarine geology, slopes) are not reflected.
  - Regarding fishing activities and ship traffic, mechanical analysis using AIS data and fishery right data does not reflect the actual activities of fisheries in detail, including fishing with small- and medium-sized ships. In addition, the analysis does not consider the possibility of impact avoidance through changes in routes or other means.
  - Regarding defense, the impacts on the radars and communications of the Japan Self-Defense Forces / the United States Forces, Japan are not considered.
  - This result does not consider whether grid connection is possible or whether additional grid system need to be developed.
  - The LCOE were analyzed mechanically on the basis of limited natural condition data and certain preconditions; this may create a gap between the result of this analysis and the actual LCOE, depending on factors such as the actual natural conditions, the matureness of offshore wind market and industry, technological advances in the future, and grid system development cost.

2. Method for analyzing potential sea areas

Conditions for analyzing potential sea areas

- Within Japan's EEZ, analyze potential sea areas using data on the natural environment, use of sea areas, and LCOE.
- Set the mean wind speed at 7 m/s or higher, the lowest mean wind speed generally required for offshore wind development.
- Set the maximum water depth at 2,000 m based on the records of the oil and gas industries.
- Identify sea areas with an estimated LCOE of less than 10 yen/kWh as relatively feasible sea areas.
- Set a threshold of shipping traffic density using the World Bank's AIS data and analyze potential sea areas with and without considering shipping traffic density.
- Set the capacity density [MW/km^2] at 4.0 MW/km^2 before considering shipping traffic density and 5.0 MW/km^2 after considering shipping traffic density on the basis of theoretical values, literature data, and data from actual projects.

Shipping traffic density in sea areas around Japan



Source: Created by Mitsubishi Research Institute based on World Bank data[1] and National Land Numerical Information (Coastal line data)[2]

Conditions for extracting potential sea areas

Item	Extraction condition
Mean wind speed	≥7 m/s (reference height: 140 m)
Water depth	Fixed: ≤75 m; Floating: >75 m and <2,000 m
Offshore distance	≥5 km, up to Japan's EEZ border
Environmental conservation area	Exclude national parks, government-designated wildlife refuges, nature conservation areas, tidal flats, seaweed beds, and coral reef areas
Fishing rights	Exclude sea areas where fishing rights are set (demarcated fishery right, fixed gear fishery right) * common fishery right is included as the sea areas requiring adjustment
Shipping traffic density	Shipping traffic density based on World Bank data[1] of less than 10 [No. of AIS data/mesh] (* 1 mesh = 500 m × 500 m)
Military exercise area	Exclude military exercise areas
Submarine cable	Exclude sea areas containing a buffer of 1 km from the construction site
LCOE	Extract sea areas that can be developed with <10 yen/kWh as more promising potential sea areas

Data used

Data item		Data source
Natural environment	Wind speed [m/s]	NeoWins (NEDO)[3]
	Water depth [m]	500-m mesh water depth data (J-EGG500, Japan Oceanographic Data Center)[4]
	Data on environmental conservation	Natural environmental survey Web-GIS (MOE)[5]
Use of sea areas	Fishing rights	MSIL (Japan Coast Guard)[6]
	Shipping traffic density [No. of AIS data/mesh]	World Bank data[1]
	US military exercise area	MSIL (Japan Coast Guard)[6]
	Submarine cable	MSIL (Japan Coast Guard)[6]

Capacity density [MW/km^2]

Item	Set value
Capacity density	Before considering shipping traffic density: 4.0 MW/km^2 After considering shipping traffic density : 5.0 MW/km^2

(Reference data)
- * The National Renewable Energy Laboratory (NREL) of the US refers to the capacity density of projects under development in the US, and uses 4.0 MW/km^2 as a conservative value[7]
- * The average value for projects, narrowed down from the 4C Offshore database[8] in terms of factors, such as project phase, farm size, wind turbine size, is approx. 6 MW/km^2

Conditions and method for analyzing LCOE

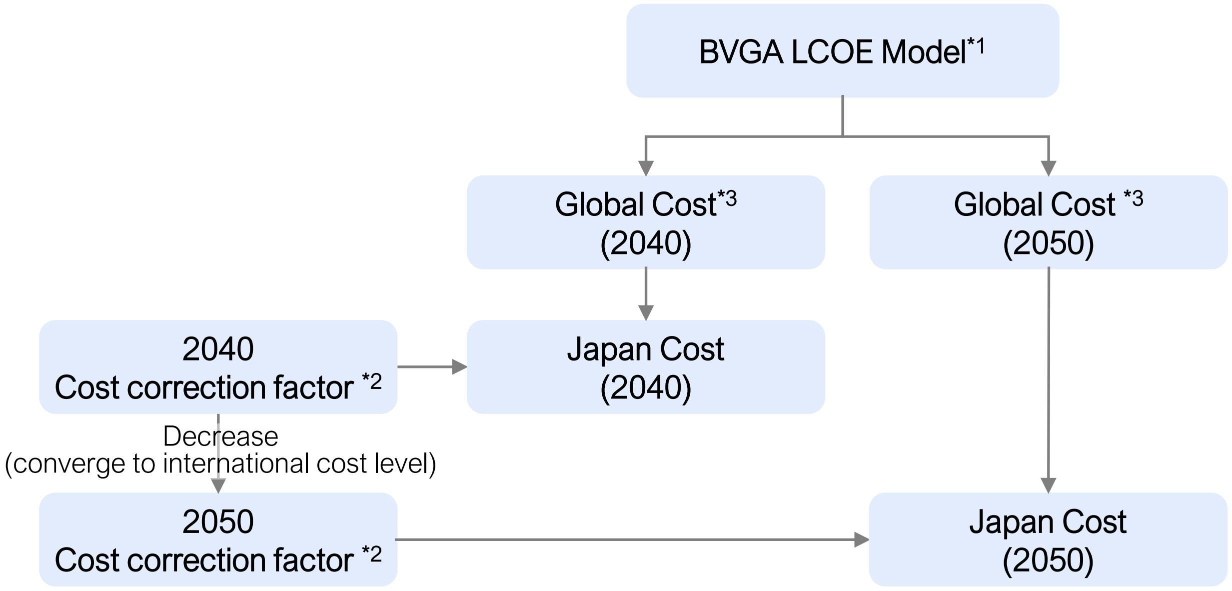
- Analyze LCOE for each technology type (Fixed / Floating) in order to identify from among potential sea areas those that are relatively feasible in terms of project profitability.
- Set two time points, i.e., **2040 and 2050 as the year of commencement of operation**, and conduct the analysis **assuming future progress of cost reduction due to expansion of wind firm size, technological innovation (growth in wind turbine size, progress in construction/O&M efficiency, etc.), domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years)**.

Main conditions for analyzing LCOE

Item	Preconditions
Year of commencement	2040, 2050
Power plant scale	–10 km* : Fixed at 500 MW 10–22 km*: Linear increase from 500 MW to 1 GW 22–50 km*: Linear increase from 1 GW to 5 GW 50 km–* : Fixed at 5 GW *Distance from the centre of the wind farm to shore
Wind turbine size	20 MW (rotor diameter: 290 m)
Technology type	Fixed: Water depth ≤ 75 m, Floating: Water depth > 75 m
Distance to construction port	Distance to the port that is closest from the wind farm, among 5 ports already designated as a construction port[9] and 10 ports intended to be designated[10]
Distance to operations port*	Calculate the distance by assuming that the operations port is 10 km away from the coast that is closest from the wind farm
Submarine cable length*	Direct distance from the wind farm to the closest shore point
Land cable length	10 km
Offshore substation	–10 km* : No offshore substation 10–100 km* : HVAC offshore substation 100 km–* : HVDC offshore substation *Distance from the centre of the wind farm to shore
Decommissioning cost	70% of construction cost
Project lifetime	30 years
Capital cost / Operating cost	Calculate using the cost model owned by BVGA on the basis of the preconditions above
LCOE calculation formula	Divide the total cost (capital cost and operating cost) by gross generation (*Calculation in accordance with the definition by the METI power generation cost verification working group)
WACC	3%

* For isolated islands, calculate the distance based on the closest coast among Hokkaido, Honshu, Shikoku, and Kyushu

Flow of LCOE analysis



*1 Cost theoretically calculated from the parametric cost model owned by BVGA. Preconditions were set by taking into account the opinions of the industry in collaboration with JWPA and BVGA.

*2 Between the Japanese and global (particularly European) markets, there is a price difference attributed to differences in the market scale, supply chain creation, skill level of the industry, etc. This price difference was set as a cost correction factor and multiplied by the global cost, which was calculated using the BVGA's cost model, to calculate the Japan cost. Under the assumption that the cost will converge to an internationally competitive level toward 2050, the price difference as of 2050 was set as zero (cost correction factor = 1.0) except for wind turbines and the foundation, which are subject to natural conditions specific to Japan (e.g., typhoons, earthquakes). This cost correction factor was set by taking into account the opinions of the industry in collaboration with JWPA and BVGA.

*3 The exchange rate used for conversion is the yearly average TTB for 2022: 136.54 yen/euro.

3. Results of analysis of potential sea areas

3. Results of analysis of potential sea areas

2040 (before considering shipping traffic density)

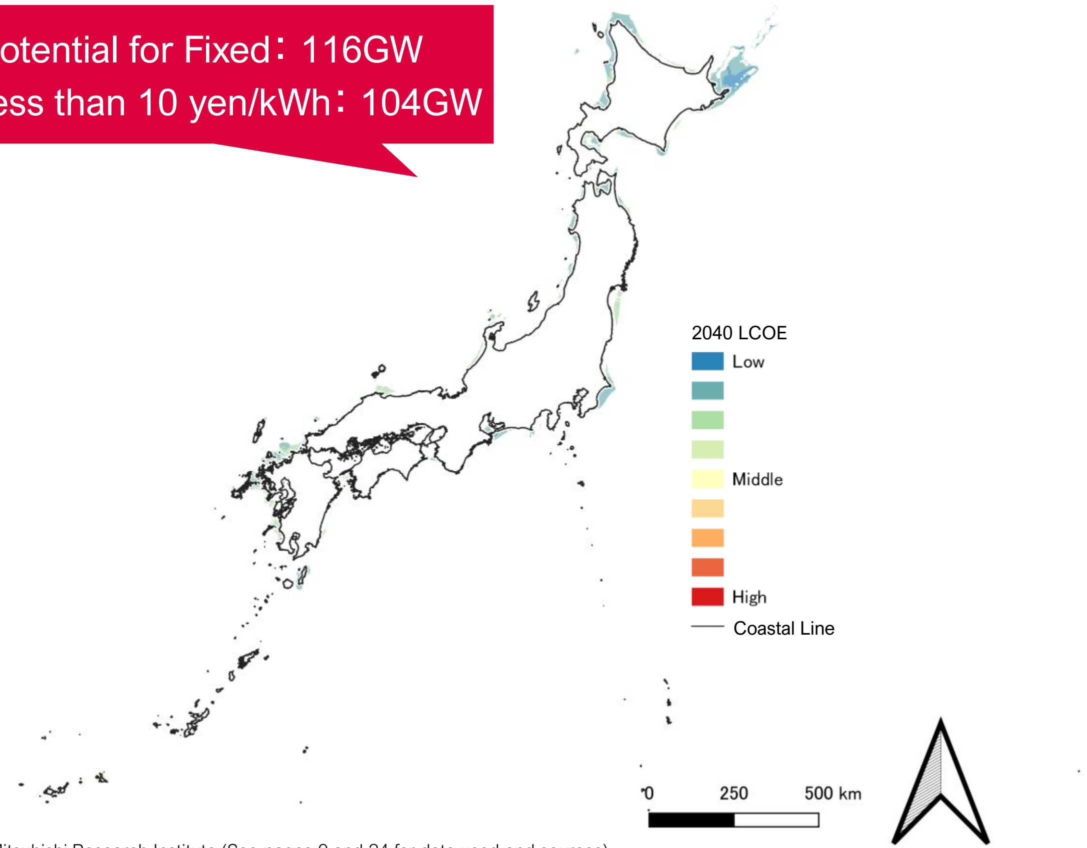
Potential of sea areas with Low LCOE are Fixed: 104GW and Floating: 492GW

- The total potential sea areas before considering shipping traffic density are equivalent to Fixed: 116GW and Floating: 2,940GW.
- Sea areas with a LCOE of less than 10 yen/kWh* are equivalent to Fixed: 104GW and Floating: 492GW, indicating a great potential even considering feasibility.
  *LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
- Because of the steep submarine topography, sea areas for Fixed is limited to coastal areas, while there are extensive potential sea areas for Floating. In Japan, the expansion of Floating is the key.

Potential sea areas for Fixed (2040: before considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE. (see page 7 for details)

Total potential for Fixed: 116GW
LCOE of less than 10 yen/kWh: 104GW



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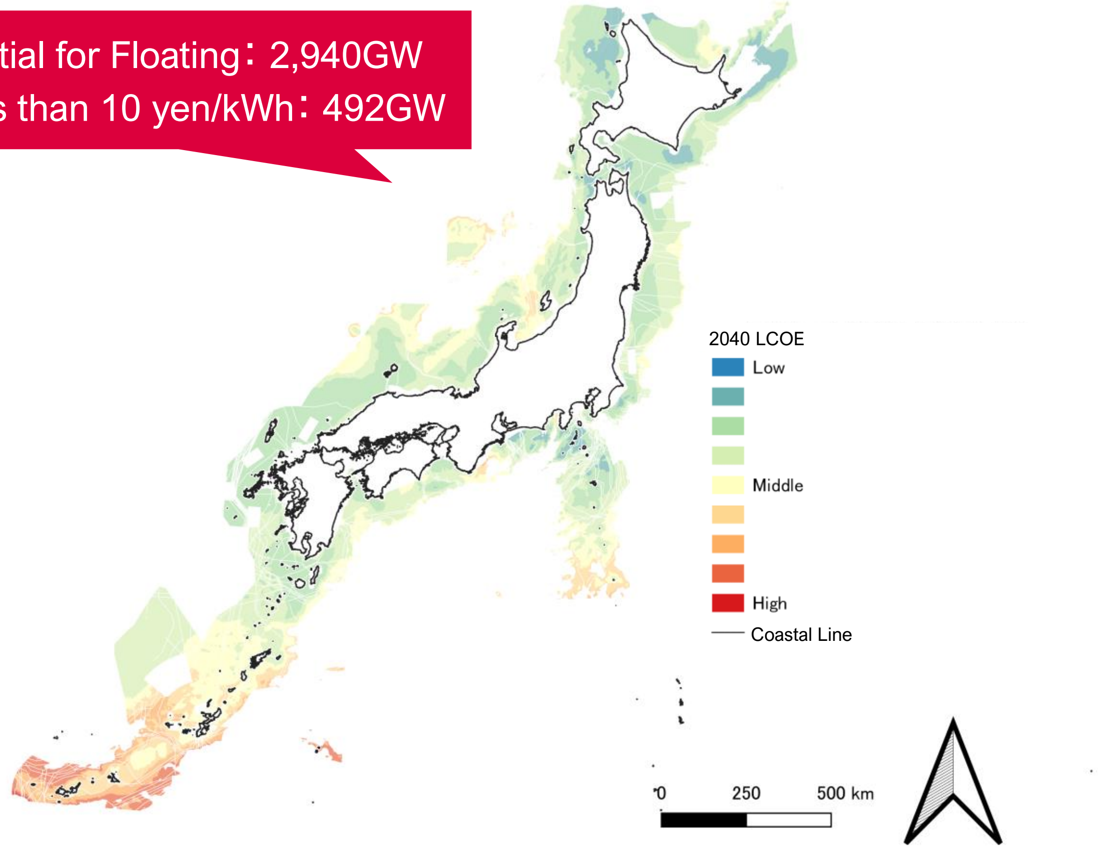
Potential sea areas for Floating (2040: before considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE. (see page 7 for details)

Total potential for Floating: 2,940GW
LCOE of less than 10 yen/kWh: 492GW



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3. Results of analysis of potential sea areas

2050 (before considering shipping traffic density)

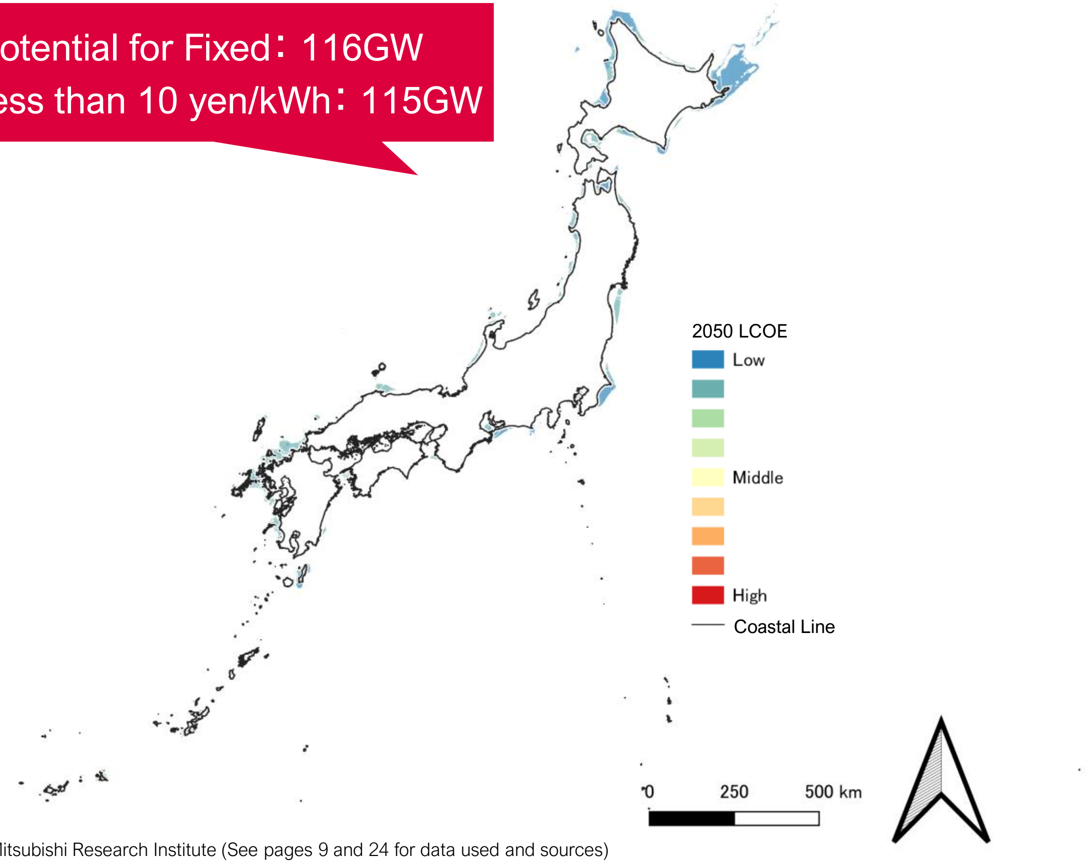
Potential of sea areas with Low LCOE are Fixed: 115GW and Floating: 1,923GW

- The total potential sea areas before considering shipping traffic density are equivalent to Fixed: 116GW and Floating: 2,940GW, as in the case of 2040.
- Sea areas with a LCOE of less than 10 yen/kWh* are equivalent to Fixed: 115GW and Floating: 1,923GW, indicating a significant expansion of the potential considering feasibility.
  * LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
- Cost reductions, which are assumed to progress until 2050, led to the extension to offshore sea areas that can be developed with a relatively low LCOE.

Potential sea areas for Fixed (2050: before considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE.
(see page 7 for details)

Total potential for Fixed: 116GW
LCOE of less than 10 yen/kWh: 115GW



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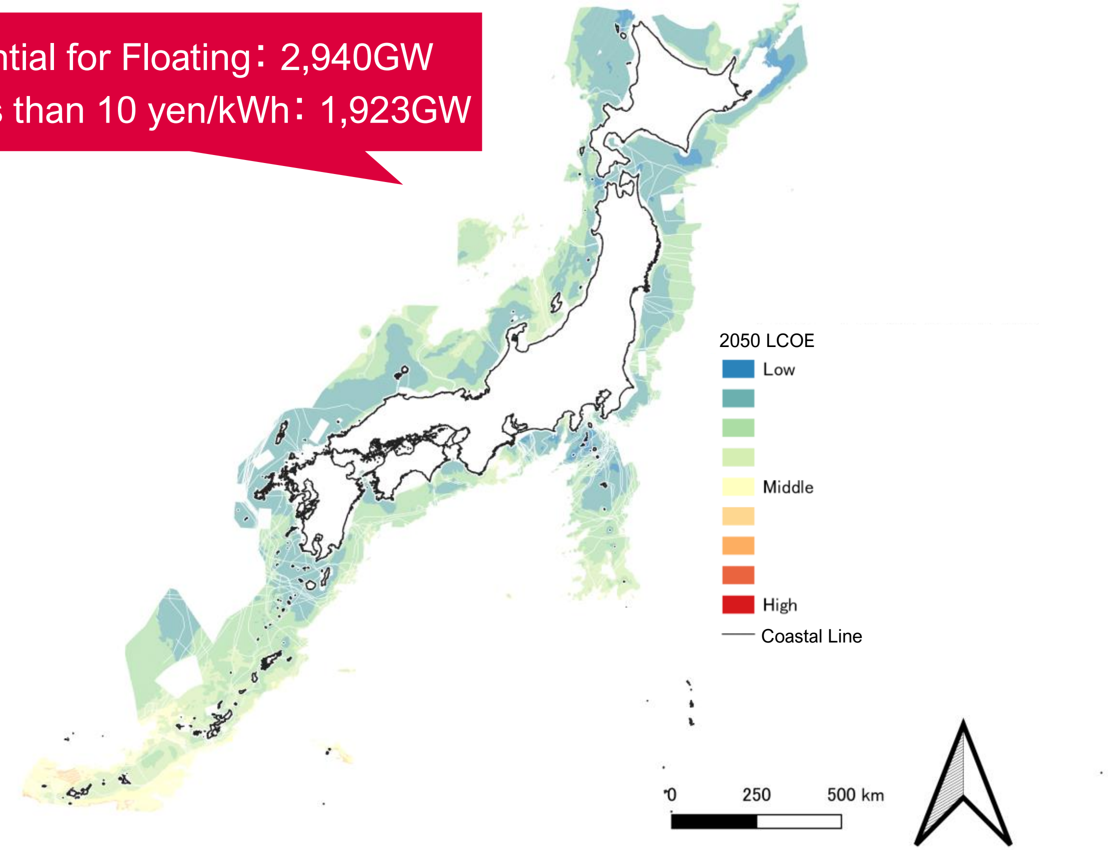
Potential sea areas for Floating (2050: before considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE.
(see page 7 for details)

Total potential for Floating: 2,940GW
LCOE of less than 10 yen/kWh: 1,923GW



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3. Results of analysis of potential sea areas

2040 (after considering shipping traffic density)

Potential of sea areas with Low LCOE are Fixed: 64GW and Floating: 343GW

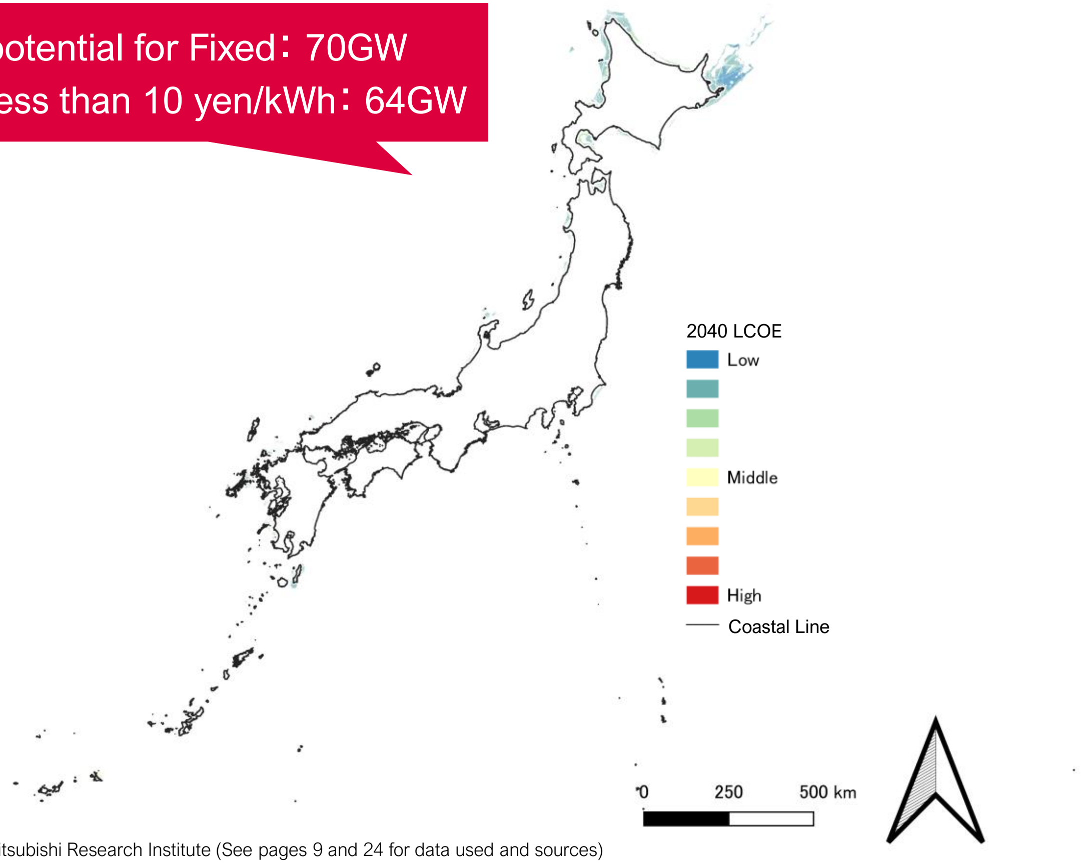
- The total potential sea areas after considering shipping traffic density are equivalent to Fixed: 70GW and Floating: 2,396GW.
  - The government's targets (2040: 30–45 GW)[11] account for several percent of them; there is a possibility to achieve this targets while minimizing the impact on shipping traffic and fishing activity.
- Sea areas with a LCOE of less than 10 yen/kWh* are equivalent to Fixed: 64GW and Floating: 343GW, indicating a great potential even considering feasibility.

* LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)

Potential sea areas for Fixed (2040: after considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE. (see page 7 for details)

Total potential for Fixed：70GW
LCOE of less than 10 yen/kWh：64GW



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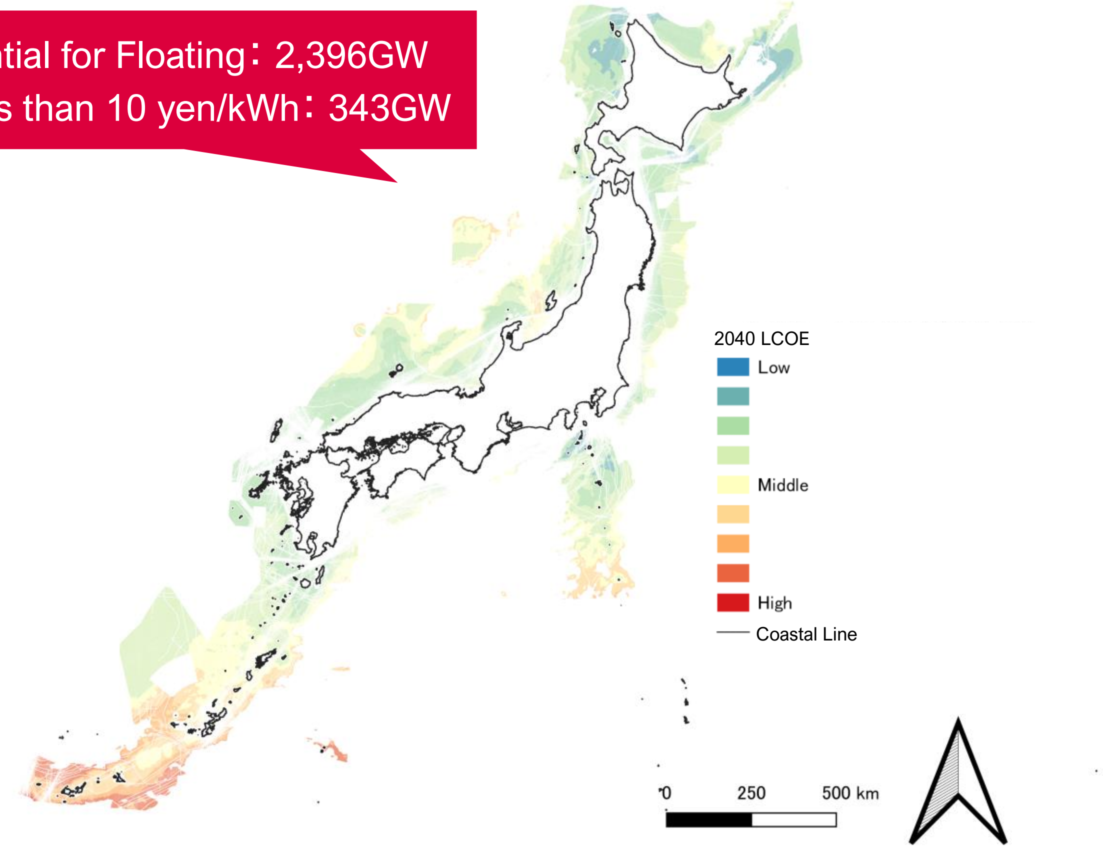
Potential sea areas for Floating (2040: after considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE. (see page 7 for details)

Total potential for Floating：2,396GW
LCOE of less than 10 yen/kWh：343GW



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3. Results of analysis of potential sea areas

2050 (after considering shipping traffic density)

Potential of sea areas with Low LCOE are Fixed: 70GW and Floating: 1,477GW

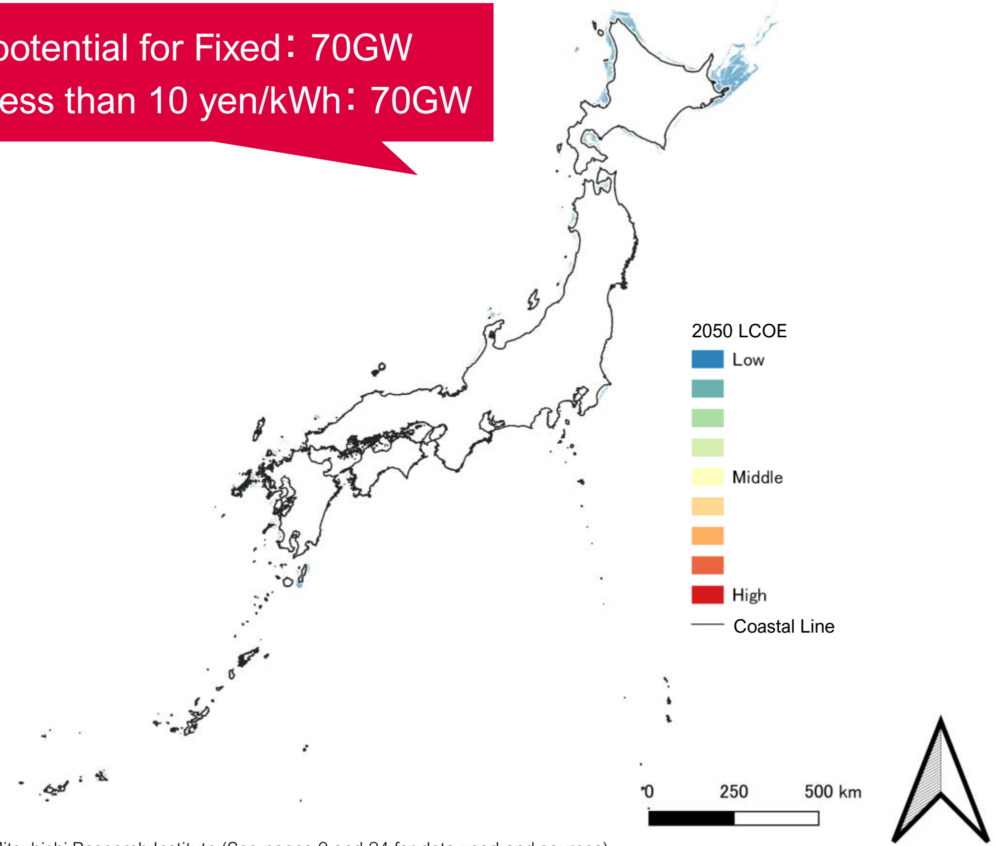
- The total potential sea areas after considering shipping traffic density are equivalent to Fixed: 70GW and Floating: 2,396GW, as in the case of 2040.
  - The installed capacity of offshore wind required to achieve carbon neutrality by 2050 (JWPA's estimation: 100 GW)[12] accounts for several percent of them; there is a possibility to achieve this targets while minimizing the impact on shipping traffic and fishing activity.
- Cost reductions until 2050 expanded potential sea areas with a LCOE of less than 10 yen/kWh* to Fixed:70GW and Floating:1,477GW.

* LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)

Potential sea areas for Fixed (2050: after considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE.
(see page 7 for details)

Total potential for Fixed：70GW
LCOE of less than 10 yen/kWh：70GW



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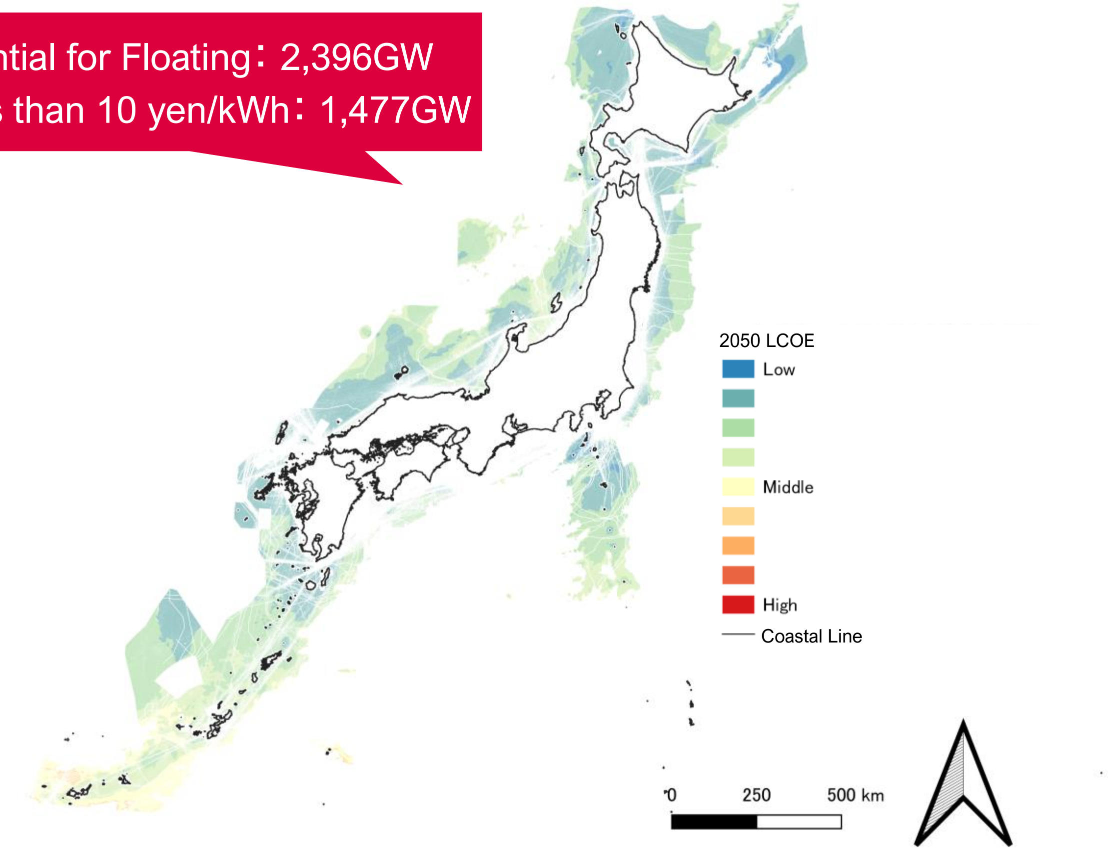
Potential sea areas for Floating (2050: after considering shipping traffic density)

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. In addition, this may create a gap with the actual LCOE.
(see page 7 for details)

Total potential for Floating：2,396GW
LCOE of less than 10 yen/kWh：1,477GW



Source: Created by Mitsubishi Research Institute (See pages 9 and 24 for data used and sources)

4. Summary and proposal

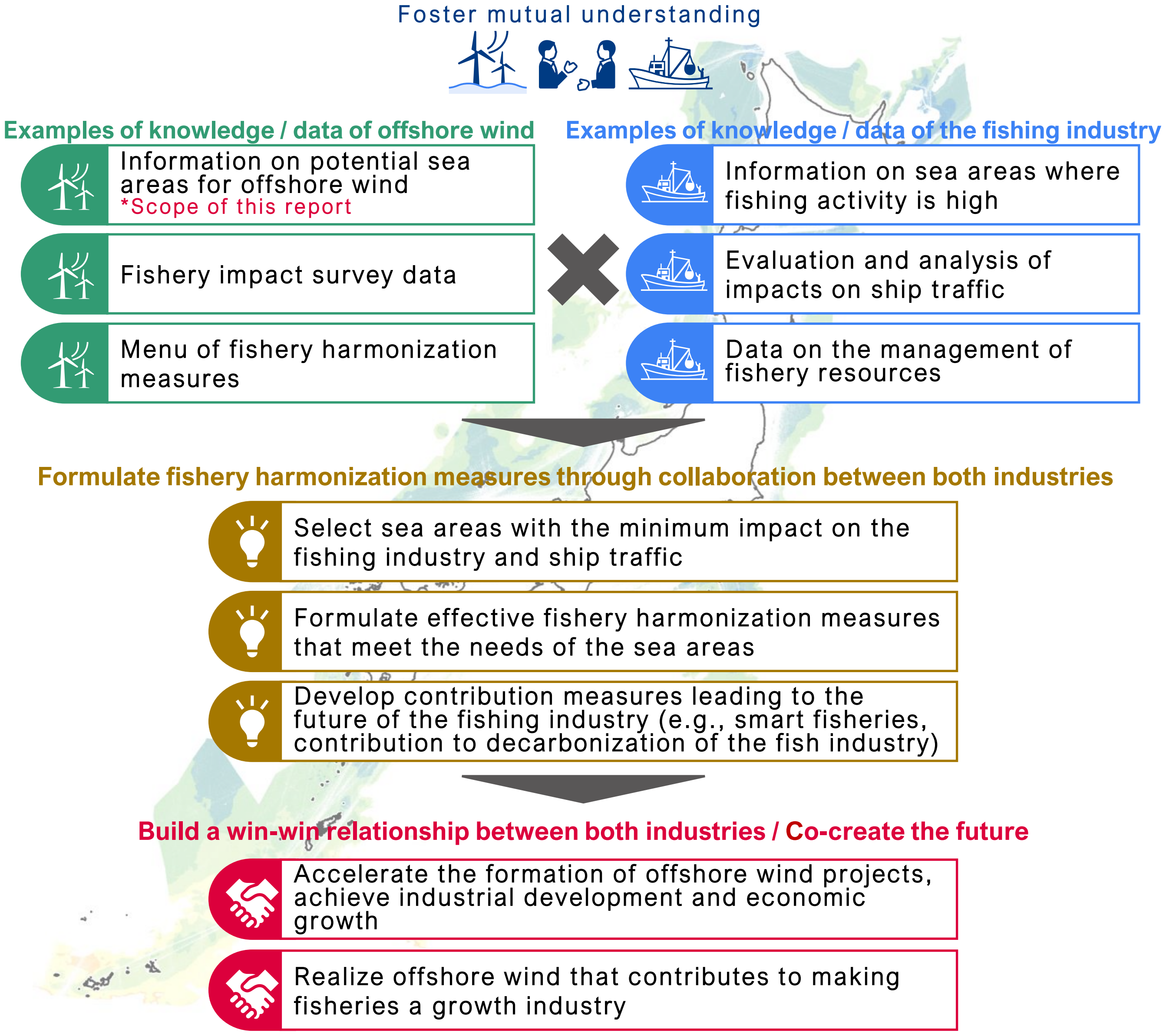
Toward the formation of a virtuous cycle that leads to the co-creation of the future of the fishing industry, and offshore wind

- To promote discussions between the offshore wind and fishing industry, it is essential to obtain concrete information on the sea areas and area sizes that are needed to achieve the targets.
- With this understanding, the initial analysis of potential sea areas for offshore wind was conducted on the basis of data on the natural environment, use of sea areas, and LCOE.
- The analysis results shows that **the total potential sea areas considering shipping traffic density are equivalent to 70GW for Fixed and 2,396GW for Floating**. The government's targets*1 and the installed capacity of offshore wind required to achieve carbon neutrality by 2050*2 account for several percent of the total potential, indicating that there is a possibility to achieve this targets while minimizing the impact on shipping traffic and fishing activity.

  *1 2040: 30–45 GW (including Floating)[11] *2 2050: 100 GW (JWPA's estimate)[12]
- In addition, the analysis results shows that **the potential of sea areas with a LCOE of less than 10 yen/kWh in 2050 are equivalent to 70GW for Fixed and 1,477GW for Floating**.

  * LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
  - 2040 Fixed: 64GW, Floating: 343GW (after considering shipping traffic density)
  - 2050 Fixed: 70GW, Floating: 1,477GW (after considering shipping traffic density)
- However, because this analysis does not consider all the natural conditions, social conditions, and actual conditions of ocean use such as fishing activities, the actual sea areas that can be developed are expected to be significantly reduced.
- **If both industries and related organizations can put together their knowledge and data, it will be possible to identify more specific potential sea areas**.
- In addition, deepening mutual understanding between both industries through knowledge and data sharing will make it possible to formulate effective harmonization measures, which will lead to the creation of a win-win relationship for both industries.
- To form a virtuous cycle that leads to the co-creation of the future of offshore wind and the fishing industry through concessions by both industries, it is essential for the central and local governments, industry, fisheries-related organizations, research institutes, and other organizations to pool their knowledge and make every possible effort.

Put together both industries' knowledge and data toward the co-creation of the future of the fishing industry and offshore wind



Source: Created by Mitsubishi Research Institute (See pages 9 and 24 for data used and sources of the potential map)

5. Reference: Details of analysis results of potential sea areas

2040 (before considering shipping traffic density): Potential sea areas by water depth/area

Potential sea areas (2040) [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	34	30	159	83	61	50	210	183	134	910
Pacific Ocean side area	64	30	112	59	40	39	203	247	233	963
Kyushu/Okinawa area	18	50	294	57	45	40	280	165	137	1,067
Total area	116	109	565	199	146	129	693	595	504	2,940

∗ These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
∗ Using the sea areas used in statistical tables for fisheries as a reference, Geographic Information System (GIS) data were created for the areas: the Sea of Japan side area, which represents the sea areas in the north of the border between Yamaguchi and Shimane prefectures; the Pacific Ocean side area, which covers the sea areas in the north of the border between Kagoshima and Miyazaki prefectures; and the Kyushu / Okinawa area, which constitutes the remaining sea areas excluding the Inland Sea of Japan
∗ Due to rounding, the sum of all the items may not match the total.

Potential sea areas (2040): LCOE of less than 10 yen/kWh [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	29	13	63	21	18	15	24	0	0	154
Pacific Ocean side area	60	18	67	41	22	20	49	5	0	222
Kyushu/Okinawa area	14	14	95	6	1	0	0	0	0	116
Total area	104	45	226	67	41	35	73	5	0	492

∗ These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
∗ LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
∗ Using the sea areas used in statistical tables for fisheries as a reference, Geographic Information System (GIS) data were created for the areas: the Sea of Japan side area, which represents the sea areas in the north of the border between Yamaguchi and Shimane prefectures; the Pacific Ocean side area, which covers the sea areas in the north of the border between Kagoshima and Miyazaki prefectures; and the Kyushu / Okinawa area, which constitutes the remaining sea areas excluding the Inland Sea of Japan
∗ Due to rounding, the sum of all the items may not match the total.

2050 (before considering shipping traffic density): Potential sea areas by water depth/area

Potential sea areas (2050) [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	34	30	159	83	61	50	210	183	134	910
Pacific Ocean side area	64	30	112	59	40	39	203	247	233	963
Kyushu/Okinawa area	18	50	294	57	45	40	280	165	137	1,067
Total area	116	109	565	199	146	129	693	595	504	2,940

∗ These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
∗ Using the sea areas used in statistical tables for fisheries as a reference, Geographic Information System (GIS) data were created for the areas: the Sea of Japan side area, which represents the sea areas in the north of the border between Yamaguchi and Shimane prefectures; the Pacific Ocean side area, which covers the sea areas in the north of the border between Kagoshima and Miyazaki prefectures; and the Kyushu / Okinawa area, which constitutes the remaining sea areas excluding the Inland Sea of Japan
∗ Due to rounding, the sum of all the items may not match the total.

Potential sea areas (2050): LCOE of less than 10 yen/kWh [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	34	30	159	83	61	48	190	71	16	658
Pacific Ocean side area	64	30	112	58	40	39	190	183	87	738
Kyushu/Okinawa area	17	46	274	40	25	19	113	9	0	527
Total area	115	105	545	181	126	106	492	263	103	1,923

∗ These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
∗ LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
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∗ Due to rounding, the sum of all the items may not match the total.

2040 (after considering shipping traffic density): Potential sea areas by water depth/area

Potential sea areas (2040) [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	23	17	122	63	56	44	203	183	134	823
Pacific Ocean side area	40	13	45	32	20	22	129	208	206	674
Kyushu/Okinawa area	6	32	241	47	35	30	227	155	132	899
Total area	70	62	409	142	111	96	559	546	473	2,396

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
* Using the sea areas used in statistical tables for fisheries as a reference, Geographic Information System (GIS) data were created for the areas: the Sea of Japan side area, which represents the sea areas in the north of the border between Yamaguchi and Shimane prefectures; the Pacific Ocean side area, which covers the sea areas in the north of the border between Kagoshima and Miyazaki prefectures; and the Kyushu / Okinawa area, which constitutes the remaining sea areas excluding the Inland Sea of Japan
* Due to rounding, the sum of all the items may not match the total.

Potential sea areas (2040): LCOE of less than 10 yen/kWh [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	21	10	59	20	19	14	23	0	0	146
Pacific Ocean side area	39	9	40	27	13	13	27	2	0	132
Kyushu/Okinawa area	4	7	54	4	1	0	0	0	0	65
Total area	64	26	153	51	32	28	50	2	0	343

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
* LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
* Using the sea areas used in statistical tables for fisheries as a reference, Geographic Information System (GIS) data were created for the areas: the Sea of Japan side area, which represents the sea areas in the north of the border between Yamaguchi and Shimane prefectures; the Pacific Ocean side area, which covers the sea areas in the north of the border between Kagoshima and Miyazaki prefectures; and the Kyushu / Okinawa area, which constitutes the remaining sea areas excluding the Inland Sea of Japan
* Due to rounding, the sum of all the items may not match the total.

2050 (after considering shipping traffic density): Potential sea areas by water depth/area

Potential sea areas (2050) [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	23	17	122	63	56	44	203	183	134	823
Pacific Ocean side area	40	13	45	32	20	22	129	208	206	674
Kyushu/Okinawa area	6	32	241	47	35	30	227	155	132	899
Total area	70	62	409	142	111	96	559	546	473	2,396

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
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* Due to rounding, the sum of all the items may not match the total.

Potential sea areas (2050): LCOE of less than 10 yen/kWh [GW]

	Fixed	Floating								
	≤75 m	75–100 m	100–200 m	200–300 m	300–400 m	400–500 m	500–1,000 m	1,000–1,500 m	1,500–2,000 m	Floating Total area
Sea of Japan side area	23	17	122	63	56	44	185	72	15	572
Pacific Ocean side area	40	13	45	32	20	22	124	152	76	484
Kyushu/Okinawa area	6	28	224	33	19	16	93	8	0	420
Total area	70	58	391	128	94	81	401	232	91	1,477

* These are results of analysis through mechanical processing based on public data and certain preconditions, and may not indicate the actual sea areas that can be developed. (see page 7 for details)
* LCOE if wind firm size expansion, technological innovation, domestic supply chain creation, port/grid infrastructure development, and expansion of project period (30 years) are realized. (see page 10 for details)
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