CARBON TRUST | OFFSHORE WIND

REPORT

Unlocking supply chain opportunities for Japanese companies in Asia's growing offshore wind market

An investigation of current supply chain capabilities in South Korea, Taiwan, Vietnam and the Philippines and analysis of the opportunities and barriers for Japanese companies in these markets.

January 2026

In partnership with

Mitsubishi Research Institute

About the report

This report aims to offer a detailed analysis of Japan's offshore wind supply chain and its potential role in the regional energy transition. It maps the key strengths and challenges in the country's offshore wind sector, and assess opportunities for Japanese suppliers in Southeast Asian markets. Through research and stakeholder input, this report provides actionable insights to support strategic decisions that enhance regional collaboration and supply chain resilience.

This report was developed by the Carbon Trust and the Mitsubishi Research Institute. The Mitsubishi Research Institute was responsible for Section 2, the analysis of the Japanese offshore wind supply chain.

Who we are

The Carbon Trust

Our mission is to accelerate the move to a decarbonised future.

We have been climate pioneers for more than 20 years, partnering with leading businesses, governments and financial institutions globally. From strategic planning and target setting to activation and communication - we are your expert guide to turn your climate ambition into impact.

We are one global network of 400 experts with offices in the UK, the Netherlands, South Africa, China, Singapore and Mexico. To date, we have helped set 200+ science-based targets and guided 3,000+ organisations in 70 countries on their route to Net Zero.

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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Abbreviations

ABS	American Bureau of Shipping
AC	Alternating current
CBF	Century Bladt Foundation
CDWE	CSBC-DEME Wind Engineering
CIP	Copenhagen Infrastructure Partners
CSC	China Steel Corporation
CWP	Century Wind Power
DC	Direct current
DOE	Department of Energy
EEZ	Exclusive Economic Zone
EPC	Engineering, Procurement, and Construction
ETS	emissions trading system
FEED	Front-End Engineering Design
FLOWRA	Floating Offshore Wind Technology Research Association
FPSO	Floating Production Storage and Offloading
GEA-5	Fifth Green Energy Auction
GIF	Green Innovation Fund
GW	Gigawatts
HD KSOE	HD Korea Shipbuilding & Offshore Engineering
HHI	Hyundai Heavy Industries
HVDC	High-voltage direct current
JIS	Japan Industrial Standards
JWPA	Japan Wind Power Association
kV	kilovolt

LCR	Local Content Requirement
LoI	Letter of Intent
LS C&S	LS Cable & System
METI	Ministry of Economy, Trade, and Industry
MoU	Memorandum of Understanding
MW	Megawatt
NCSS	National Climate Change Strategy
NEDO	New Energy and Industrial Technology Development Organization
NK	Nippon Kaiji Kyokai
NKT	Nordiske Kabel og Traadfabriker
O&M	operation and maintenance
PDP8	Power Development Plan VIII
PEP	Philippine Energy Plan
PTSC	PetroVietnam Technical Services Joint Stock Corporation
PTSC M&C	PTSC Mechanical & Construction
PVN	PetroVietnam
R&D	Research and development
SDMS	Sing Da Marine Structure
SHI	Samsung Heavy Industries
WTO	World Trade Organisation

Contents

Tables

Figures

Executive Summary

The Asia Pacific region is expected to see a substantial expansion of offshore wind development in the coming decades, driven by new decarbonisation commitments, national targets and supportive policy frameworks. This growth poses significant opportunity for suppliers that are already active in or could become active in the sector.

Japanese companies are already active in many parts of the offshore wind supply chain and have technical capability and expertise in related sectors. This report examines the opportunities for Japanese companies to export or expand their offerings to four countries in Asia Pacic where offshore wind development is set to increase, as well as discussing the current barriers to securing these opportunities.

Offshore wind opportunities for Japanese companies in Asia Pacific

This report investigates the supply chain capabilities in floating substructures and mooring systems, as well as export cables and HVDC substations. Our analysis shows that as offshore wind market expands across South Korea, Taiwan, Vietnam and the Philippines, and regional supply chains face increasing pressure to meet rising demand, there is potential for Japanese companies to leverage their expertise in advanced technology and manufacturing.

Of the markets analysed, **South Korea** has the strongest current and future potential capabilities across these four aspects of the supply chain, thanks to its strong industrial base and the growing momentum around domestic fixed and floating offshore wind development. However, South Korea is the only country in the region, alongside Japan, where dynamic submarine cables are being manufactured, creating a dependency for other markets and potential bottlenecks if demand surges.

There is currently limited capability to manufacture these components in **Taiwan**, the country's first submarine cable facility is anticipated to begin operations in 2027, thanks to a new joint venture between a domestic entity and European partner. Likewise, although there are currently no capabilities in floating substructures, the country's strong steel industry provides a foundation for scale-up in the future.

In **Vietnam**, project developers are expected to rely heavily on imports until local manufacturing capacity increases. There is currently no domestic capability in submarine cables, mooring systems and floating substructures, although at least one company is emerging as a critical player in fabrication of HVDC substations. New strategic partnerships with other Southeast Asian suppliers in some areas of the supply chain (i.e., cable manufacturing) and planned port upgrades indicate potential for increased capacity.

Finally, there is little domestic supply chain capability for offshore wind in the **Philippines**, where the sector is still in very early stages of development. Therefore, although this market provides the biggest opportunity for Japanese suppliers to export products and services, it is also the most uncertain.

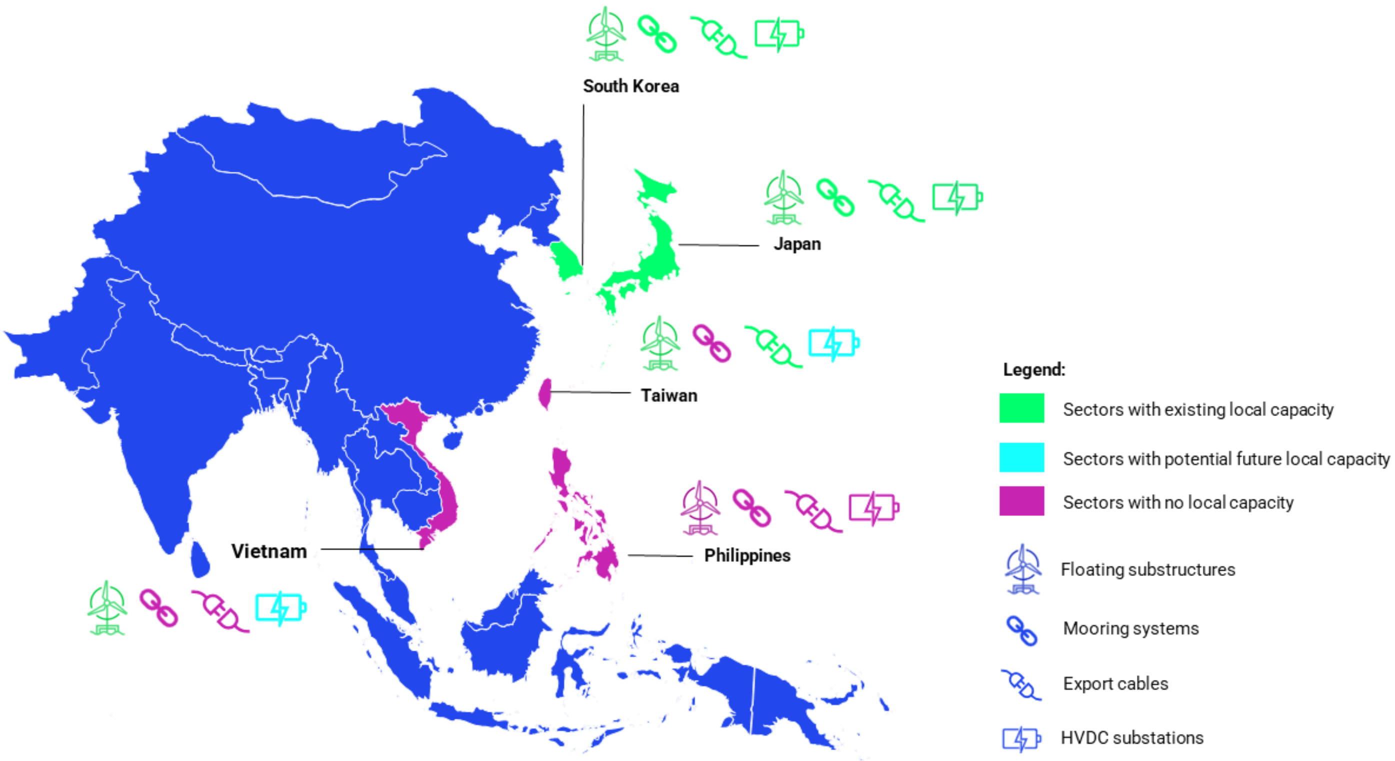

Figure 1. Offshore wind supply chain capacity and gaps in South Korea, Taiwan, Vietnam, the Philippines and Japan.

Across these markets, there is currently:

- **Limited floating substructure capabilities** outside of South Korea, but some potential for development in the other countries;
- **Limited capability for mooring systems** (Taiwan, Vietnam and the Philippines) and no indication of future expansion plans.
- **Limited current capacity in export cable production** (including dynamic cables) outside of South Korea and Japan, and only one future facility planned to open in Taiwan;
- **Uneven capability in fabrication of HVDC substations**, with South Korea and Vietnam developing domestic capability and Taiwan and the Philippines reliant on imports now and into the future;

While domestic suppliers in South Korea are likely to be able to meet many of the offshore wind development needs, there is strong potential for Japanese suppliers to collaborate and contribute technical expertise, particularly for advanced electrical infrastructure, such as the design and manufacturing of export cables.

Furthermore, assuming the supply chain is sourced outside Japan, if offshore wind development expands as anticipated across the region, an over-reliance on supply of critical components from South Korea could develop. Greater participation from Japanese suppliers could ease this dependence.

Leveraging Japanese suppliers' strengths

An analysis of Japan's current and future capabilities in these aspects of the offshore wind supply chain revealed strengths that align with the wider region's needs.

Key areas of competitive advantage include:

- **Offshore foundations and earthquake-resistant designs,** leveraging Japan's engineering expertise in complex steel structures;
- **Large-diameter mooring systems,** with Japan among the few countries capable of mooring chain and high-strength synthetic fibre ropes production at the required size and quality required for next-generation floating offshore wind turbines, developed through collaborations between material and equipment manufacturers;
- **High-voltage cables (static and dynamic)**, supported by a strong track record and investment in research and development (R&D);
- **Offshore substations**, including the delivery of the world's first floating offshore substation.

Japan is home to leading engineering and manufacturing capabilities in large-scale steel structures, developed through long-standing experience in shipbuilding, large steel structure, and civil infrastructure. These strengths offer potential for offshore wind applications, particularly in floating substructures and complex foundation systems. Japan also benefits from an advanced materials sector, which underpins the production of high-performance components such as mooring chains, synthetic fibre ropes, and submarine transmission cables.

Given the gap in supply chain capabilities across the region, the comparative strengths of the Japanese supply chain could justify future export to and expansion of operations in Asia Pacific. Furthermore, commercial scale floating offshore wind development is anticipated in all of these countries. Knowledge exchange and joint innovations in floating offshore wind systems could be critical not just for the regional deployment, but the global success of the technology. To fully realise its potential across the region, Japanese offshore wind suppliers can explore alternative routes for expansion, such as:

- **Export-based expansion:** Opportunity mapping revealed increasing demand across other Asian markets, highlighting strong export potential for Japanese offshore wind suppliers once domestic technological capabilities and industry foundations are well established.
- **Local manufacturing expansion:** Strengthening regional manufacturing capacity in priority Asian markets through collaboration and investment, supporting resilient cost-effective supply chains linked to Japan's industrial base.
- **Knowledge sharing and capacity building:** Enhancing cross-market learning and technical capabilities to prevent over-specialisation in Japan-specific designs and promote regionally relevant, cost-efficient technologies competitive across Asian markets.

Barriers to capitalising on the Asia Pacific opportunity

Although there is a clear need for more robust and diversified supply across the region, there are real and perceived barriers to Japanese companies exporting their services and products or expanding operations to the Asia Pacific region.

Despite Japan's excellent domestic capabilities, technological competitiveness in these areas of the supply chain compared to other countries and a history of strong research and development (R&D) initiatives, its offshore wind industry is still nascent. Therefore, there is a limited track record of involvement by Japanese suppliers in domestic offshore wind projects, and an even more limited track record of their involvement in overseas offshore wind markets. Additionally, the scale of the offshore wind 'opportunity' in Japan and further afield remains uncertain, due to inconsistent policy signals, slow development of enabling regulatory frameworks, and global economic strain.

Interviews with Japanese suppliers conducted as part of this analysis provide additional context, indicating:

- Japanese companies expect to supply to the domestic market first, before diverting attention to other Asia Pacific markets. However, offshore wind development in Japan has been slow or stilted, which creates uncertainty about the domestic project pipeline and overall market.
- Japanese companies perceive that their products and services may not be cost-competitive in the wider region (e.g., due to higher labour and material costs, compared to South Korea and China); the use of different technology standards could exacerbate this challenge.

Paving the way for Japan's role in the regional offshore wind supply chain

Increasing Japanese companies' involvement in the domestic (Japanese) offshore wind projects and alleviating concerns about competitiveness can and should be overcome in parallel. These challenges are not insurmountable but will require concerted effort in the coming years to address; doing so could ultimately enable Japanese companies to participate more fully in the regional offshore wind supply chain. Recommendations for enabling Japan's role in the regional offshore wind supply chain include:

1. **Increase certainty in the Japanese offshore wind market to enhance domestic suppliers' confidence and experience.**

Clear medium to long term project pipelines, supported by consistent policy signals and streamlined and enabling regulatory frameworks are essential to enhance market stability and predictability in Japan. This will provide the supply chain with a better understanding of component requirements and associated lead times, enabling companies to plan investments, scale production, and develop the capacity needed to meet market demand and future export opportunities. The Japanese government should establish a clear and reliable project delivery framework that links permitting and grid availability, and reflects realistic financing timelines, to ensure a steady mid to long term pipeline of domestic projects.

2. **Enhance existing government support mechanisms for domestic supply chain development.**

The government should continue to develop targeted financial and policy mechanisms to incentivise investment in manufacturing capacity and workforce development. Initiatives targeting efficiency and innovation can help lower the cost of design and manufacturing in Japan. Building on existing programmes, these support mechanisms can help channel support to priority technologies and solutions and drive process innovation and automation. Likewise, industry associations can create more streamlined channels for information flow, to synthesize industry needs and priorities and communicate these clearly to policy-makers.

3. Address real and perceived challenges around regional cost-competitiveness.

Enhancing the competitiveness of Japan's offshore wind supply chain will depend on strengthening efficiency and innovation, but also leaning into its strengths, including quality and reliability. Although Japanese products, particularly cables and mooring systems, tend to be more expensive than those supplied from South Korea and China, focusing on lifecycle value and technical performance will help Japanese suppliers compete on overall product quality, not only price. Differences in technical standards – Japan adheres to Japan Industrial Standards (JIS) or Nippon Kaiji Kyokai (NK) standards, whereas most other Asian offshore wind markets follow European norms – can also increase costs and complexity through compatibility issues in welding, coatings, and quality assurance when exporting components, requiring additional adaptation or certification. Although not the main cost driver, harmonizing standards with international norms can simplify project execution and enhance competitiveness when looking at export opportunities. Further research on the difference in these standards and effort associated with adapting to them could clarify whether the benefit justifies the cost. Domestic industry associations and collaboration initiatives could promote alignment of domestic technical standards with international benchmarks through joint industry working groups and mutual recognition agreements to improve qualification processes, lower compliance costs and facilitate market interoperability for Japanese suppliers.

4. Develop more formal mechanisms for regional supply chain coordination.

Increasing demand across Asian markets has intensified competition for key components and services and will continue to do so. Coordination initiatives, such as the North Sea Offshore Wind Coalition between the Nordic countries in Europe, where stakeholders jointly plan and manage offshore wind development, could help manage overlapping demand, reduce supply chain disruptions, and allocate resources more strategically. Both the government and domestic industry associations should promote bilateral and multilateral engagement with other Asian offshore wind markets through joint working groups, technical exchanges, and regional offshore wind coalitions, sharing market intelligence and project pipelines to create favourable conditions for international cooperation and knowledge sharing.

While opportunities exist for Japanese offshore wind suppliers in its domestic market, as well as in other Southeast Asian markets, government support and strategic coordination across the sector is key to overcome challenges and allow for a sustainable growth of Japanese presence in other markets. With coordinated action and sustained policy support, Japan is well-positioned to become a technology leader and supply chain hub for Asia's energy transition.

1. Offshore wind market update

1.1. Overview of offshore wind targets in Asia Pacific

The offshore wind sector is expanding rapidly in the Asia-Pacific region. While China is expected to continue dominating offshore wind development in the coming decades, countries such as South Korea, Vietnam, Taiwan, and Japan are projected to experience substantial growth and play a significant role in driving regional expansion over the next decade.[1] The Philippines, still in early stages of offshore wind development, is also gaining attention due to its ambitious long-term targets and recent policy signals, such as the launch of its first offshore wind auction.

Several countries have set targets for offshore wind, primarily focusing on fixed-bottom installations, Figure 2. Japan and South Korea are the only countries to have explicitly defined targets for floating offshore wind.

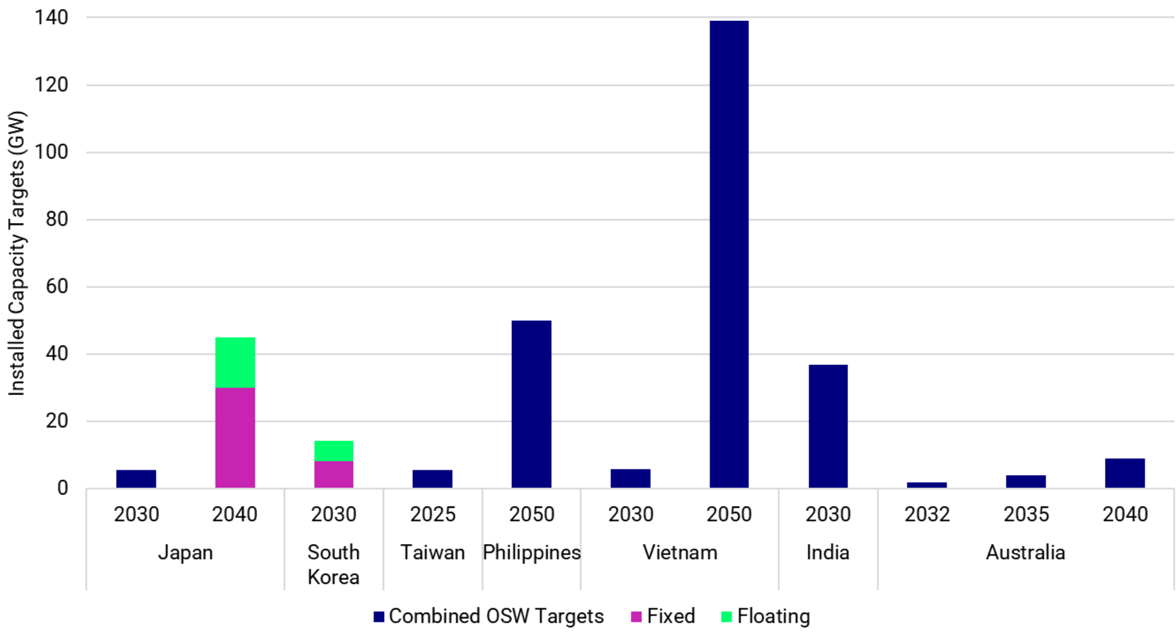

Figure 2. Offshore wind targets in the Asia Pacific region, excluding China[2]

The offshore wind targets across Asia-Pacific imply substantial supply chain demand over the coming decades. Meeting these goals will require the fabrication of thousands of fixed and floating foundations, construction of numerous offshore substations, and manufacturing of large volumes of export cables. While exact numbers depend on project specifications and technology choices, the scale of this challenge highlights significant opportunities for suppliers, particularly those with advanced technical knowledge and capabilities.

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[1] Reuters (2025) Japan to start planning floating wind test centre next year, industry official says– Link

[2] Philippines offshore wind target ranges between 19 and 50 GW. For illustrative purposes, this graph uses the maximum value of the range, 50 GW.

Japan is targeting 10 gigawatts (GW) of offshore wind pipeline by 2030 and 30 to 45 GW of offshore wind pipeline by 2040, from which at least 15 GW are expected be floating wind.[1]

South Korea has set a target of 14.3 GW of offshore wind capacity by 2030. Notably, the country is emerging as a frontrunner in floating wind development, with approximately 6 GW of floating offshore wind capacity planned in the Ulsan region by 2030.[3]

Taiwan has a target of 5.7 GW of offshore wind power by 2025, with no specific target for floating offshore wind.[4]

Philippines is targeting between 19 and 50 GW of operational offshore wind by 2050.[5] There is no indication for a floating wind target with the near-term focus on fixed-bottom projects that can perform under current technical, regulatory, and infrastructure conditions.

Vietnam aims to install 6 to 17 GW offshore wind capacity by 2030–2035, with a significant scale-up to up to 139 GW by 2050.[6] There is no specific target for floating wind announced for Vietnam.

India has an offshore wind allocation target of 37 GW by 2030. There is no indication for a floating wind target.[3]

Australia is targeting 2 GW of offshore wind by 2032, 4 GW by 2035, and 9 GW by 2040. There is no indication for a floating wind target.[3]

The following sections provides a closer examination of Japan and four other key emerging markets in Asia; namely South Korea, Taiwan, the Philippines, and Vietnam, each with distinct planned trajectories for offshore wind deployment.

[3] 4C Offshore Market Overview Report Q4 2024

[4] Executive Yuan (2019) Four-year Wind Power Promotion Plan – Link.

[5] Philippine Department of Energy (2024) Philippine Energy Plan 2023-2050 – Link

[6] World Bank (June 2025) A framework for private sector-led offshore wind projects in Vietnam – Link

1.2. Japan

Japan has set ambitious targets to achieve 10 GW of offshore wind pipeline by 2030 and 30 to 45 GW by 2040, including 15 GW or more of floating wind within Japanese territorial waters and further across its larger exclusive economic zone (EEZ).[7] These targets correspond to the amount of capacity that has been awarded in tenders up to date rather than operational capacity.

Currently, Japan has approx. 500 MW of installed offshore wind capacity (including projects scheduled to begin operation within FY2025), of which 22 MW is floating (16.8MW of floating wind began operation in January 2026 [8]) – supported by significant investments since the late 2000s, most notably Fukushima Forward project and demonstration project off the coast of Goto city, Nagasaki prefecture. To reach its 2030 goal, the government is planning to award around 1 GW of capacity annually between 2021 and 2030. [7] The Japanese government has held three offshore wind auction rounds to date. These auctions have awarded a total of 4.4 GW fixed-bottom capacity scheduled for commissioning between 2028–2030.

Three fixed-bottom projects were awarded as part of Round 1, in 2021; however, the sole winner in this auction has since withdrawn, citing challenging financial conditions. In Round 2, in 2023, Japanese and international consortia were awarded 1.8GW of capacity targeting operations by 2028-2029. The most recent Round 3, in 2024, awarded 1.1GW of capacity across two sites off Aomori and Yamagata, aiming for installation by 2030. While these projects are progressing though their development phases, the industry is concerned about ongoing market challenges that may put these projects at risk, raising broader questions about the design of Japan's offshore wind auctions.[9]

Japan's Renewable Sea Area Utilization Act defines three types of areas for offshore wind development: preparatory zones, promising zones, and promotion zones. Several sites have been identified within each category, representing multiple gigawatts of potential capacity. Areas designated as There are currently several gigawatts of capacity for each of these zones.[10] Areas designated as preparatory or promising can progress to promotion zones, which are formally designated by the Ministry of Economy, Trade, and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). Once designated, these zones are opened for public offering to offshore wind developers.

In June 2025, amendments to the Marine Renewable Energy Act facilitated offshore wind development in the Exclusive Economic Zone (EEZ) beyond territorial waters. This change is expected to drive floating wind deployment, suitable for deeper waters.[11] The projects proposed for these areas will need to progress through a two-step approval process: an initial stage where METI selects the relevant areas for offshore wind development and applicants are given a provisional approval, and a second stage where

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[7] METI (2020) Vision for Offshore Wind Power Industry – Link

[8] Toda Corporation (2026) Goto offshore wind farm– Link

[9] GWEC (2025) Japan's Offshore Wind Success at a Critical Juncture: Auction Redesign and Public-private Forum Critical to Accelerated Progress - Link

[10] (2025) Status of Designation and Reorganisation of Promotion Areas, Promising Areas - Link

[11] METI (2024) Cabinet Decision on the Bill for the Act for Partially Amending the Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities – Link

the official approval of the project will be granted, provided the outcome of the consultation between all interested parties, such as fishermen and shippers, is positive.

To advance offshore wind projects and meet its targets, the Japanese government has established the Green Innovation (GI) Fund Programme and the GX Supply Chain Enhancement Programme. The GI Fund is a long-term funding scheme supporting innovation in green technologies like hydrogen and carbon capture, driving private investment to accelerate the low-carbon transition. The GX Supply Chain Enhancement Programme aims to build resilient, low-carbon supply chains by promoting green transformation across industries through substantial investment, development of green energy technologies like hydrogen and the implementation of an emissions trading system (ETS). Together, these government-backed initiatives support Japan's leadership in offshore wind technology development.

1.3. South Korea

South Korea's has significant technical potential for offshore wind, estimated at 624 GW, with floating offshore wind accounting for 546 GW of this total.[12] As of today, the country's total installed offshore wind capacity is 245 MW.

In 2025, South Korea finalised its 11th Basic Plan on Electricity Supply and Demand, setting ambitions targets of 78 GW of renewable capacity by 2030 and 121.9 GW by 2038. While the plans do not specify a dedicated offshore wind target, they include an overall goal of 18.2 GW by 2030 and 40.7 GW by 2038 for the wind sector.[13]

This builds on the government's earlier ambition of reaching 14.3 GW of offshore wind capacity by 2030. With only 0.25 GW of offshore wind capacity installed operating today, achieving these goals will require a major scale-up in supply chain capacity, creating opportunities for both the local and international industry. According to the Carbon Trust' South Korean Supply Offshore Wind Chain study, the market would require an investment of over KRW 132 trillion by 2035 to reach a 35 GW of offshore wind capacity by 2035, highlighting the significant economic opportunity that exists in the market.[70]

There is clear interest in the South Korean market and projects in development, and therefore barriers are not a lack of pipeline, but rather slow development procedures. On 27 February 2025, the Special Act on the Promotion of Offshore Wind Power Distribution and Industrial Development (Offshore Wind Promotion Act) was passed, introducing a government-led approach to licensing and permitting for offshore wind. This replaces the previous 'open door' policy, aiming to streamline regulatory processes and accelerate industry development.[14] If effectively implemented, the new framework has the potential to shorten development timelines significantly, stimulate investment and accelerate deployment of offshore wind needed to meet South Korea's ambitious targets.

There is no formal local content requirement in South Korea, but bid evaluations apply an equal weighting between price and non-price criteria. The non-price criteria include industrial economic

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[12] GWEC (2021) Offshore wind technical potential in South Korea – Link

[13] Yonhap News (2025) South Korea finalised 11th Basic Plan on Electricity Supply and Demand – Link

[14] Riviera (2025) Korea's Offshore Wind Promotion Act approved by National Assembly – Link

effects, such as contributions to the local supply chain, safety considerations, and public impact, as well as community acceptance and facility maintenance.[15]

1.4. Taiwan

Taiwan plays a key role in the development of offshore wind in Asia as it strives to achieve a Net Zero society by 2050. With a current installed capacity of 3.2 GW, the government aims to triple installed capacity to 10.9 GW of offshore wind capacity by 2030.[16] The market's technical potential in Taiwan is estimated at 494 GW in total, of which 427 GW are floating wind.[17] While the country's first floating offshore wind project is still yet to be installed, the potential of its deep-water areas highlights significant opportunities expected to arise in the market in the coming decades.

The market's offshore wind sector has experienced significant growth through its competitive auction rounds. Over 10 GW of offshore wind capacity has been awarded in multiple auctions since 2018. The country's third auction round, launched in 2021 to unlock 15 GW of capacity between 2026 and 2035 through three separate bidding phases, is currently in its last phase.[18]

In 2021, Local Content Requirement was introduced for its wind auction, where at least 60% of the components used in offshore wind farm development must be sourced locally, with exceptions made for products and services that were not yet commercially available from the Taiwanese supply chain. However, due to a formal trade complaint from the European Union, citing restrictions on foreign suppliers, the requirement was removed in November 2024. [19]

1.5. Philippines

The Philippines is forecasted to have a technical potential for over 178 GW of offshore wind, with up to 21 GW projected to be installed by 2040 in its high growth scenario.[20] There are, however, no operational offshore wind projects in the country to date. The government of the Philippines has set ambitious renewable energy targets, aiming to increase the share of renewables from 22% in 2023 to 35% by 2030, 50% by 2040, and over 50% by 2050. The Philippine Energy Plan (PEP) 2023–2050 outlines two Clean Energy Scenarios (CES) to achieve these goals:

- CES 1: 19 GW of operational offshore wind and 26 GW of onshore wind by 2050.
- CES 2: 50 GW of operational offshore wind and 15 GW of onshore wind by 2050.[21]

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[15] Norton Rose Fulbright (2024) Global offshore wind: South Korea – Link

[16] 4C Offshore (2025) Offshore Wind Farms Intelligence – Link

[17] GWEC (2021) Offshore Wind Technical Potential in Taiwan – Link

[18] Norton Rose Fulbright (2024) – Global offshore wind: Taiwan - Link

[19] The Maritime Executive (2024) Taiwan Drops Local-Content Rules, Smoothing the Path for Offshore Wind – Link

[20] World Bank Group (2022) – A Roadmap for Offshore Wind in the Philippines – Link

[21] Philippine Department of Energy (2024) Philippine Energy Plan 2023-2050 – Link

These scenarios are further supported by the Department of Energy (DOE)'s approval in August 2024 of 85.6 GW in wind energy development rights, including 65.12 GW for offshore wind and 20.48 GW for onshore wind.

In June 2025, the DOE launched its Fifth Green Energy Auction (GEA-5), the first auction to focus exclusively on offshore wind, offering 3,300 MW of fixed-bottom capacity. The awarded projects are expected to start delivering power between 2028 and 2030.[22]

In the short term, the DOE is prioritising fixed-bottom offshore wind projects that are more viable under current technical, regulatory, and infrastructure conditions. However, with most of the Philippines' offshore wind technical potential lying in deep waters, the long-term outlook points to a strong focus on floating offshore wind and the inclusion of this technology in future auction rounds is set to be reassessed as the technology matures and global deployment grows.[23]

1.6. Vietnam

According to the World Bank Group, Vietnam has 599 GW of offshore wind potential, of which 261 GW comes from fixed-bottom technology and 338 GW from floating technology. [24] There are, however, no operational offshore wind projects in Vietnam to date, with all the installed wind capacity currently coming from onshore and intertidal wind projects. [25,26] Intertidal or nearshore offshore wind farms are located in shallow waters close to shore.

Vietnam has set ambitious climate commitments and renewable energy targets to drive offshore wind development. The National Climate Change Strategy to 2050 (NCCS) outlines a goal of achieving Net Zero emissions by 2050,[27] while the revised Power Development Plan VIII (PDP8) (2025) aims to install 6–17 GW offshore wind capacity by 2030–2035, with a significant scale-up to up to 139 GW by 2050.[28]

Despite the ambitious targets, the Vietnamese government is yet to establish a dedicated seabed leasing process, with existing offshore wind projects in early development stages and without having secured site exclusivity.

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[22] Philippine Department of Energy (2025) DOE Kicks Off Green Energy Auction for Fixed-Bottom Offshore Wind - Link

[23] offshoreWIND.biz (2025) First Offshore Wind-Focused Auction Launched in Philippines – Link

[24] World Bank Group (2021) Offshore Wind Technical Potential in Vietnam – Link

[25] 4C Offshore (2025) Offshore Wind Farms Intelligence: Country Explorers – Vietnam; Filter: Partially Generating/Under Construction and Fully Commissioned – Link

[26] GWEC (2024) Building the Asia Pacific Wind Energy Supply Chain for a 1.5°C World

[27] GWEC (2024) GWEC Report Outlines Crucial Next Steps for Vietnam to Scale Investment and Achieve Offshore Wind Targets – Link

[28] World Bank (June 2025) A framework for private sector-led offshore wind projects in Vietnam – Link

2. Japan's offshore wind supply chain

2.1. Key strengths in Japan's offshore wind sector

The Japanese market has long demonstrated a strong and technologically advanced industrial base, particularly in steel manufacturing, materials and electrical systems. These strengths have enabled the build out of the necessary capabilities to advance its offshore wind sector, namely in the areas of substructure manufacturing, mooring systems and electrical systems.

Companies operating in Japan demonstrate extensive expertise in the design and fabrication of large-scale steel structures such as ships and bridges, which reinforces the strengths of the supply chain in the manufacturing and processing of jacket foundations and floating substructures.

Japan's materials sector, including its advanced chemical fibre and iron and steel sectors, is another element that can be leveraged to respond to the expected demand from floating offshore wind. By combining material manufacturing technologies with processing expertise, Japan is well-positioned to lead in the production of mooring system components such as synthetic fibre ropes and mooring chains.

Furthermore, the market's electrical and machinery industries hold global technological competitiveness, providing a strong technological advantage in the electrical system sector, particularly in the manufacturing of submarine cables and substation equipment.

It should be noted that this study excludes an analysis of the industry status for wind turbine manufacturing, installation, and operation and maintenance (O&M). Japan lacks domestic large-scale wind turbine manufacturers, and project management, O&M, and decommissioning are inherently localised activities, as detailed in Figure 3. Nonetheless, this exclusion does not imply that Japanese industries lack competitiveness or expansion potential in these areas.

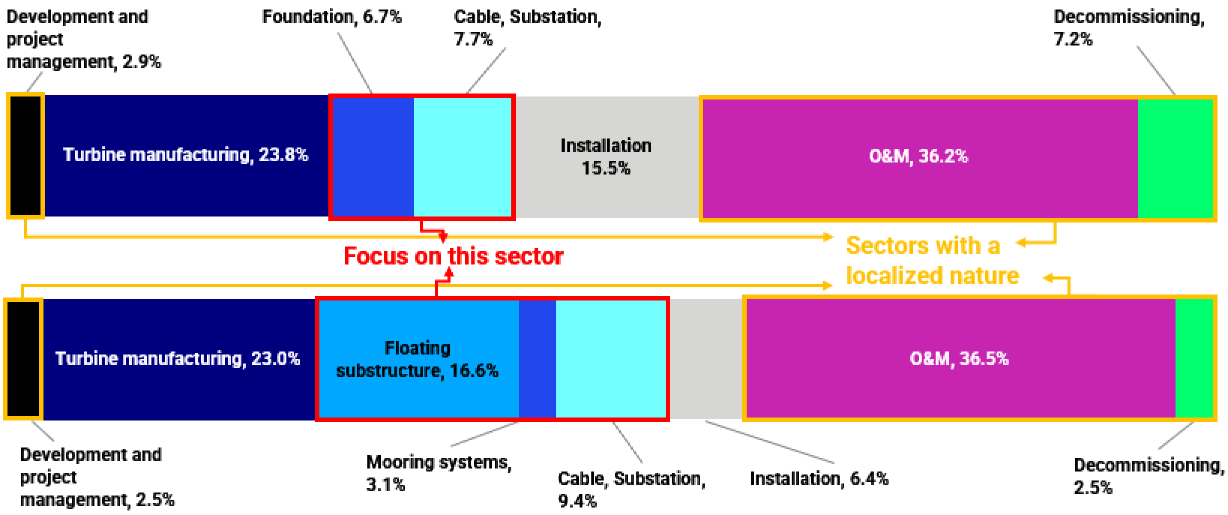

Figure 3. Cost breakdown of offshore wind (top: fixed-bottom, bottom: floating)[29]

[29] BVGA (January 2019) Guide to an Offshore Wind Farm – Link

2.1.1. Methodology for research and analysis

Based on publicly available information and the results of interviews with experts and major domestic suppliers, a quantitative assessment was conducted to evaluate the potential for expansion into the Asian market for each sector. This assessment used six evaluation parameters and corresponding scoring criteria (Table 1). Based on these initial scores, an overall score for the export opportunity was assigned. (Table 2). This analysis is accompanied by a qualitative assessment of the strengths of Japanese industries in each sector, as well as the opportunities and challenges for expansion into the Asian market.

Table 1. Assessment parameters and scoring criteria

Assessment parameter	Score	Scoring criteria
Track record of introducing related products outside the offshore wind sector	0	No supply record in related fields to the Japanese or overseas market
	1	Some supply record in related fields to the Japanese or overseas market
	2	Extensive supply record in related fields to the Japanese or overseas market
Track record of deployment in the Japanese offshore wind market	0	No supply record to the Japanese offshore wind market to date
	1	Supply record to the Japanese offshore wind market to date (demonstration projects)
	2	Supply record to the Japanese offshore wind market to date (commercial projects)
Track record of deployment in overseas offshore wind market	0	No supply record to overseas offshore wind market to date
	1	Supply record to overseas offshore wind market to date (demonstration projects)
	2	Supply record to overseas offshore wind market to date (commercial projects)
Product competitiveness in the Asian offshore wind market	0	Challenges exist in Product Competitiveness in both the Japanese and Asian market
	1	Product Competitiveness exists in the Japanese market, but challenges remain in the Asian market
	2	Product Competitiveness exists in both the Japanese and Asian market
Technological competitiveness in the Asian offshore wind market	0	Challenges exist regarding the competitiveness of the technology in the Japanese and Asian market
	1	The technology is at a comparable level to competitors in the Japanese and Asian market
	2	The technology has a clear competitiveness in the Japanese and Asian market
Status of R&D and facility investments	0	No initiatives in R&D or facility investments
	1	R&D initiatives exist, but no investments in commercial facilities
	2	R&D initiatives exist, with a track record or plans for investments in commercial facilities

Table 2. Overall evaluation and criteria

Strengths and export potential of Japanese suppliers	Evaluation criteria
High	Clear strengths, with high potential for expansion into the Asian market **Total score: 10 points or more**
Medium	Some challenges exist, but there is potential for expansion into the Asian market **Total score: 6–9 points**
Low	Low potential for expansion into the Asian market **Total score: 5 points or less**

2.2. Strengths of Japanese industry and potential challenges for expansion into the Asian market

Japanese companies demonstrate strong technological capabilities and high product quality across various segments of the offshore wind supply chain, providing them with a competitive advantage for expansion into other Asia markets. Nevertheless, challenges reaming in ensuring cost competitiveness and ensuring sufficient manufacturing capacity to meet the region's growing demand.

Enhancing visibility of future domestic market growth and providing policy support aligned with the offshore wind market expansion by the Japanese government will be key to enabling Japanese companies to expand into new markets. Clear market outlooks and a steady pipeline of projects are critical to reduce risk, attract investment in manufacturing facilities and workforce and achieve cost reductions in line with the pace of market growth. To realise these outcomes, all stakeholders across the offshore wind value chain, including the Japanese government, must actively be involved, acknowledging these opportunities and challenging while promoting a sustainable and stable industry environment.

Based on publicly available information and the results of interviews with experts and major domestic suppliers, we assessed and analysed the strengths of Japanese industries in each sector and the potential and challenges for expansion into other Asian markets. A summary of the analysis results is presented in Table 3.

Table 3. Summary of strengths of Japanese offshore wind supply chain and its potential and challenges for expansion into other Asian markets[30]

Sector	Strengths of Japanese industry	Strengths and export potential of Japanese suppliers	Potential and challenges for expansion into the Asian market
Floating substructure manufacturing	· Japanese companies have know-how in shipbuilding and in the manufacturing of large-scale heavy steel structures. · Active R&D and infrastructure investments. · Potential for advancements in large-scale production technologies through Japan's market expansion.	Medium	· Production in collaboration with local partners, leveraging Japan's technological capabilities and quality, will be essential to ensure competitiveness in other Asian markets. · Expansion of the Japanese market in the future may constrain manufacturing capacity, limiting supply to the Asian market in order to prioritise domestic demand. · If Japanese industrial standards differ from those of the Asian market, adaptation measures will be required.
Fixed-bottom foundation manufacturing	· Potential strengths in assembly technology, high quality, and earthquake-resistant design for complex jacket foundations. · Extensive track record in the fabrication of steel structures for offshore wind to in other Asian countries.	Medium	· Production in collaboration with local partners, leveraging Japan's technological capabilities and quality, will be essential to ensure competitiveness in other Asian markets. · If Japanese standards differ from those of the Asian market, adaptation measures will be required.
Mooring system – Synthetic fibre ropes	· Experience in producing high-quality ropes through the integration of cutting-edge material manufacturing and processing technologies. · Potential differentiate by developing high-strength, durable ropes that enhance the product value.	Medium	· Manufacturing large-diameter and long-length ropes for deep-water applications will require technological development and investment in facilities. · As the Japanese market is expected to expand in the future, strengthening production capacity will be essential to supply other Asian markets.

[30] Prepared by MRI based on interview results and public information. Evaluation is limited to companies with manufacturing bases in Japan

Sector		Strengths of Japanese industry	Strengths and export potential of Japanese suppliers	Potential and challenges for expansion into the Asian market
	Mooring chains	• Only four manufacturers worldwide are capable of producing large-diameter steel chains. • The quality of Japanese mooring chains is highly valued by the oil and gas industry.	Medium	• Investments in manufacturing facilities will be necessary for the manufacturing of large-diameter chains. • As the Japanese market is expected to expand in the future, strengthening production capacity will be essential to supply other Asian markets.
Export cables	Static cables	• Extensive track record of installations in offshore wind market, both domestically and internationally. • Strong technological know-how in long-distance high-voltage direct current (HVDC) transmission systems.	High	• To enhance competitiveness in the Asian market, providing comprehensive solutions such as anomaly detection and emergency restoration will be key to increasing the added value of components.
	Dynamic cables	• Advanced technological capabilities in high-voltage and large-capacity solutions. • Existing R&D and infrastructure investments for technological development.	Medium	• Leveraging technological competitiveness, securing an early share of the Asian market will be key
Substation equipment		• Advanced technological capabilities in heavy electric machinery. • Ongoing R&D focus on floating substations and converter stations.	Medium	• At-sea experience may pose challenges to the development of the sector.

2.2.1. Floating substructure manufacturing

2.2.1.1. Potential of the Japanese supply chain for floating substructures

Since the late 2000s, there have been significant investments in the floating offshore wind sector in Japan. These investments have mainly focused on the development of floating substructures, leveraging the existing engineering capabilities in the design and production of large scale streel structures, and have been promoted by the government, through programmes as the Fukushima Forward project, the demonstration project off the coast of Goto city, Nagasaki prefecture, the Green Innovation Fund (GI Fund), as well as earlier New Energy and Industrial Technology Development Organization (NEDO) initiatives. These initiatives have built the basis for a strong supply chain for floating substructures, which is now preparing for the large-scale production of these components.

In 2021, the Japan Dredging and Reclamation Engineering Association conducted a survey targeting 43 Japanese shipbuilding companies. Of these, 23 companies indicated the potential to manufacture semi-submersible or spar-type floating substructures, with an estimated total annual manufacturing potential of 1.6 GW.

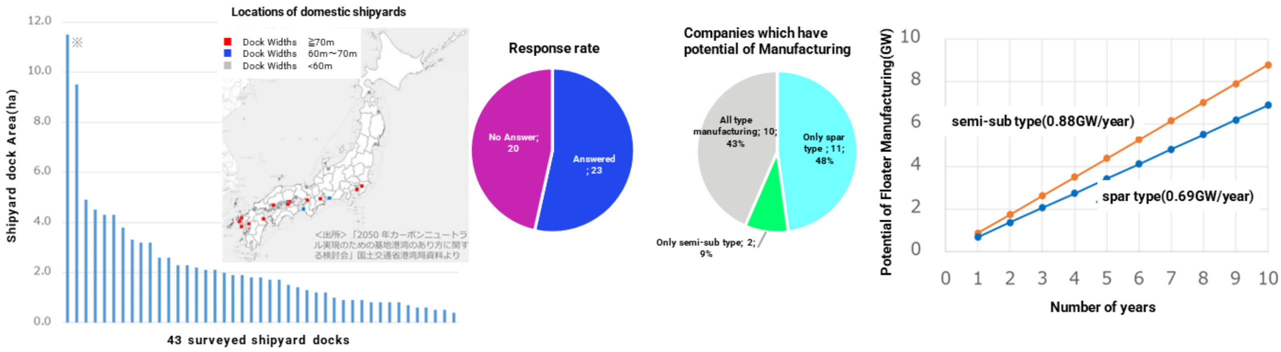

Figure 4. Survey results of companies with shipyard docks (Ministry of Land, Infrastructure, Transport and Tourism)[31]

While shipbuilding docks are well-suited for floating substructure manufacturing and important players for the Japanese market, the number of docks wider than 90 meters, necessary for the final assembly of large-scale floating substructures, are limited and concentrated in western Japan (Figure 5). Most of the potential offshore wind areas, however, are located in the northern part of the country. When considering the fabrication of floating substructures using shipyards docks, however, it is necessary to account for not only its technical suitability, but also for dock availability. In recent years, strong demand from the commercial shipbuilding market has resulted in fully occupied docks, suggesting that capacity constraints may limit the availability for the manufacture supply floating offshore wind and pose challenges to the large-scale production of floating substructures relying solely on shipyards.

In response to this challenge and to realise alternative solutions for using facilities other than shipyards, Japanese companies and overseas companies are developing designs and manufacturing and assembly methods for floating substructures that can be fabricated in modules and transported to ports

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[31] MLIT (December 2021) 4th Meeting on the Role of Base Ports for Achieving Carbon Neutrality by 2050 Document 3 On the Role of Base Ports for Floating Offshore Wind Facilities – Link

near project sites where final assembly takes place, as highlighted in Figure 6. This strategy could facilitate the expansion of the supply chain capacity for floating substructure manufacturing and provide additional flexibility for the assembly of floating units at multiple sites.

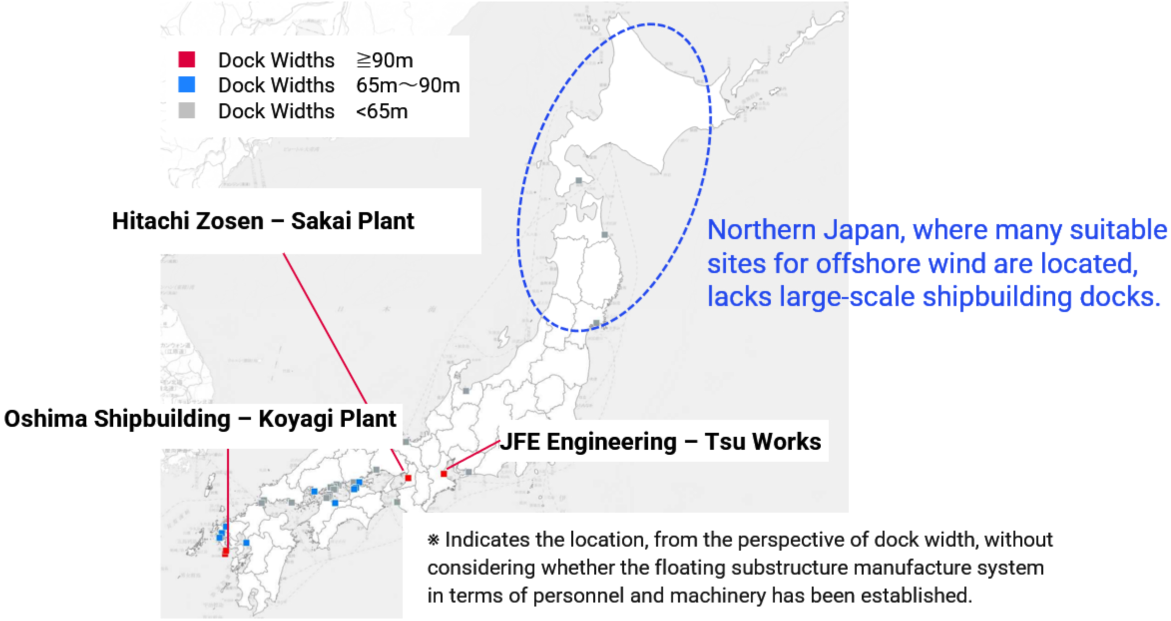

Figure 5. Map of shipbuilding docks and its dock width across Japan[32]

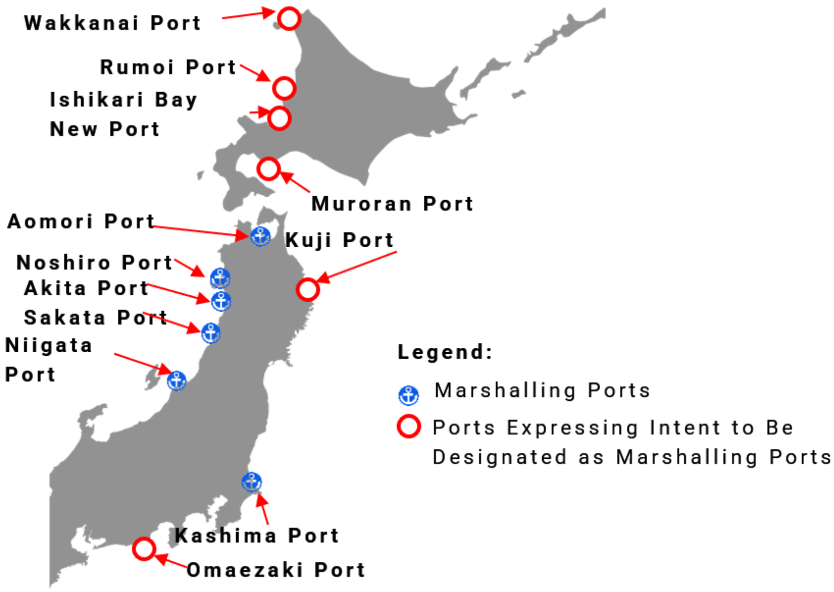

Figure 6. Location status of marshalling ports (including candidates) in northern Japan[33]

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[32] Ministry of Land, Infrastructure, Transport and Tourism (May 2023) 1st Study Group on the Role of Ports in Promoting Offshore Wind Power Deployment Material 3 with partial additions by Mitsubishi Research Institute

[33] Ministry of Land, Infrastructure, Transport and Tourism (September 2022) Ports (Wharves) with Intentions for Designation as Marshalling Ports p.2 prepared by Mitsubishi Research Institute

2.2.1.2. Key players in the floating substructure manufacturing sector and interview results

Table 4 provides an overview of the some of the major players in the floating substructure manufacturing sector in Japan.

Table 4. Key players in the floating substructure manufacturing in Japan[34]

Company name	Summary
Japan Marine United	• The company owns shipbuilding docks wide enough to assemble large floating substructures and has a track record of manufacturing floating substructures for turbines and the substation for the Fukushima Floating Offshore Wind Demonstration Project. • It is considering overseas expansion of floating substructures and has been selected for Phase 2 of the GI Fund program, under which it is planning a demonstration project aimed at the large-scale production of floating offshore wind substructures.
Kanadevia	• The company owns shipbuilding docks wide enough to assemble large floating substructures and has a track record of manufacturing barge-type floaters for turbines currently in commercial operation off the coast of Hibikinada, Kitakyushu. • It has been selected for Phase 2 of GI Fund program and is planning a demonstration project aimed at the large-scale production of floating substructures.
Oshima Shipbuilding	• The company owns shipbuilding docks wide enough to assemble large floating substructures. It has been selected for the GX Supply Chain Enhancement Program[35] and is receiving support for investments in floating substructure manufacturing capacity.
Sumitomo Heavy Industries	• The company owns production facilities capable of manufacturing modules for floating substructures. It has established a dedicated project team to strengthen its fixed-bottom foundation and floating substructure manufacturing business, and is strengthening its production system.

[34] Prepared by MRI based on publicly available information from each company

[35] Subsidy program to support the establishment of a domestic manufacturing supply chain in the GX field, aimed at achieving carbon neutrality by 2050 and enhancing international competitiveness.

Company name	Summary
Sumitomo Corporation & JGC Holdings Corporation	• The company plans to build a floating offshore wind supply chain focused on cost reduction, efficiency, and large-scale production.
Nippon Steel Engineering	• The company has been selected for the GX Supply Chain Enhancement Program by METI and is receiving support for investments in floating substructure manufacturing capacity.

Some of these companies were interviewed to gather their views on the strengths of Japanese industries and the potential and challenges for expansion into other Asian markets. The results of the interviews are summarised in Table 5.

The interviewees highlighted the Japanese industry's strengths in large steel plate processing technologies, leveraging its established industrial base, but emphasized that collaboration with overseas suppliers will be essential for enhancing cost competitiveness.

In addition, it was noted that the establishment of a supply chain for floating substructure manufacturing is still at an early stage, and there is a significant gap between the manufacturing capacity required to meet Japan's installation targets and the actual capacity available. Therefore, it was pointed out that if the Japanese market takes off first, in comparison to other Asian markets, the capacity available for overseas projects may be limited, as priority would naturally be given to meeting domestic demand.

Table 5. Interview results[36]

Japan's technological competitiveness: processing technologies leveraging the existing industrial base
• The Japanese supply chain has strengths in large steel plate processing technologies through its shipbuilding and bridge industries. • Designs that improve the efficiency of assembly work are being explored.
Cost competitiveness: collaboration with overseas suppliers is essential
• To enhance cost competitiveness, approaches such as final assembly in existing shipbuilding docks and establishment of large-scale, high-speed manufacturing system based on partial utilisation of low-cost overseas modules and collaboration with neighbouring countries can be considered.
Manufacturing capacity: priority given to domestic demand in Japan
• If the Japanese market takes off first, priority will be given to meeting domestic demand, therefore limiting the manufacturing capacity available for overseas expansion.

[36] Prepared by MRI based on interview results.

- To enhance domestic module supply capacity, developing floating substructure designs compatible with automated manufacturing equipment will be effective.

Entry into the Asian market: high potential for expansion into Taiwan

- There are opportunities for Japanese companies to enter and establish a presence in the Taiwanese market. Given its relatively small market size, technology transfer to local partners, rather than building local factories, is anticipated.
- In contrast, entry into the Korean and Chinese market will be difficult due to well-established strong public–private partnerships.
- While JIS/ NK standards are adopted in Japan, European standards such as DNV are adopted in Asian countries, requiring adaptation of Japanese designs and manufacturing methods.

2.2.1.3. Strengths of the Japanese industry for floating substructures and its potential and challenges for expansion into the Asian market

By leveraging the Japanese industry's expertise in shipbuilding and the fabrication and processing of large-scale heavy structures, as well as expanding its manufacturing capacity and collaborating with local partners, Japanese offshore wind suppliers have the potential to be a key player in the floating offshore wind industry in other Asian markets.

The potential for expansion in the floating substructure manufacturing sector received an overall evaluation of "Medium" (total points: **7 points**). The strengths of Japanese industries, along with the potential challenges for expansion are summarised in Table 6.

The supply chain for floating substructure manufacturing is still at an early stage in the whole Asia region, and supply from Japanese manufacturers to its emerging market is likely to take priority, limiting availability of supply to other Asian markets. To promote capacity expansion, it is essential to improve visibility on the long-term project pipeline and ensure alignment of government industrial development policies to attract investment in manufacturing capacity and technology development initiatives.

Overall evaluation result: Medium (Total points: 7)

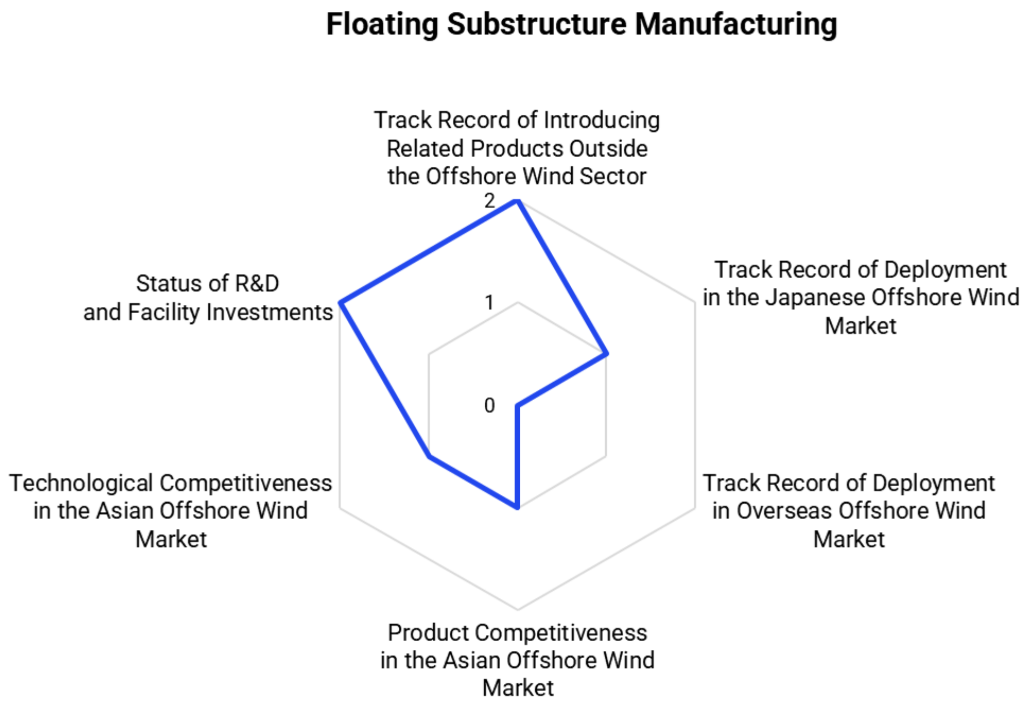

Figure 7. Potential for expansion of floating substructure manufacturing in the Asian offshore wind market[37]

Table 6. Strengths of Japanese supply chain for floating substructures and its potential and challenges for expansion into other Asian markets[38]

Strengths of Japanese industry	• Japan has a thriving shipbuilding industry and advanced capabilities in the fabrication and processing of large-scale heavy steel structures, giving it expertise in module manufacturing, assembly, and efficiency improvement. • Japan also has significant potential for floating offshore wind, and in line with the government's target of forming projects exceeding 15 GW of floating offshore wind by 2040, active R&D and facility investments are being undertaken. • Among Asian countries, Japan is likely to take the lead in the floating offshore wind market along South Korea, with the potential for large-

[37] Product competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

[38] Prepared by MRI based on interview results and public information.

	scale production technologies to advance as the domestic market develops.
Potential and challenges for expansion into the Asian market	• Many countries in Asia lack an industrial base capable of supporting GW-scale projects. Collaboration with local partners, leveraging Japan's technological capabilities and quality, can help overcome this limitation. • The manufacturing capacity of shipyards is influenced by the demand from the shipbuilding industry. With the anticipated expansion of the Japanese floating offshore wind market, capacity may become constrained, limiting supply to other Asian markets. • To enhance supply capacity, developing floating substructure designs compatible with automated manufacturing equipment will be effective. • If Chinese or Korean companies enter the Asian market, cost competitiveness will likely become a key challenge. • Differences between JIS and NK standards adopted in Japan and European standards used in many Asian countries may require adjustments to Japanese designs and manufacturing methods.

2.2.2. Fixed-bottom foundation manufacturing sector

2.2.2.1. Potential of the Japanese supply chain for fixed-bottom foundations

Advanced engineering capabilities in large-scale heavy steel structures are a key strength of the Japanese industry. These capabilities can be leveraged in the design and production of jacket foundations, which need to be engineered to withstanding extreme natural events such as earthquakes and typhoons, prevalent in the Asia-Pacific region.

To leverage this know-how and engineering expertise for expansion into Asia market, continued efforts to improve cost competitiveness will be essential, including utilization of low-cost modules produced overseas and the development of a global supply chain in collaboration with neighbouring countries. Difference in standards and country-specific risks present additional challenges that must be addressed to compete effectively with foreign manufacturers.

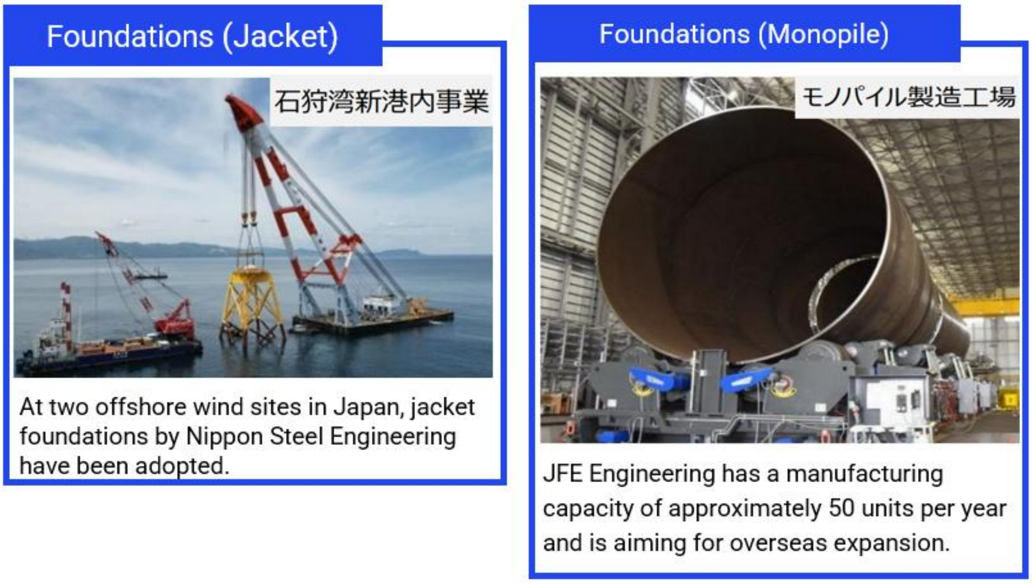

Figure 8. Status of domestic production of fixed-bottom foundations[39]

Site name	Output Capacity (MW)	Number of Installed Units	Start of Operation
Ishikari Bay New Port Offshore Wind Farm	112	14	2024/1
Hibikinada Offshore Wind Farm	225	25	Within FY2025

Figure 9. Projects in which jacket foundations have been adopted[40]

[39] Ministry of Economy, Trade and Industry (November 2024) 71st Subcommittee on Large-scale Introduction of Renewable Energy and Next-generation Power Networks Material 1: Summary of Discussions to Date for the Formulation of the Next Strategic Energy Plan (Renewable Energy-related) p.152 prepared by Mitsubishi Research Institute

[40] Nittetsu Engineering (n.d.) Offshore wind power generation facilities – Link

2.2.2.2. Key players in the fixed-bottom foundation manufacturing sector and interview results

Table 7 provides an overview of the some of the major players in fixed-bottom foundation manufacturing sector in Japan.

Table 7. Key players in the fixed-bottom foundation supply in Japan[41]

Company Name	Summary
JFE Engineering	• The company began manufacturing monopile foundations in 2024. Its annual production capacity is 80,000 to 100,000 tons, equivalent to approximately 50 monopile foundations
Nippon Steel Engineering	• The company has a track record of manufacturing 14 jacket foundations for 8 MW turbines and 25 jacket foundations for 9.5 MW turbines. • It has been selected for the Ministry of Economy, Trade and Industry's GX Supply Chain Enhancement Program and is receiving support for facility investments toward floating substructure manufacturing.
Sumitomo Heavy Industries	• The company owns production facilities capable of manufacturing transition pieces for fixed-bottom foundations. It has established a dedicated project team to strengthen fixed-bottom foundation/floating substructure manufacturing business and is strengthening its production system.

Some of these companies were interviewed to gather their views on the strengths of Japanese industries and the potential and challenges for expansion into other Asian markets. The results of the interviews are summarised in Table 8.

While Japanese suppliers have expertise in earthquake-resistant design technology, to ensure cost competitiveness, the establishment of a global supply chain that includes collaborative manufacturing system with neighbouring countries, such as procuring lower-cost modules from other markets, would be effective. However, it was also noted that in the Asian market, country risks such as incompatibility of standards and changes in regulations present barriers.

[41] Prepared by MRI based on publicly available information from each company

Table 8. Interview results[42]

Japan's technological competitiveness: earthquake-resistant design
• The Japanese industry has strengths in earthquake-resistant design, offering potential for business expansion in Asian countries where seismic requirements exist.
Cost competitiveness: collaboration with overseas suppliers is essential
• To improve cost competitiveness, the use of low-cost modules produced overseas can be one of the possible options. • To meet the growing demand in both domestic and international markets, strengthening domestic supply capacity and building a global supply chain which includes collaborative manufacturing system with neighbouring countries, is seen as an effective approach.
Entry into the Asian market: addressing country risks and standards compatibility
• Asian countries present high country risks such as regulatory changes and local content requirements. • Many countries adopt European standards, which may pose challenges for compatibility with Japanese standards in areas such as welding and coating. If Japanese standards differ from those of the Asian market, adaptation measures will be required.
Market development policy: domestic priority, but considering expansion into the Asian market
• Priority will be given to supplying the Japanese market, but if the launch of the Japanese market is delayed, overseas expansion may be pursued ahead of time. In this scenario, Taiwan is seen as the most promising market, since jacket foundations are more commonly adopted than monopile foundations due to factors such as water depth, geological conditions, and environmental awareness.

2.2.2.3. Strengths of the Japanese industry for fixed-bottom foundations and its potential and challenges for expansion into the Asian market

The engineering expertise, particularly in seismic design, and the high quality of jacket foundations manufactured in Japan represent a competitive advantage that fixed-bottom foundation manufacturers can leverage to expand their production capacity into other Asian markets.

This potential for expansion received an overall evaluation of "Medium" (**total score: 8 points**). The strengths of Japanese industries, along with the potential challenges for expansion are summarised in Table 9.

[42] Prepared by MRI based on interview results.

Overall evaluation result: Medium (Total points: 8)

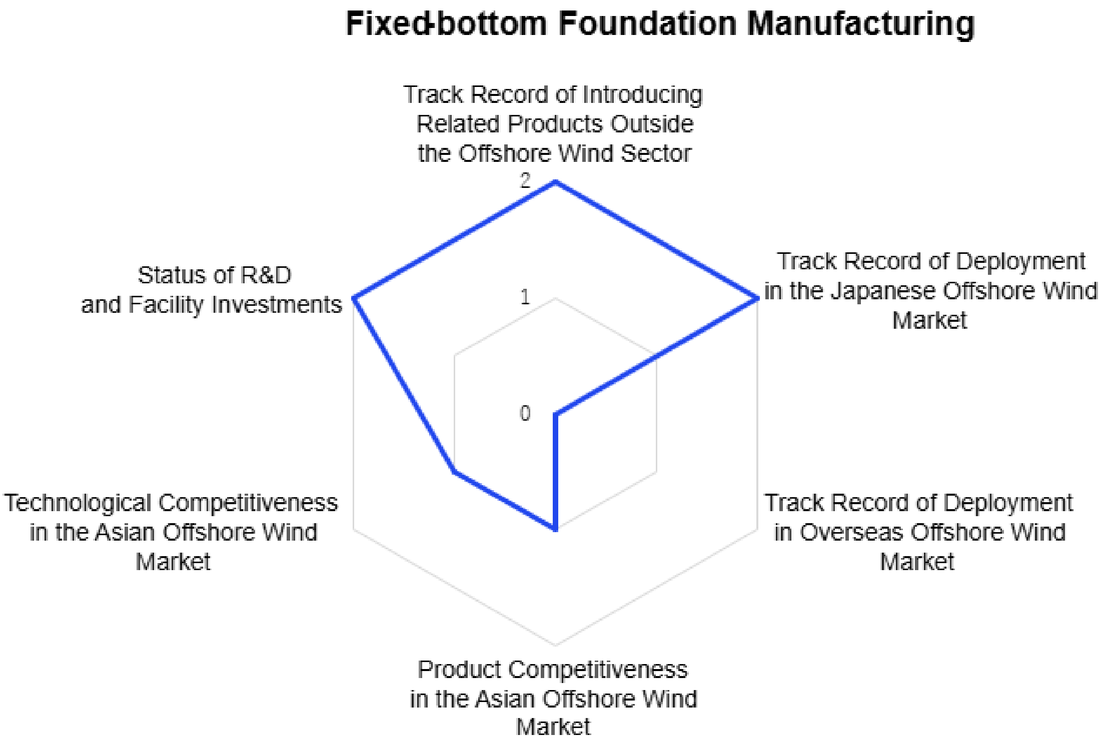

Figure 10. Potential for expansion of fixed-bottom foundation manufacturing in the Asian offshore wind market[43]

Table 9. Strengths of Japanese supply chain for fixed-bottom foundation manufacturing and its potential and challenges for expansion into other Asian markets[44]

Strengths of Japanese industry	• Particularly for jacket foundations, which have complex structures, the assembly technology and high quality delivered by Japanese companies represent a significant strength. • In the field of earthquake-resistant design, Japanese companies have the potential to demonstrate technical expertise not found in other countries. • Japanese companies also have extensive experience in manufacturing offshore steel structures in other Asian countries, and facility investments are being made through the GX Supply Chain Enhancement Program.

[43] Product competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

[44] Prepared by MRI based on interview results and public information.

Potential and challenges for expansion into the Asian market	• Cost competitiveness is essential to secure a competitive advantage in Asia. • If low-cost supply chains can be built in collaboration with supply chain companies in other markets, Japan may be able to leverage its technological strengths to enter the Asian market. • Differences between JIS standards adopted in Japan and European standards used in many Asian countries may create challenges in terms of compatibility of designs and manufacturing methods for areas such as welding and coating.

2.2.3. Mooring system sector

2.2.3.1. Potential of the Japanese supply chain for mooring systems

Japanese companies have strong capabilities in manufacturing high-quality mooring systems, supported by close collaboration between material and equipment manufacturers.

Japan has a well-established chemical fibre industry, and several chemical fibre manufacturers are actively developing materials for synthetic fibre ropes designed for deep-water applications. Chemical material manufacturers and fibre rope manufacturers have established a collaborative framework enabling the production of high-quality ropes that integrate advanced material manufacturing and processing technologies.

Japan has a strong steel industry and its steel manufacturers already have experience collaborating with mooring chain producers to supply high-quality mooring chains for O&G in Europe, the US and Asia. Furthermore, they have even supplied mooring chains for the FOSW demo project

Japan has a strong steel industry, where steel manufacturers collaborate with mooring chain producers to manufacture high-quality mooring chains. Japanese mooring chain companies have supplied products to the oil and gas industries in Europe, the United States, and Asia. Furthermore, they have been involved in the floating offshore wind sector, having supplied the mooring chains for the demonstration project off the coast of Fukushima.

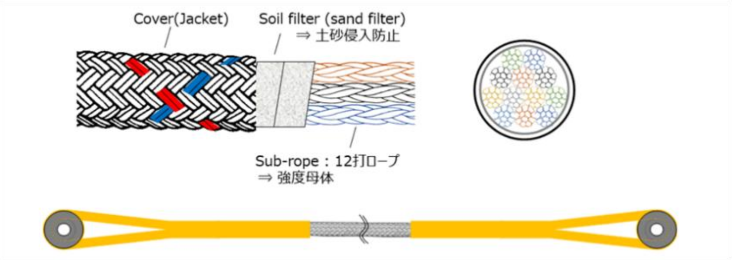

Figure 11. Illustration of fibre ropes for offshore wind[45]

[45] Tokyo Rope MFG Co., Ltd. Fiber Rope News Release (August 2024) Participation in Japan's First Offshore Installation Test of a TLP-type Floating Structure for Offshore Wind Power Facilities in Open Sea Conditions p.2/2.

Figure 12. Ultra-high-strength polyethylene fibre[46]

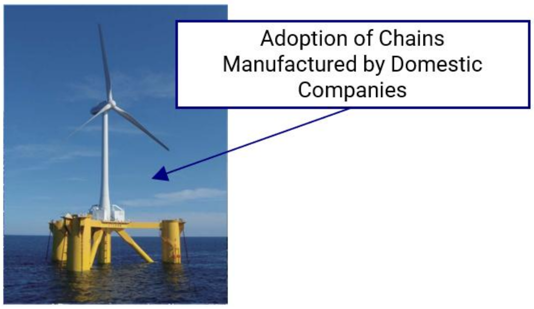

Figure 13. Mooring chains used in the Fukushima floating demonstration project[47]

2.2.3.2. Key players in the mooring system sector and interview results

Table 10 provides an overview of the some of the major suppliers of mooring systems in Japan.

Table 10. Key players in the mooring system supply chain in Japan[48]

Category	Company name	Summary
Mooring chains	Hamanaka Chain Mfg	• The company has a track record of manufacturing steel mooring chains for the Fukushima Floating Offshore Wind Demonstration Project. • It is one of only four companies worldwide capable of producing large-diameter steel chains.
Synthetic fibre ropes	Tokyo Seiko Rope MFG	• The company manufactures synthetic fibre ropes for floating offshore wind and obtained approval in principle (AiP) certification for high-modulus polyethylene (HMPE) ropes from ClassNK in 2024. • It has been selected for Phase 2 of GI Fund program and initiated R&D aimed at demonstration project toward the commercialization of synthetic fibre ropes.

[46] Toyobo MC News Release (August 2024) Participation in Japan's First Demonstration Test of a TLP-type Floating Structure for Offshore Wind Power Generation in Open Sea Conditions p.3

[47] Fukushima Offshore Wind Consortium (n.d.) Fukushima Floating Offshore Wind Farm Demonstration Project Brochure – Link

[48] Prepared by MRI based on publicly available information from each company.

Category	Company name	Summary
	Naroc Rope Tech	• A synthetic fibre rope manufacturer. It has been selected for the GX Supply Chain Enhancement Program and is receiving support for investment in new manufacturing facilities for synthetic fibre ropes for floating offshore wind.
	Teijin	• The company manufactures aramid fibres, which can be used in synthetic fibre ropes and submarine cables for floating offshore wind.
	Toyobo MC	• The company manufactures ultra-high-strength polyethylene fibres used as materials for synthetic fibre ropes. • It has conducted joint R&D on mooring ropes with Tokyo Seiko Rope MFG and obtained type certification for high-modules polyethylene (HMPE) fibre yarn from ClassNK in 2024.

Interviews were conducted with some of these companies to gather their views on the strengths of Japanese industries and the potential and challenges for expansion into other Asian markets. The results of the interviews are summarised in Table 11.

Regarding synthetic fibre ropes, Japan's strength lies in their reliability stemming from high material quality. On the other hand, challenges have been noted in terms of cost competitiveness compared to global manufacturers, limited delivery records for offshore wind projects mainly demonstration projects, and the need to address larger diameters and longer lengths required for 15 MW-class turbines.

Regarding mooring chains, Japan also has a strong reputation for reliability due to high material quality and has an established track record in the oil & gas sector. However, as turbines increase in size, the need for thicker chains may require new capital investments in production facilities.

While the Japanese market for both synthetic fibre ropes and mooring chains is expected to grow in the future, expanding supply to the broader Asian markets will require enhancing manufacturing capacity. In addition, it was noted that for successful expansion into Asia markets, it would be effective for Japanese suppliers to jointly provide integrated packages that include floating substructures, mooring ropes, and anchors.

Table 11. Interview results[49]

Japan's technological competitiveness: high-quality material and performance reliability
Synthetic fibre ropes • Capable of manufacturing small-size ropes with high quality when comparable to overseas products. **Mooring chains** • Japan is home to one of only four chain manufacturers in the world who are capable of producing large-diameter steel chains. These include Asian Star in China, Vicinay in Spain, and Hamanaka Chain Mfg. in Japan, and DaiHan Anchor Chain Mfg. in Korea. • Mooring chains manufactured by Japanese companies have been delivered to oil & gas industry in Europe, the United States, and Asia, with no record of breakage accidents, demonstrating its high standards in terms of quality.
Cost competitiveness: challenges in cost competitiveness, overseas track record, and large-diameter capability
Synthetic fibre ropes • Delivery record for floating offshore wind is limited to domestic demonstration projects, with no overseas deliveries. • Large-scale facilities to handle larger diameters and long-length synthetic fibre ropes required for deep-water applications have not yet been established. • As Japan lacks testing machines for large-diameter ropes, transporting them overseas for testing imposes significant burdens in terms of time and logistics. **Mooring chains** • There is a shortage of experience, manufacturing facilities and testing equipment for the manufacturing large-diameter chains, required for increasingly larger floating offshore wind turbines.
Market development policy: demand for integrated package supply of foundations and mooring system
Synthetic fibre ropes • While expansion into Asia is anticipated over the medium to long term, demonstrating competitiveness with ropes alone is expected to be challenging. • Japanese suppliers should explore the opportunity to collaborate and provide integrated package encompassing floating substructures, mooring ropes, and anchors.

[49] Prepared by MRI based on interview results.

Mooring chains

- Priority will first be given to meeting domestic market demand, with investment expansion to be considered in line with demand growth.

2.2.3.3. Strengths of Japanese industry for synthetic fibre ropes and its potential and challenges for expansion into the Asian market

Japan has strengths in producing high-quality ropes that integrate material manufacturing and processing technologies, but it faces challenges in cost competitiveness, capability to handle larger diameters, and supply capacity.

The potential for expansion of Japan's mooring system supply chain for synthetic fibre rope received an overall evaluation of "Medium" (**total score: 6 points**). The strengths of Japanese industry, along with the potential challenges for expansion into other Asian markets are summarised in Table 12.

Establishing a track record in the domestic market and enhancing technology reliability are critical first steps to ensure the supply chain is ready for overseas expansion. To achieve this, it is essential to ensure clarity around the mid and long-term project pipeline and market demand and to align government support with that demand and its timeline, enabling the necessary investments in research and development, as well as in infrastructure, to drive the deployment of this technology in the market and strengthen its supply chain.

Overall evaluation result: Medium (Total points: 6)

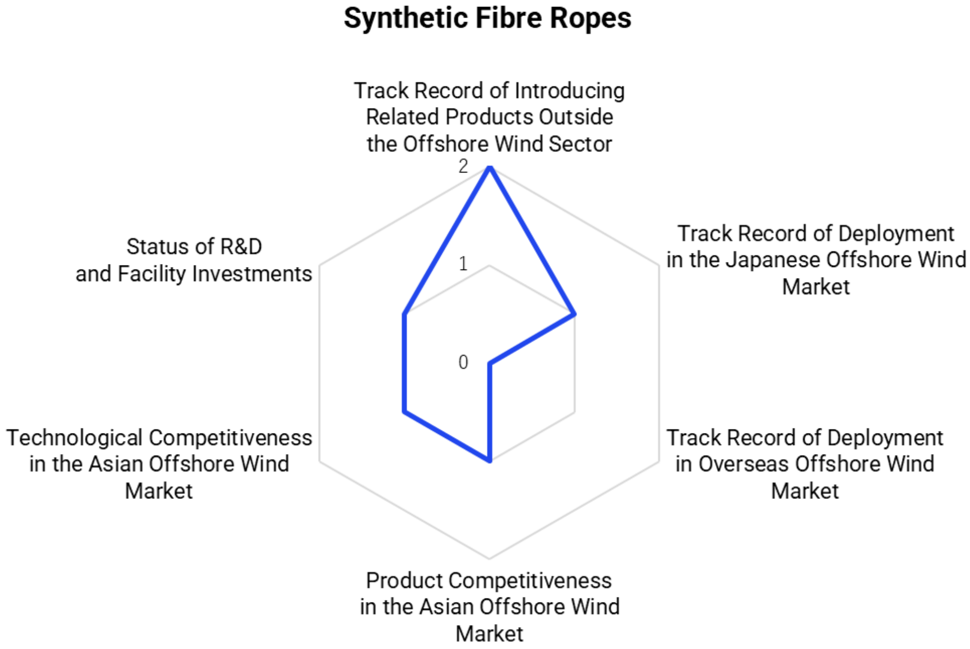

Figure 14. Potential for expansion of mooring system sector (synthetic fibre ropes) in the Asian offshore wind market[50]

Table 12. Strengths of Japanese supply chain for synthetic fibre ropes and its potential and challenges for expansion into other Asian markets[51]

Strengths of Japanese industry	• Japan has strengths in the manufacturing of materials for synthetic fibre ropes. • A collaborative framework between chemical material manufacturers and fibre manufacturers has enabled the production of high-quality ropes that combine advanced material manufacturing and processing technologies. • The development of high-strength, highly durable ropes can add value to products and lead to differentiation in the market.
Potential and challenges for expansion into the Asian market	• The use of larger units, such as 15 MW floating offshore wind turbines, requires the development of larger-diameter mooring ropes. While Japanese companies have the technological expertise to manufacture these components, limited manufacturing experience may present challenges to its expansion into other markets.

[50] Product competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

[51] Prepared by MRI based on interview results and public information.

	• The manufacturing of larger-diameter and long-length mooring ropes required for deep-water applications will require investment in manufacturing facilities. • There are challenges in terms of cost competitiveness compared to overseas manufacturers such as Chinese suppliers. Since raw material costs account for a large proportion of rope production, developing products that utilise lower-cost raw materials will be key. • As the Japanese market is expected to expand in the future, strengthening manufacturing capacity will be essential to supply other Asian markets.

2.2.3.4. Strengths of Japanese industry for mooring chains and its potential and challenges for expansion into the Asian market

The potential for expansion into other Asian markets in the mooring chain sector received an overall evaluation “Medium” (**total score: 7 points**). The strengths of Japanese supply chain and the potential and challenges for expansion into other Asian markets are summarised in Table 13.

Japanese offshore wind suppliers for mooring chain have a strong technical expertise and track record, having supplied high-quality chains to oil and gas facilities in Europe, the United States, and Asia. However, challenges remain in enhancing cost competitiveness, expansion of production capacity and securing investments to enable the manufacturing of larger-diameter chains, required for the next generation of turbines, represent some of the challenges to expanding into other Asian offshore wind markets.

To address these challenges and promote expansion into the Asian markets, it is essential, just as in other parts of the supply chain, that the government ensures clarity on future market demand and to provides support that is aligned with that demand and its timeline.

Overall evaluation result: Medium (Total points: 7)

Figure 15. Potential for expansion of mooring system sector (mooring chains) in the Asian offshore wind market[52]

Table 13. Strengths of Japanese supply chain for mooring chains and its potential and challenges for expansion into other Asian markets[53]

Strengths of Japanese industry	• Japan is home to one is home to one of only four chain manufacturers in the world capable of producing large-diameter steel chains. • Mooring chains manufactured by Japanese suppliers have proved to have a superior quality when compared to overseas products and have an extensive track record in the oil and gas sector.
Potential and challenges for expansion into the Asian market	• If the quality of the components produced by Japanese manufacturers is recognized and the product competitiveness increases, there is potential to increase their market share in Asia. • For 15 MW-class floating offshore wind turbines, requires the production of chains with larger diameters than those used in the oil

[52] Product Competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

[53] Prepared by MRI based on the results of the interview and public information

	and gas sector, which may require new facility investments. Depending on the number of mooring ropes, it may be possible to meet the requirements with the current chain diameters. • As the Japanese market is expected to expand in the future, strengthening manufacturing capacity will be essential to supply other Asian markets.

2.2.4. Electrical system sector

2.2.4.1. Potential of Japanese supply chain for electrical systems

The Japanese industry has advanced technological capabilities in submarine cables and substation equipment, with a track record in the supply of electrical systems for demonstration initiatives and commercial offshore wind projects both domestically and internationally. Notably, for the Fukushima demonstration project, Japanese manufacturers applied their technology to deliver the world's first floating offshore substation.

Japanese players have historically expanded their manufacturing capacity beyond the domestic market. Japanese suppliers already rely on manufacturing facilities based overseas to provide HVDC systems for offshore wind projects around the world.

The GI Fund program is supporting technology development to integrate high-voltage dynamic cables with floating offshore substation and converter stations, building on Japan's existing strong expertise. Through this initiative, the government aims to promote cost reduction in offshore wind by leveraging the combined technologies of Japanese companies.

Project name	Company name
Nemo Link (United Kingdom , Belgium)	Sumitomo Electric
Gwynt y Môr (United Kingdom)	Sumitomo Electric
Fukushima Floating Offshore Wind Power Demonstration Project (Japan)	Furukawa Electric
Ishikari Bay New Port Offshore Wind Farm (Japan)	Furukawa Electric

Submarine cable

Submarine Cable Laying Work

Figure 16. Examples of submarine cable delivery track record[54] [55]

Figure 17. Offshore substation equipment (Fukushima demonstration project)[56]

Figure 18. DC converter equipment[57]

[54] Sumitomo Electric Industries (2021) Receives order from Gwynt y Môr OFTO in the UK for 132kV submarine power cable for offshore wind power generation – Link

[55] Furukawa Electric Co., Ltd. (2024) Delivered submarine cable system to Ishikari Bay New Port offshore wind power generation project (commercial operation started in January this year) – Link

[56] Agency for Natural Resources and Energy (August 2022) Final Report (Summary Version) of the Review Committee on the Demonstration Project for a Floating Offshore Wind Power Generation System off the Coast of Fukushima p.5

[57] Mitsubishi Electric (n.d.) HVDC-Diamond® - Link

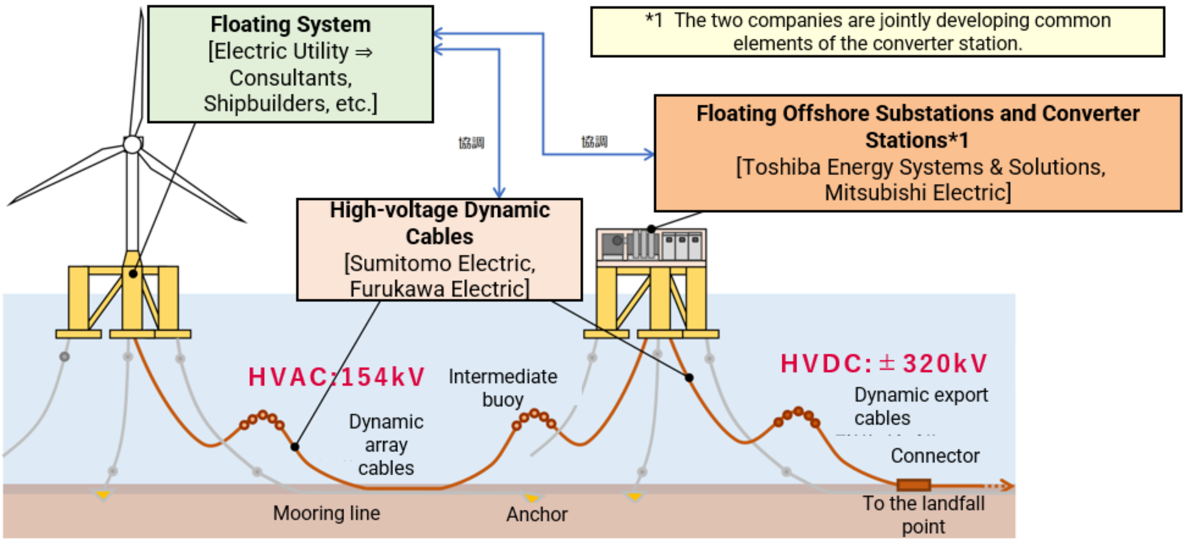

Figure 19. Overview diagram of the electrical system technology development project[58]

2.2.4.2. Key players in the submarine cable sector and interview results

Table 14 provides an overview of the key players in the submarine cable sector in Japan.

Table 14. Key players in the submarine cable sector in Japan[59]

Company name	Summary
Furukawa Electric	• The company has a track record of supplying submarine cables for offshore wind farms located within port and harbour areas. • It has been selected for Phase 2 of GI Fund program and is planning technology development for high-voltage dynamic cables.
Sumitomo Electric	• The company has a track record of delivering high-voltage direct current (HVDC) cables for overseas offshore transmission projects. • The company has a track record of supplying submarine cables for offshore wind farms located within port and harbour areas. • It has been selected for Phase 2 of the GI Fund program and is planning technology development for high-voltage dynamic cables.

58 GI Fund Project Strategic Vision (November 2023) Development of Common Elemental Technologies for Floating Offshore Wind Power (Dynamic Cables, Offshore Substations, Offshore Converter Stations) – Link

59 Prepared by MRI based on publicly available information from each company.

Interviews were conducted with sector participants to gather their views on the strengths of Japanese industries and the potential and challenges for expansion into other Asian markets. The results of these interviews are summarised in Table 15.

Japanese suppliers have strong technical capabilities in the design of submarine cables, namely on high-voltage direct current (HVDC) cables and dynamic cables, with technological development being advanced under the GI Fund project. For alternating current (AC) cables, which have already become commoditised and where technological differentiation is difficult, cost competitiveness remains a challenge.

The supply chain has noted that, in the overseas offshore wind market, the growing trend to separate product procurement and construction work is making differentiation through standalone submarine cables increasingly difficult. Against this backdrop, it was suggested that the Japanese industry could maintain competitiveness by offering integrated solutions such as anomaly detection during operation, prevention of damage accidents by third parties, and emergency restoration support.

Table 15. Interview results[60]

Dynamic cables: upfront investment is key
• Although the market is still small, Japanese companies hold international competitiveness, and demand is expected to increase with the growth of the floating offshore wind market. • Since manufacturing facilities and fundamental technologies are almost identical to those for static cables, differentiation is difficult. • It is necessary to address mechanical fatigue caused by repeated bending due to floating substructure motion and marine biofouling, both of which could become areas of technological differentiation for Japan. Related technologies are currently under development through programs such as the GI Fund. • Addressing future requirements for higher voltage and larger capacity remains a challenge and Japanese companies are taking a cautious approach towards technology development.
Japan's technological advantage: HVDC cables
• Japanese firms hold a technological advantage in the development and manufacturing of long-distance high-voltage direct current (HVDC) transmission assets, especially insulating material technology. • Domestic demand may limit the availability of resources for overseas expansion. • Alternating current (AC) cables have become commoditised, making differentiation in this field difficult for Japanese suppliers.

[60] Prepared by MRI based on interview results.

Construction framework: concerns over separate procurement of products and construction
• In the offshore wind market, separate procurement, where products and installation are contracted separately, is becoming more common, making standalone submarine cable price competition inevitable. • This procurement framework is already being implemented in Europe, Taiwan, and South Korea.
Differentiation strategy: providing comprehensive added value
• Japan lacks competitive advantage in pure price competition, meaning that focusing on differentiation through added value is necessary. • Comprehensive solution offerings, such as anomaly detection during operation, prevention of damage caused by third parties, and emergency restoration response, could serve as effective differentiation points.

2.2.4.3. Strengths of the Japanese industry for static submarine cables and its potential and challenges for expansion into the Asian market

The potential for expansion into other Asian markets in the static cable sector received an overall evaluation "High" (**total score: 11 points**). The strengths of Japanese industries and the potential and challenges for expansion into other Asian markets are summarised in Table 16.

Japan's technological capability in submarine cables is high, particularly demonstrating technological competitiveness in long-distance high-voltage direct current transmission. However, enhancing the added value of products will be key to achieving cost competitiveness in the Asian market.

Overall evaluation result: High (Total points: 11)

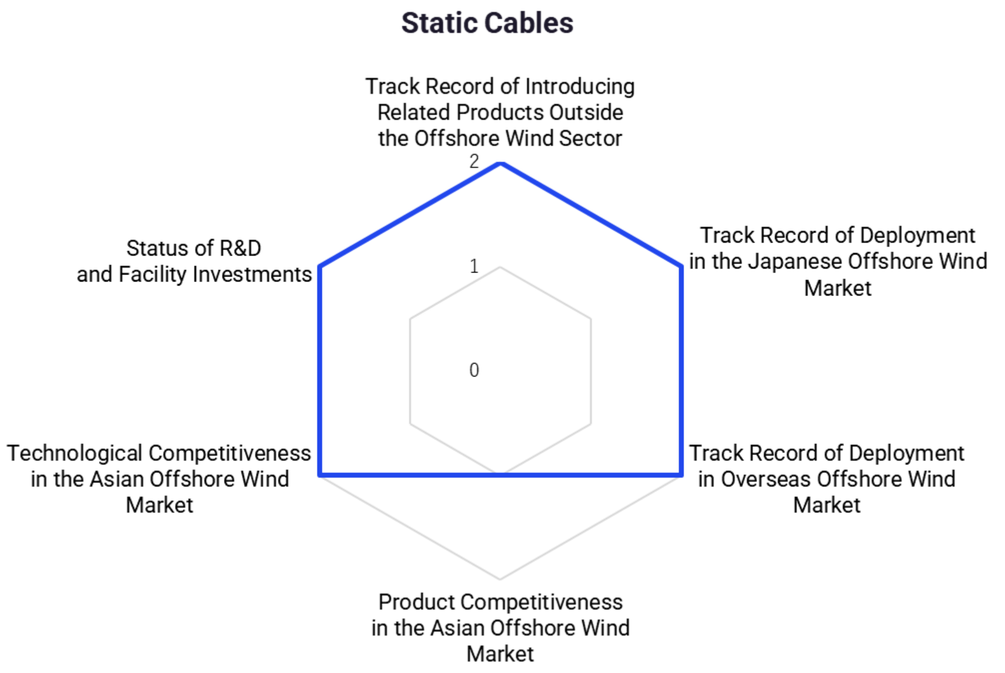

Figure 20. Potential for expansion of the submarine cable sector for static cables in the Asian offshore wind market[61]

Table 16. Strengths of Japanese supply chain for static submarine cables and its potential and challenges for expansion into other Asian markets[62]

Strengths of Japanese industry	• Japanese companies have an extensive track record of deployments in the offshore wind market, both domestically and internationally, with strong competitiveness, particularly in insulating material technology for long-distance HVDC transmission. • They also have numerous delivery records in transmission cable projects outside the offshore wind sector, both in Japan and internationally.
Potential and challenges for expansion into the Asian market	• If the quality of the components supplied by Japanese manufacturers is recognised by the industry, they may be able to increase their market share in Asia, despite the strong competitive advantage on costs by Chinese and Korean companies

61 Product Competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

62 Prepared by MRI based on interview results and public information.

	• Globally, the adoption of separate procurement, where products and installation are contracted separately, has intensified competition for cables. • To increase market share in Asia, Japanese companies will need to enhance added value by providing comprehensive solutions, such as anomaly detection during operation and emergency restoration support. • As supply to the emerging Japanese market will be prioritised, availability of supply to other Asian markets may be limited.

2.2.4.4. Strengths of Japanese industry for dynamic submarine cables and its potential and challenges for expansion into the Asian market

The potential for expansion into other Asian markets in the dynamic cable sector received an overall evaluation "Medium" (**total score: 8 points**). The strengths of Japanese industries and the potential and challenges for expansion into other Asian markets are summarised in Table 17.

Although the dynamic cable market is still small, Japanese companies may demonstrate technology competitiveness especially in markets requiring higher voltage and larger capacity.

On the other hand, because the manufacturing equipment and basic technologies for dynamic cables are similar to those for static cables, there is a risk of falling into price competition if technological differentiation disappears. To increase and maintain market share in Asia, securing an early share of the Asian market will be key.

Overall evaluation result: Medium (Total points: 8)

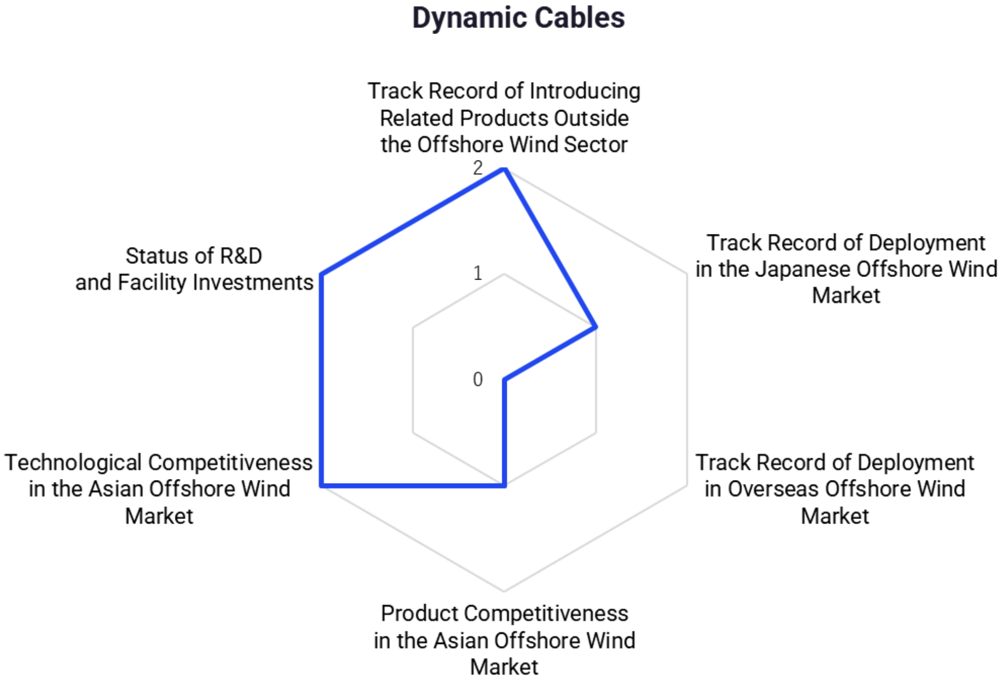

Figure 21. Potential for expansion of the submarine cable sector for dynamic cables in the Asian offshore wind market[63]

Table 17. Strengths of Japanese supply chain for dynamic cables and its potential and challenges for expansion into other Asian markets[64]

Strengths of Japanese industry	• In dynamic cables, Japanese companies hold technological competitiveness, with particular potential to demonstrate strength in market requiring higher voltage and larger capacity. • R&D and facility investments are being carried out through programs such as the GX Supply Chain Enhancement Program and the GI Fund.
Potential and challenges for expansion into the Asian market	• The manufacturing facilities and fundamental technologies for dynamic cables are almost identical to those for static cables, creating a risk of falling into cost competition if technological differentiation is lost. • To increase and maintain market share in Asia, securing an early share of the Asian market will be effective.

[63] Product Competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength.

[64] Prepared by MRI based on interview results and public information.

	• In addition, it will be necessary to enhance added value by providing comprehensive solutions such as anomaly detection during operation and emergency restoration support. • Because supply to the emerging Japanese market will be prioritised, supply to Asian market may be limited.

2.2.4.5. Strengths of Japanese industry for substation equipment sector and its potential and challenges for expansion into other Asian markets

The potential for expansion into other Asian markets in the substation equipment sector received an overall evaluation "Medium" (**total score: 6 points**). The strengths of Japanese industries and the potential and challenges for expansion into other Asian markets are summarised in Table 18. Note that this evaluation is limited to companies that have manufacturing bases in Japan.

Japanese heavy electric manufacturers have high technological capability in the substation equipment sector and have the world's only track record of introducing floating offshore substation. However, lack of on-site experience, due to the lack of a domestic market, limits its potential for expansion into other markets. It is considered essential first to build a domestic track record and strengthen technology, reliability, and supply capacity.

Overall evaluation result: Medium (Total points: 6)

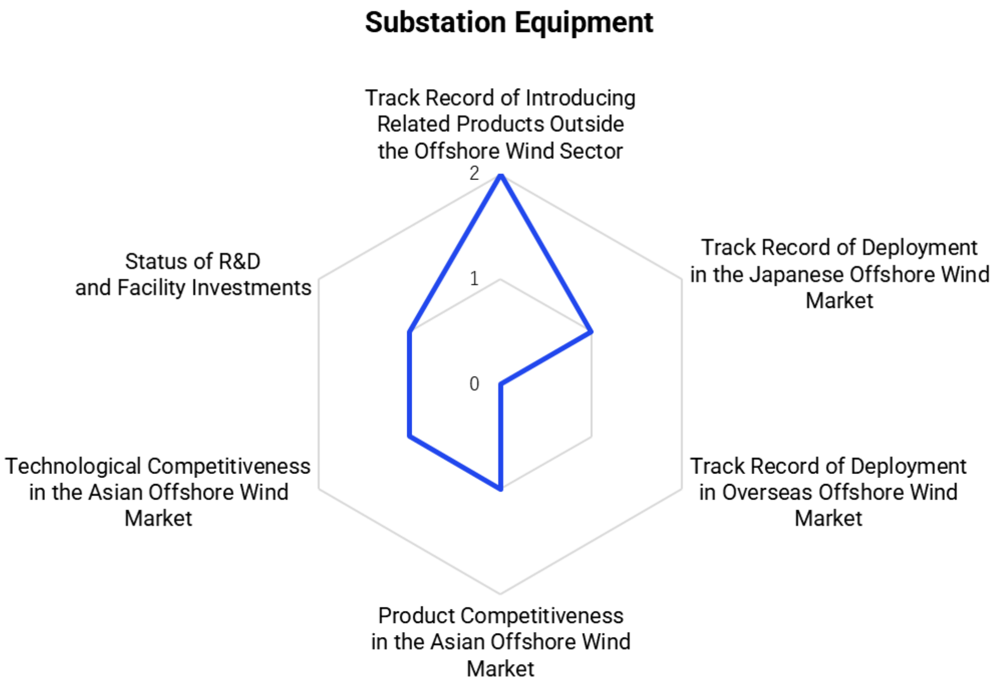

Figure 22. Potential for expansion of the substation equipment sector in the Asian offshore wind market[65]

Table 18. Strengths of Japanese supply chain for substation equipment and its potential and challenges for expansion into other Asian markets[66]

Strengths of Japanese industry	• Japanese heavy electric machinery manufacturers have strong technological expertise in the development of substation equipment. • Japan is the only country with a proven track record in deploying a floating offshore substation. • R&D on floating offshore substations and converter stations is being advanced under the GI Fund program. • Japanese companies with manufacturing bases overseas have an extensive track record of deliveries for offshore wind projects internationally.
Potential and challenges for	• There are currently no commercial offshore wind projects with substations in Japan, limiting field experience at sea.

[65] Product Competitiveness: Comprehensive competitiveness in the market, encompassing cost competitiveness and brand strength. Evaluation limited to companies with manufacturing bases in Japan.

[66] Prepared by MRI based on interview results and public information.

expansion into the Asian market	• Transformers are heavy equipment weighing several thousand tons and Japan has a limited number of quays capable of handling their transport and installation. Export to other Asian markets may require local production, at ports with suitable infrastructure.

3. Asian offshore wind supply chain analysis

3.1. Status of the supply chain in key Asian markets

As regional supply chains face challenges in meeting rising demand, Japan's advanced technology and robust policy framework gives Japanese suppliers an advantage with respect to participating in the Asian offshore wind supply chain. The following section assesses key Asian markets (South Korea, Vietnam, Taiwan and the Philippines) to identify where Japan's offshore wind capabilities could be expanded most effectively.

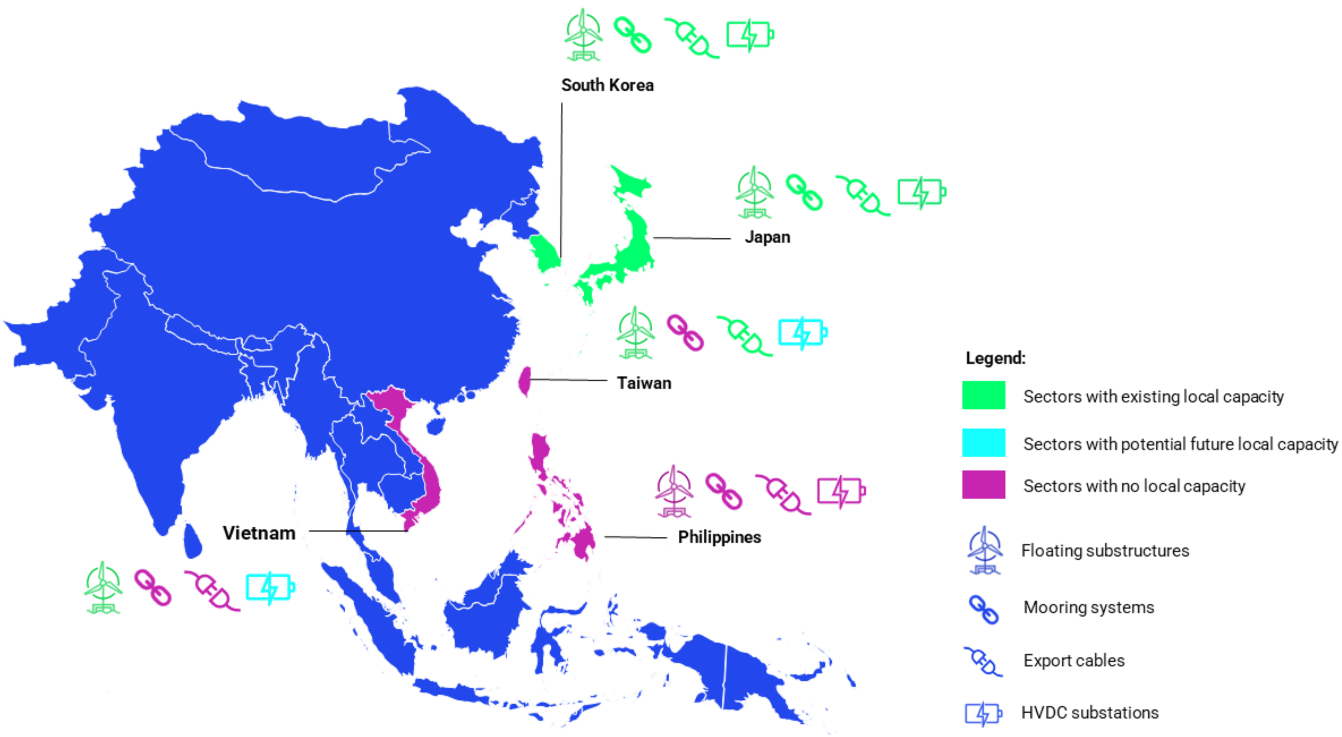

Figure 23. Existing offshore wind capacity in key offshore wind markets in Southeast Asia

South Korea

The majority of South Korean companies in the offshore wind industry specialise in the development and consenting stage, reflecting the early stage of the market development.[67] While local suppliers have installed offshore turbines for South Korean projects, their experience in the sector still lags behind global leaders which poses a challenge for large-scale offshore wind deployment. To address this gap, partnerships between local and international companies are being formed to accelerate technology transfer and capacity building.

South Korea's strongest domestic capability lies in tower supply, where local companies are expanding their manufacturing capacity. However, this advantage may be challenged as competition from Chinese manufacturers intensifies. South Korea's strengths in secondary steel works and electrical systems can also be leveraged in the manufacturing of foundation structures, despite growing competition from Chinese manufacturers.

South Korea's existing wind turbine installation vessel capacity and port infrastructure is expected to fall short of demand, requiring investment for its improvement and expansion to be able to support the stable growth in the offshore wind supply chain.

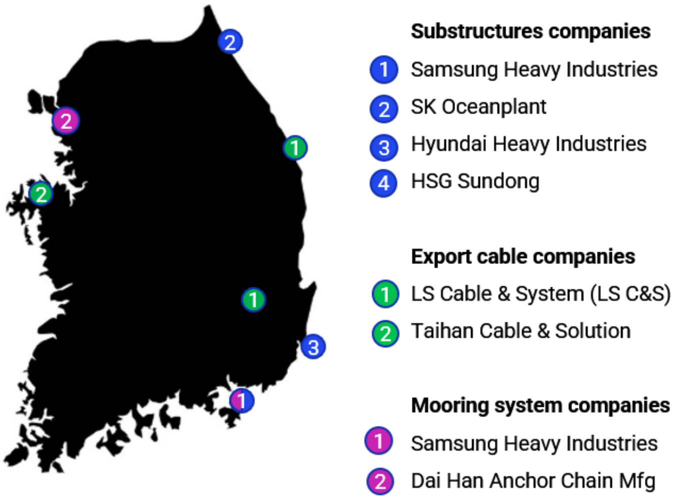

Figure 24. Offshore wind suppliers in South Korea

South Korea has a foundation in shipbuilding and heavy industry that supports its involvement in floating substructure manufacturing. While domestic suppliers do not yet have fully established capabilities in manufacturing HVDC offshore substations, some suppliers have relevant experience in onshore substation construction and are currently exploring the design of floating offshore substation technology. In the export cable segment, established manufacturers are expanding their production and export capacity in response to rising demand from offshore wind and interconnector projects.

Taiwan

Taiwan's offshore wind supply chain remains focused on fixed-bottom foundations, with companies such as Century Wind Power, China Steel Corporation, Sing Da Marine Structure, and CSBC Corporation leading fabrication of monopiles and jackets.

The country currently has no commercial capability in the manufacturing of floating substructures or mooring system, and offshore substations are still imported, with local firms only involved in their transport and installation.. However, efforts to localise key components are advancing, most notably through Walsin Energy Cable Systems, a joint venture between Walsin Lihwa and Denmark's NKT, which is building Taiwan's first submarine cable facility, expected to be fully operational by 2027.

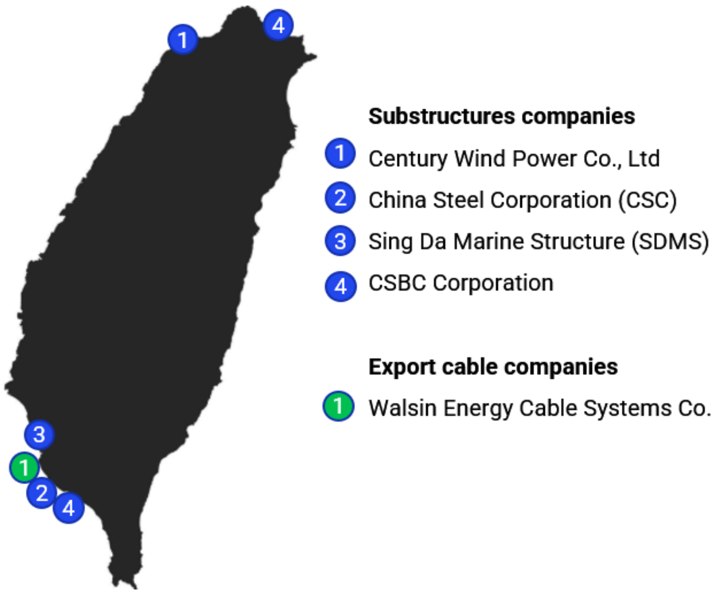

Figure 25. Offshore wind suppliers in Taiwan

Supported by a strong steel industry and growing offshore wind expertise, the Taiwanese market has the industrial foundation to expand into more complex fabrication areas as market demand and technological investment increase.

Philippines

The Philippines has limited domestic manufacturing capabilities for onshore wind and no established supply chain for key offshore wind components, including substructures, offshore substation and export cables. Historically, the country has relied on imported components for its onshore wind projects, with key parts sourced from Europe, China, and Vietnam. While experience from operating onshore wind farms exists, transferability to offshore wind is limited due to differing technical requirements.

Figure 26. Offshore wind suppliers chain companies in the Philippines

The country's established vessel manufacturing industry, which primarily serves the oil and gas and logistics sectors could potentially support the offshore wind sector provided appropriate investment, workforce training, and strategic partnerships, providing specialised vessels and related services.

The Philippines has strong steel manufacturing capabilities that could support future offshore wind development. While most steel is still imported from other Asian markets, local steel producers have doubled in number over the past decade. Targeted investment in equipment and workforce training could enable local firms to supply components for offshore wind.

Despite the limited immediate demand for cement structures in the offshore wind sector, the industry, currently dominated by foreign-owned companies, demonstrates strong industrial capability that could be used to meet the capacity demand from offshore wind projects.

Vietnam

As Vietnam works toward developing its offshore wind sector, foreign private sector investment has played a key role in strengthening its manufacturing and steel industries, laying the groundwork for a future offshore wind supply chain.

Vietnam's strong shipbuilding capabilities position its shipyards to support the offshore wind vessel industry. Significant domestic and foreign direct investment since the early 2000s has made Vietnam a leading global shipbuilder, backed by universities and a skilled workforce. The sector is projected to grow at a 6% CAGR from 2023 to 2032,

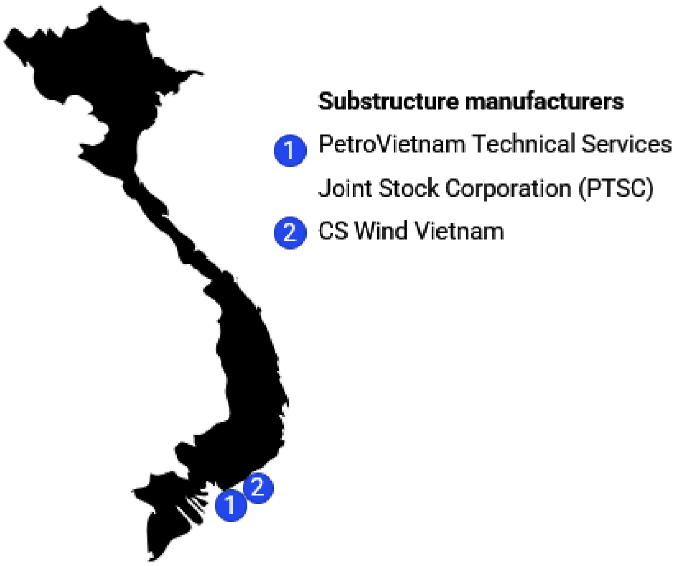

Figure 27. Offshore wind suppliers chain companies in Vietnam

reaching US$680 million in ship value by 2032.[68]

3.2. Supply chain for floating substructures

Key takeaways

- South Korea leads regional floating substructure manufacturing with advanced steel fabrication capabilities, while Taiwan and Vietnam remain focused on fixed-bottom offshore wind and currently have no track record in floating substructure manufacturing. The Philippines currently lacks domestic capability in substructure manufacturing.
- **South Korea:** A strong industrial base in shipbuilding and heavy fabrication supports South Korea's capability and technical expertise in floating substructure manufacturing. A number of publicly announced floating wind projects in the country are expected to use steel semi-submersible floating substructures.[69] Floating substructure suppliers include Samsung Heavy Industries (SHI), SK Oceanplant, and Hyundai Heavy Industries (HHI).
- **Taiwan:** Taiwan currently has no commercial floating substructure manufacturing capability. Its offshore wind fabrication remains focused on fixed-bottom foundations, such as monopiles and jackets. However, its strong steel industry provides a foundation to potentially scale its capabilities in the future. Fixed-bottom substructure suppliers include Century Wind Power (CWP), China Steel Corporation (CSC), Sing Da Marine Structure (SDMS), and CSBC Corporation.
- **Philippines:** No established offshore wind manufacturing supply chain, but foreign firms are showing interest in the market.
- **Vietnam:** Existing industrial base in wind turbine tower and onshore component fabrication but no floating substructure manufacturing track record. Planned port upgrades could support future offshore wind fabrication activities. Fixed-bottom substructure suppliers include PetroVietnam Technical Services Joint Stock Corporation (PTSC) and CS Wind Vietnam.

[68] ASD Reports (2023) Vietnam Shipbuilding Industry Research Report 2023-2032 – Link

[69] Offshorewindbiz (2025) Equinor Selects Ekwil's Semi-Submersible Floating Foundation for South Korean Project - Link

South Korea

South Korea has a strong industrial heritage in the shipbuilding industry and has advanced capabilities in both substructure manufacturing capacity and technology development.[70]

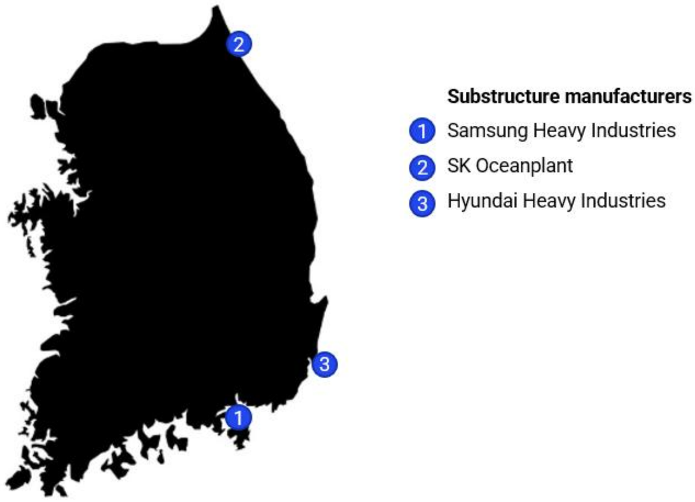

Figure 28. Floating substructure manufacturers in South Korea

Leading domestic players such as SK Oceanplant and Hyundai Engineering & Steel Industries are driving growth in the industry alongside traditional shipbuilders that have pivoted their operations toward foundation manufacturing. While competition from Chinese manufacturers is expected to intensify, Korean suppliers may be able to maintain their competitiveness in the growing domestic market, given the high costs associated with the transport of these components. However, investment in research and development will be essential to sustaining this edge and drive long-term competitiveness.

Samsung Heavy Industries (SHI)

Samsung Heavy Industries (SHI), a key division of the Samsung Group, has established a strong presence in the offshore wind sector by leveraging its shipbuilding and marine engineering expertise. The company is actively engaged in the design and fabrication of floating platforms for offshore wind turbines. Among its innovations is the Tri-Star Float, compact, steel-framed floating platform engineered to shorten construction timelines from design to installation. [71]

In addition to advancing its own designs, SHI collaborates with leading offshore wind developers such as Equinor.[72] SHI recently signed a strategic agreement to supply floating substructures for the 750 MW Firefly (Bandibuli) Floating Offshore Wind Project. SHI plans to fabricate the foundations at its Geoje shipyard, which features the company's largest dock, measuring 640 metres in length, 97.5 metres in width, and 13 metres in depth. The shipyard completes up to 10 full shipbuilding cycles annually and supports the launch of up to 30 ships per year.[73]

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[70] The Carbon Trust (2023) Challenges and opportunities for South Korean offshore wind supply chain - Link

[71] Riviera (2021) Samsung Heavy Industries secures AIP for floating wind concept – targets Donghae-1 project - Link

[72] offshoreWIND.biz (2024) Samsung Heavy Industries to Build Foundations for Equinor's Korean Floating Wind Farm – Link

[73] Samsung Heavy Industries - Link

SK Oceanplant

SK Oceanplant, a subsidiary of SK Ecoplant which specialises in the production of structures for the offshore wind sector. Its core capabilities span the development, manufacturing, and installation of key components such as jacket foundations, floating foundations, and offshore substations. The company is partnering with Copenhagen Infrastructure Partners (CIP) to manufacture and install floating foundations for the Haewoori floating wind farm off Ulsan. [74] This project underscores their role in advancing large-scale offshore wind projects in the region, with Haewoori Offshore Wind Power 1, 2, and 3 projects collectively targeting a delivery of 1.5 GW by 2030.[75] [76] It is also supplying fixed-bottom jacket foundations for CIP's Fengmiao 1 wind farm in Taiwan, highlighting its growing regional footprint.[77]

To strengthen its manufacturing capacity, SK Oceanplant is building a new facility in Goseong, Gangwon Province, set to become operational by the end of 2026. Spanning an area of 1.57 million square metres, this site will complement the company's existing 930,000 square metres of production space. Together, the facilities will support annual production of approximately 50 jackets and 40 large floating substructures.[78]

Hyundai Heavy Industries (HHI)

Hyundai Heavy Industries is actively advancing innovative floating wind solutions within the offshore wind sector. Its Hi-Float semi-submersible foundation, designed to support large-scale wind turbines features a passive ballast system that enhances stability and minimise risks during offshore operations.[79] Together with consortium partner DORIS Engineering, HHI has been instrumental in the 1.5 GW Ulsan Gray Whale floating offshore wind project's Front-End Engineering Design (FEED) and has been appointed as the preferred Engineering, Procurement, and Construction (EPC) contractor for the 504 MW Gray Whale 3 floating offshore wind farm.[80] [81]

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[74] SK Ecoplant (2024) SK Oceanplant to Build and Install Floaters - Link

[75] 4C Offshore (2025) LS Cable & System secures strategic role in Ulsan floating wind project with Danish developer CIP - Link

[76] offshoreWIND.biz (2024) SK Ecoplant, SK Oceanplant to Build and Install Floaters for CIP's 1.5 GW Project Offshore South Korea – Link

[77] offshoreWIND.biz (2024) CIP Orders Jacket Foundations for Taiwanese Offshore Wind Project in South Korea - Link

[78] offshoreWIND.biz (2024) CIP Orders Jacket Foundations for Taiwanese Offshore Wind Project in South Korea - Link

[79] Hi-Float (2021) Hyundai Heavy Gets BV AiP for Floating Wind Turbine Foundation - Link

[80] offshoreWIND.biz (2022) TotalEnergies, Corio Award FEED Contract for Floating Wind Project Offshore South Korea – Link

[81] Doris (n.d.) Gray Whale 3 floating offshore wind farm - Link

Taiwan

Taiwan currently has no commercial track record in floating substructure fabrication, with its offshore wind supply chain focused on fixed-bottom foundations. While existing shipyards and fabrication facilities can produce large steel components, upgrades are needed to accommodate the specific demands of floating substructures.

Taiwan consistently ranks among the world's top steel producers, with annual crude steel output ranging from 20 to 23 million tons in recent years.[82] This positions Taiwan as a key steel producer in Asia, supported by major firms such as China Steel Corporation. The steel industry is vital to both domestic infrastructure and international exports.

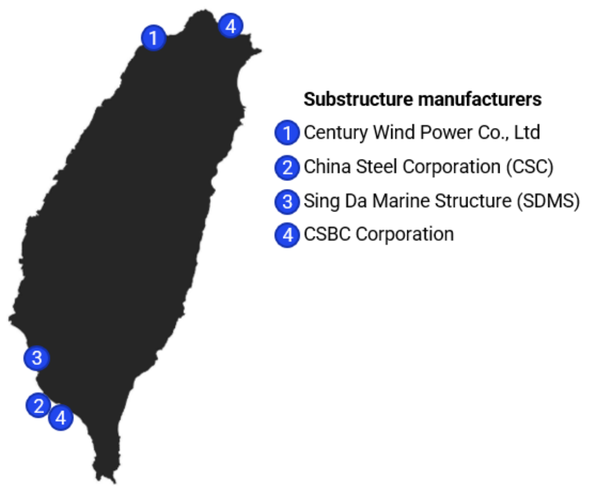

Figure 29. Floating substructure manufacturers in Taiwan

Taiwanese steel companies are increasingly engaged in manufacturing substructures, such as monopiles and jacket structures. While not all companies currently have plans for manufacturing floating substructures, their experience in steel structures provides a foundation that could be expanded if market demand emerges.

Century Wind Power (CWP)

Century Wind Power Co., Ltd. (CWP), founded in 2017 as a subsidiary of Century Iron and Steel Industrial, is a key player in Taiwan's renewable energy supply chain. Based in Taoyuan City, CWP specialises in manufacturing, installation, and maintenance of power generation, transmission, and distribution equipment, and is also involved in the production of steel structures for offshore wind.

In 2020, CWP established a joint venture with CS WIND (formerly Bladt Industries) to launch the Century Bladt Foundation (CBF) facility. Spanning 14 hectares, CBF facility manufactures jacket and monopile foundations and pin piles, that have sourced project such as ChangFang and Xidao off the Changhua Coast, Taiwan.[83] [84]

CWP now operates Taipei Port as its primary production base and collaborates with local suppliers such as Wanchi Steel, APEX Wind Power, and Far East Machinery to build an industrial cluster in northern Taiwan. This industrial cluster in Northern Taiwan jointly invest in jacket foundation and contributes to nearly 40% of the region's development capacity.[85]

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82 World Steel Association (2021) World steel in figures - Link

83 CS WIND Offshore (n.d.) Changfang & Xidao – Link

84 Copenhagen Infrastructure Partners (n.d.) Changfang & Xidao Offshore Wind Farms – Link

85 Metal Industry Intelligence (2022) The Supply Chain Study of Offshore Wind Industry in Taiwan – Link

China Steel Corporation (CSC)

Established in 1971 and headquartered in Kaohsiung, China Steel Corporation (CSC) is Taiwan's largest steelmaker with an annual steel production capacity of approximately 10 million tons. CSC manufactures a wide range of steel products including steel plates, bars, wire rods, hot-rolled and cold-rolled sheets, and electro-galvanised coils. These products support diverse sectors such as construction, shipbuilding, automotive manufacturing, and engineering. In recent years, CSC has also expanded its operations to include green energy initiatives, with plans to achieve carbon neutrality by 2050.[86]

CSC has been heavily involved in the supply of pin piles for jacket foundations to be deployed in the 300 MW Zhong Neng offshore wind project. Without in-house capabilities in pin manufacturing, CSC has contracted CTCI Machinery Corporation for the manufacturing of the piles where four dedicated production lines were established in Kaohsiung's Nansing Free Trade Zone, adhering to Taiwan's high local content requirements.[87]

CSC's offshore wind engagement also extends through its subsidiary Sing Da Marine Structure, see next section.

Sing Da Marine Structure (SDMS)

Sing Da Marine Structure Corporation (SDMS) was established in 2018 as a subsidiary of CSC to support Taiwan's offshore wind power industry. Based in Kaohsiung, SDMS plays a critical role in the development of local supply chains for offshore wind energy, focusing on manufacturing subsea substructures. SDMS operates a state-of-the-art fabrication facility at Sing Da Harbour, spanning 27 hectares and equipped with a with a 210-metre heavy-duty cargo wharf and cranes designed for large-scale production. [88]

SDMS produces jacket foundations at the Sing Da harbour with an output of around 50 jackets annually.[89] The company supplied jacket foundations for Ørsted's Changhua 1 and 2a wind farms, each weighing over 1,200 tons.[90]

CSBC Corporation

Founded in 1973, CSBC Corporation is a major shipbuilding company in Taiwan, with its headquarters in Kaohsiung and shipyards located in Kaohsiung and Keelung.[91] The company has a long-standing track record in the construction and maintenance of merchant vessels, naval ships, as well as large steel

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[86] Taiwan News (2025) Taiwan's China Steel Corp reaffirmed as member of World Steel Association Sustainability Charter – Link

[87] offshoreWIND.biz (2020) Zhong Neng Offshore Wind Project to Feature Locally-Made Pin Piles - Link

[88] SDMS (2024) Development of the company - Link

[89] offshoreWIND.biz (2019) Sing Da Marine Opens Jacket Foundation Plant in Taiwan - Link

[90] offshoreWIND.biz (2022) First Made-in-Taiwan Jacket Foundations Installed at Ørsted's Greater Changhua Offshore Wind Farm – Link

[91] CSBC (n.d.) About CSBC – Link

structures and offshore engineering. In recent years, CSBC has strategically expanded its operations to support Taiwan's offshore wind industry.

In 2018, Ørsted awarded CSBC Corporation its first offshore wind contract for the fabrication of foundation pin piles for the 900 MW Greater Changhua 1 and 2a projects in Taiwan.[92] Under this contract, CSBC invested in a dedicated pin pile production line at its Kaohsiung facility with Kaohsiung Port served as the heavy-lift terminal for assembly and temporary storage.[93] The piles, each measuring up to 90 meters in length, were manufactured using over 20,000 tons of steel.[94] In April 2020, CSBC also secured a contract to supply 20 steel transition pieces for the same Changhua project.[95] In 2022, Hai Long Offshore Wind selected CSBC Corporation as the pin pile supplier for its 300 MW Hai Long 2a project, awarding a contract to fabricate 63 pin piles.[96]

Philippines

The Philippines has limited domestic manufacturing capabilities for onshore wind and no established supply chain for offshore wind components. Historically, the country has relied on imports from Europe, China, and Vietnam to build its onshore wind projects.

Recent developments indicate increasing interest from foreign companies to set up manufacturing capacity in the Philippines. Dajin Offshore, a Chinese tower and foundation manufacturer, has expressed interest in establishing a manufacturing base in the Philippines.[97] In 2022, the company exported approximately $25 million worth of wind energy products and services to the country.

HD Korea Shipbuilding & Offshore Engineering (HD KSOE) is constructing a facility in the Philippines to manufacture offshore wind floating platforms and shipbuilding modules, with operations expected to begin in 2026.[98]

Key domestic steel manufacturers include SteelAsia Manufacturing Corp., Maxima Steel Mills Corp., Cathay Metal Corp., and Cathay Pacific Steel Corp. Major cement firms include Big Boss Cement, Cemex Philippines, and Eagle Cement. While none of these companies have announced plans to enter the offshore wind market, their experience in large-scale steel and cement production provides foundation to potentially support offshore wind substructure manufacturing in response to growing market demand.

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[92] offshoreWIND.biz (2018) Ørsted Piles On Greater Changhua Pin-Pile Orders – Link

[93] offshoreWIND.biz (2020) CSBC Opens Pin-Pile Production Line in Taiwan – Link

[94] Orsted (2018) Ørsted seals deal with CSBC Corporation on pin-piles – Link

[95] offshoreWIND.biz (2020) CSBC Lands Changhua OWF Transition Piece Deal – Link

[96] Hai Long Offshore Wind (2022) Hai Long Offshore Wind Project and CSBC Corporation Sign Foundation Pin Pile Fabrication Contract – Link

[97] Dajin Heavy Industry (2023) Renewable Roundtable Meeting with Philippine President Ferdinand R. Marcos Jr. – Link

[98] The Korea Economic Daily (2025). HD KSOE picks Philippines as offshore wind power base camp – Link

Vietnam

Vietnam has a supply base for onshore and offshore wind towers, onshore generators, and onshore power converters, supported by investment and partnerships with foreign companies such as Korea's CS Wind and GE Renewable Energy. However, the country has yet to develop domestic manufacturing capabilities for offshore wind substructures.

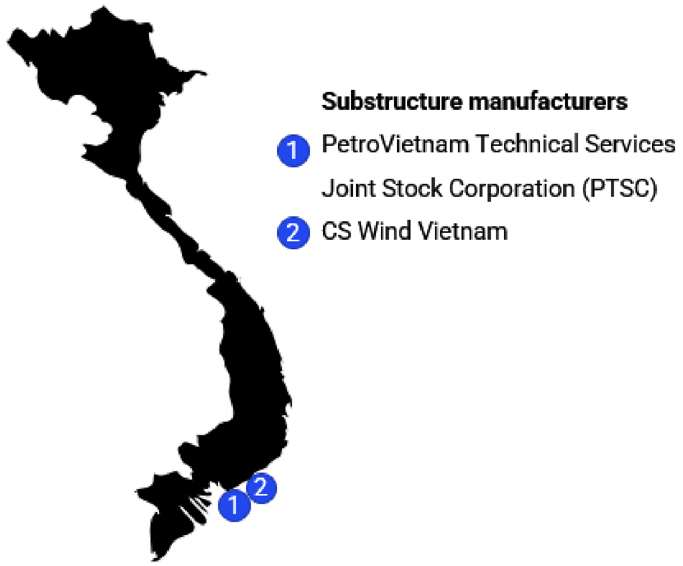

Figure 30. Floating substructure manufacturers in Vietnam

Vinh Tan International Port is a deep-water port situated near areas best suited for fixed-bottom offshore wind development in Vietnam. The Vinh Tan Port Master Plan, currently under development, aims to establish a dedicated offshore wind terminal within the port, positioning it as a hub for offshore wind construction and foundation fabrication, indicating growing interest in building domestic capacity. Additionally, other ports in southern Vietnam would require only minimal investment to become suitable for offshore wind foundation fabrication, marshalling, and O&M.[99] [100]

While there is currently no domestic track record in floating substructure manufacturing, Vietnam's existing fabrication capabilities provide a foundation for future development in this area. Strategic investment and technology partnerships will be key to unlocking this potential.

PetroVietnam Technical Services Joint Stock Corporation (PTSC)

PTSC, a member of Vietnam oil & gas Group (PetroVietnam - PVN), provides technical services to the oil and gas, energy, and industrial sectors. In the offshore wind industry, PTSC has an established track record in supplying foundations for offshore wind farms and substations in Taiwan and Europe.

In 2024, PTSC manufactured its first batch of jacket foundations for export to Taiwan. This included the delivery of 33 suction bucket jacket foundations for the Greater Changhua project in Taiwan and marked Vietnam's first large-scale offshore renewable energy export contract.[101]

[99] GWEC (2024) Building the Asia Pacific Wind Energy Supply Chain for a 1.5°C World

[100] Danish Energy Agency (2024) Mapping Port Infrastructure for the Offshore Wind Industry and Job Creation in Viet Nam – Link

[101] PTSC (2025) Projects: Ørsted Taiwan Limited – Link

CS Wind Vietnam

CS Wind Vietnam, a subsidiary of South Korea's CS Wind Corporation, produces both onshore and offshore wind turbine towers at its Phu My facility in Ba Ria-Vung Tau province, southeastern Vietnam. Opened in 2023, the facility manufactured its first offshore tower in 2024 for the 99 MW Jeonnam I project in South Korea. In September 2024, CS Wind signed a cooperation agreement with Dong Tam Group to lease land for a wind power manufacturing facility in the Southeast Asia Industrial Park, Vietnam. This new facility will produce onshore and offshore towers, as well as monopiles and transition pieces.[102]

3.3. Supply chain for HVDC substations

Key takeaways

- Globally, HVDC system technology is dominated by a few players, including Hitachi Energy and Siemens Energy, although there is limited publicly available details on their manufacturing locations. There is varied capacity in supplying HVDC substations across the region, with South Korea and Vietnam building domestic HVDC fabrication capability, and Taiwan and the Philippines fully reliant on foreign suppliers.
- **South Korea:** South Korea has established domestic expertise, with Hyosung Heavy Industries developing the country's first 200 MW HVDC converter.
- **Taiwan:** Taiwan has no offshore substation manufacturing capability, with CDWE responsible only for the transportation and installation of offshore substations.
- **Philippines:** The Philippines has no offshore substation manufacturing capability and depends on imported components.
- **Vietnam:** Vietnam is gradually building local experience, with PTSC M&C emerging as a key player in HVDC substation fabrication.

South Korea

South Korea's industrial players have successfully developed domestic HVDC and offshore substation technologies.

Hyosung Heavy Industries developed South Korea's first 200 MW Voltage Source HVDC technology in 2024, with a converter station installed at KEPCO's Yangju Substation to stabilise the grid in northern Gyeonggi Province, and is now scaling toward multi-gigawatt systems.[103]

[102] offshoreWIND.biz (2024) CS Wind to Pour USD 200 Million Into New Factory in Vietnam – Link

[103] Korea IT Times (2024) Hyosung Heavy Industries Develops South Korea's First 200MW Voltage Source HVDC Technology – Link

Hyundai Heavy Industries has initiated the development of its own basic design technology for floating offshore substations, strategic move marks a notable shift for Hyundai Heavy Industries, transitioning from solely manufacturing to establishing proprietary design capabilities.[104]

Taiwan

Taiwan has no domestic manufacturing capability and remains reliant on foreign suppliers for offshore wind project such as Greater Changhua 2b and 4, and Hai Long 2 and 3.

The offshore substations for the 920 MW Greater Changhua 2b and 4 wind farms were manufactured in Singapore by Seatrium. [105] Seatrium was contracted by Ørsted to build the substation topsides and jackets, and they completed the fabrication and integration before the components were shipped to Taiwan for installation.[106]

The substations for Hai Long 2 and the 504 MW Hai Long 3 projects were built in Vietnam by PTSC M&C in collaboration with Semco Maritime. [107] Taiwanese joint venture CSBC-DEME Wind Engineering (CDWE) was responsible for transporting and installing the foundations and offshore substations for the Hai Long projects. [108]

Philippines

The Philippines has no established supply chain for offshore wind components and lacks domestic offshore wind substation manufacturing capabilities.

Vietnam

Vietnam's offshore wind substation manufacturing capabilities are emerging, with PTSC Mechanical & Construction (PTSC M&C) establishing itself as a key player. In partnership with Semco Maritime, PTSC M&C secured contracts for the engineering, procurement, and fabrication of four 375 MW HVDC offshore substations for the Baltica 2 project.[109] The primary structures for the substation platforms will be fabricated at PTSC M&C's yard in Vung Tau City.[110] PTSC M&C and Semco Maritime also successfully constructed two offshore HVAC substation topsides for Taiwan's Hai Long offshore wind

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[104] Business Korea (2024) HD Hyundai Heavy Industries Develops Basic Design Technology for Floating Offshore Substations – Link

[105] 4C Offshore (2025) Ørsted offshore substation departs for Taiwan's Greater Changhua wind farms – Link

[106] offshoreWIND.biz (2025) Greater Changhua 2b & 4 Offshore Substation Topside En Route To Taiwan – Link

[107] offshoreWIND.biz (2025) Second Hai Long Offshore Substation Starts Journey to Project Site – Link

[108] Hai Long Offshore Wind (2024) Hai Long Offshore Wind Project Advances Steadily, Driving Taiwan's Energy Transition – Link

[109] NS Energy (2025) Baltica 2 Offshore Wind Farm, Poland – Link

[110] PTSC (2024) Baltica 2 substation platforms achieved new milestone – Link

project.[111] The substation for Hai Long 2 was completed in April 2024, while the Hai Long 3 substation is scheduled for installation and commissioning by Q2 2025.[107]

Global overview

While offshore substations can be either HVAC or HVDC, recent offshore wind projects in Europe increasingly feature HVDC substations to support transmission over long distances and higher capacities. Appendix 1: provides a global overview of offshore wind farms HVDC systems, highlighting the limited track record in the technology and the opportunity for Japanese companies to expand their knowledge and strengthen their capabilities in this emerging area.

HVDC system technology is dominated by a few global players, namely Hitachi Energy and Siemens Energy, but there is little information on the manufacturing locations of these HVDC equipment. Globally, topside manufacturing of HVDC substations is led by Aibel and Aker Solutions, with the fabrication based in Thailand and Norway respectively, while Sembcorp Marine carries out topside fabrication in Batam, Indonesia.

CASE STUDY

Hitachi

Hitachi Ltd., established in 1920, is one of Japan's oldest and largest technology conglomerates.[1] In its early years, Hitachi concentrated on the manufacture of heavy electrical equipment and industrial machinery, laying the foundation for its later diversification into infrastructure, energy, and advanced technology sectors.[1] Over the decades, the company expanded operations beyond Japan, through affiliates, subsidiaries, associates, and joint ventures across Asia-Pacific, North America, Middle East and Africa and Europe.

In the early 2010s, Hitachi began supplying offshore wind turbines in Japan, including projects such as the Fukushima FORWARD floating offshore wind demonstration.[1] The company developed offshore wind turbines with a unique downwind rotor design that reduced wind load, improved safety, and lowered foundation costs. These turbines were also marketed overseas in Taiwan and other Southeast Asian locations that faced challenging environmental conditions and were prone to typhoons, similar to Japan. Participation in these early projects provided Hitachi with technical experience in offshore wind generation.

[111] Semco Maritime (2021) Hai Long 2 and 3 offshore substations – Link

In 2020, Hitachi partnered with ABB's Power Grids business to establish Hitachi ABB Power Grids, marking its entry into high-voltage direct current (HVDC) transmission. By 2022, the venture became fully owned by Hitachi and was rebranded as Hitachi Energy. The company's first major offshore wind HVDC deployment was achieved in 2023, where Hitachi Energy successfully delivered its HVDC transmission system for Dogger Bank A, the initial phase of the world's largest offshore wind farm, located off the northeast coast of England. The project transmitted first power in October 2023, representing a milestone for both Hitachi's presence in offshore wind and the advancement of HVDC technology in renewable energy integration.[112]

Hitachi Energy has since developed global manufacturing presence to meet the increasing demand for HVDC systems. In 2024, the company announced an investment of over $1.5 billion in its global transformer production capacity. This investment includes a state-of-the-art transformer factory in Finland to supply HVDC technology globally.[113]

While the company does not currently manufacture HVDC systems for offshore wind in Japan, Hitachi's global expansion illustrates how Japanese engineering know-how can extend beyond domestic boundaries and lead technology deployment globally, supplying advanced technologies and manufacturing solutions in multiple international markets.

3.4. Supply chain for export cables

Key takeaways

- **South Korea** is a global leader in high-voltage and submarine cable manufacturing, driven by companies like LS Cable & System and Taihan Cable & Solution. These firms are expanding capacity and export capabilities to meet growing demand from offshore wind and interconnector projects.
- **In Taiwan**, Walsin Energy Cable Systems, a joint venture between Walsin Lihwa and Denmark's NKT, is building the country's first submarine cable facility, set to begin full operations by 2027 to support local offshore wind development.
- **The Philippines and Vietnam** lack domestic submarine cable manufacturing. Both markets rely on imports for subsea infrastructure, with Vietnam supplying its limited offshore wind cable activity through Chinese suppliers and early-stage partnerships like LS C&S and PTSC. The Philippines remains in the early phases of offshore wind deployment.

[112] Hitachi Energy (2023) Hitachi Energy helps deliver first power from world's largest offshore wind farm in record time – Link

[113] Hitachi (2024) Hitachi Energy to invest additional $1.5 billion to ramp up global transformer production by 2027 - Link

- As of 2025, **South Korea** is the only country in the region confirmed to manufacture **dynamic submarine cables**, essential for floating offshore wind projects. Taiwan, Vietnam, and the Philippines have no dynamic cable production.

South Korea

South Korea has developed a strong presence in the global cable manufacturing industry with a particular focus on high-voltage and extra-high-voltage products used in power transmission and infrastructure. It is currently the only country in South Korea with confirmed dynamic cable manufacturing to support the floating offshore wind expansion.

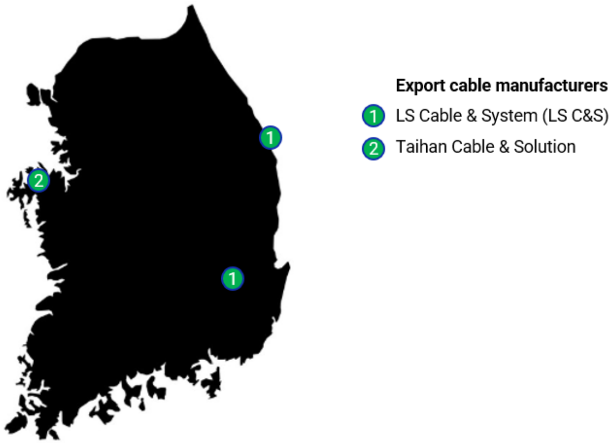

Figure 31. Export cable manufacturers in South Korea

The country's cable manufacturers have supported a range of domestic and international projects, supplying both land and submarine cable systems. This capability is underpinned by a well-established industrial base and ongoing investment in production technologies.

In response to growing demand for submarine and HVDC cables, driven by the expansion of offshore wind and cross-border interconnection projects, South Korean suppliers have begun to scale up their manufacturing capacity and expand into new markets.[114] Recent developments include new production facilities, enhanced export capabilities, and participation in global project tenders.

LS Cable & System Ltd.

LS Cable & System (LS C&S) is one of the world's leading cable manufacturers, known for delivering a comprehensive range of high-performance cable solutions across various industries and for having built the largest HVDC submarine cable factory in Asia.[115] The company specialises in high-voltage and extra-high-voltage submarine cables, which are critical for offshore wind energy transmission and other large-scale infrastructure projects.

With a strong global footprint, LS C&S operates 18 advanced manufacturing facilities in South Korea, China, Malaysia, Vietnam, and India, supporting efficient production and delivery to international markets. The company's technological expertise and commitment to quality have earned it a central role in major renewable energy initiatives. The company was selected as the supplier of extra-high voltage

[114] WindPowerMonthly (2024) South Korea cable production 'marks new beginning' – Link

[115] TGS | 4C Offshore (2023) LS Cable completes largest HVDC submarine cable factory in Asia – Link

submarine cables for Taiwan's 1,044 MW Hai Long Offshore Wind Project, which is expected start operation by 2027.[116]

LS C&S has developed dynamic submarine cable solutions for floating offshore wind advancement in the region. In 2024, the company signed a MoU with Balmoral Comtec for cooperation on dynamic cables provision for Equinor South Korea's Bandibuli (also known as Firefly) floating project off the coast of Ulsan as well as a Letter of Intent (LoI) with Copenhagen Infrastructure Partners for the third phase of the Haewoori Offshore Wind 3 project, in South Korea.[117,118]

Taihan Cable & Solution

Taihan Cable & Solution is a South Korean cable manufacturer specialising in high-voltage and extra-high-voltage submarine cables for export markets. The company supplies cable systems for offshore wind farms and interconnector projects, with experience in both AC and DC applications. Taihan has been active in the international submarine cable market since 2009, delivering products to projects in Russia, Australia, Vietnam, and South Korea. Its existing manufacturing facility in Dangjin produces inter-array cables of up to 66kV[119] and currently supports domestic developments such as the Yeonggwang Nakwol offshore wind farm.[120]

In response to growing global demand for submarine export cables, particularly from the offshore wind and HVDC sectors, Taihan is investing approximately £515 million in a second manufacturing facility in Dangjin. Construction is scheduled to begin in 2025, with operations expected to start by 2027. The new plant will feature vertical continuous vulcanisation systems and will be capable of producing cables rated up to 620 kV for HVDC transmission.[121]

To offer more complete project solutions, Taihan acquired South Korea's only offshore cable-laying vessel in 2023.[122] The company has also secured a place on a UK National Grid framework for HVDC cable systems, providing access to a project pipeline valued at up to £21.3 billion.[123]

Taihan Cable & Solution remains focused on static high-voltage AC and DC submarine cables, with no public disclosure of dynamic cable production.

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[116] Hai Long Offshore Wind (2022) Hai Long Concluded Submarine Export Cable Supply Agreement with LS C&S – Link

[117] Balmoral Comtec (2025) Balmoral partners for world's largest floating offshore wind project - Link

[118] offshoreWIND.biz (2024) LS Cable & System to Supply Offshore Cables for CIP's South Korean Floating Wind Farm – Link

[119] Taihan (2023) Taihan Cable & Solution 2023 Annual Report – Link

[120] Taihan (2025) Renewable Energy, Submarine Cable – Link

[121] offshoreWIND.biz (2024) South Korean Submarine Cable Maker to Launch Second Manufacturing Facility in 2027 – Link

[122] offshoreWIND.biz (2023) Taihan Buys 'Korea's Only Cable-Layer for Offshore Wind' – Link

[123] OffshoreEnergy (2025) South Korean cable maker gains access to £21.3B in projects through deal with UK's National Grid – Link

Taiwan

As of 2025, Taiwan has one domestic subsea power cable manufacturer serving the offshore wind sector. There are currently no public announcements of local companies planning to scale up domestic cable manufacturing for floating offshore wind projects. This presents a strategic opportunity for Japanese to leverage their expertise in cable technology to supply Taiwan's growing offshore wind industry.

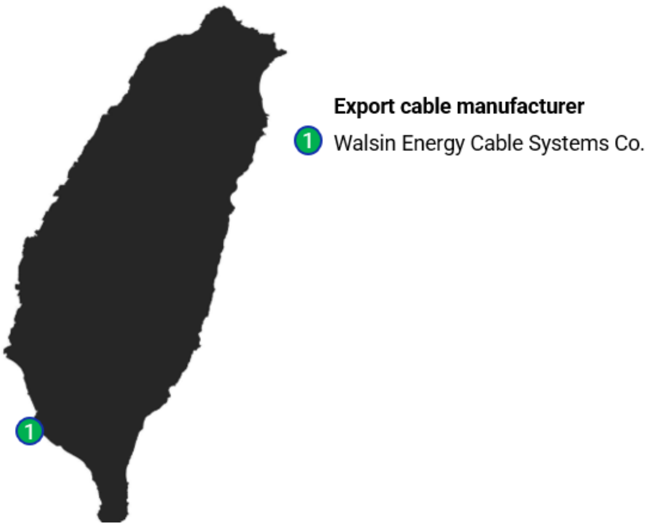

Figure 32. Export cable manufacturer in Taiwan

Walsin Energy Cable Systems Co.

Formed in 2023, the joint venture Walsin Energy Cable Systems Co., between Taiwanese Walsin Lihwa and Danish Nordiske Kabel og Traadfabriker (NKT), has started building Taiwan's first and currently only submarine cable manufacturing facility in Kaohsiung.[124] This facility, operated by Walsin Energy Cable System, a joint venture between Taiwan's Walsin Lihwa and Denmark's NKT, in Kaohsiung, is expected to begin trial production in 2025 and is set to commence operations in 2027 specialising in high-voltage export cable and medium-voltage array cables to supply the offshore wind market. [125]

Philippines

While global subsea cable manufacturers like Prysmian, Nexans, ZTT, and Sumitomo have executed projects in the Philippines, none have been linked to offshore wind. There are currently no submarine power cable manufacturing facilities in the Philippines, either domestic or foreign-owned, and all such cables used for grid interconnections or transmission projects have been imported from foreign manufacturers.

As of 2025, all existing subsea cable installations have been undertaken for inter-island and grid-interconnection purposes. Projects such as the Negros-Panay (230kV) interconnector by China's ZTT Submarine Cable & System in 2022[126] and the Cebu-Bohol (230kV) link by Japan's Sumitomo Electric[127] were delivered to strengthen the national grid.

The country's offshore wind sector remains in earlier development stages, not yet aligned to offshore wind deployment.

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[124] NKT (2023) NKT will sign joint venture agreement to support construction of the first offshore cable factory in Taiwan – Link

[125] offshoreWIND.biz (2023) Taiwan to Get Its First Subsea Power Cable Factory in 2027 – Link

[126] Offshore-Energy.biz (2022) ZTT loads out subsea cable for Filipino interconnector – Link

[127] Offshore-Energy.biz (2024) Sumitomo completes 27-kilometer subsea interconnector in the Philippines – Link

Vietnam

Vietnam does not have any domestic or foreign-owned subsea power cable manufacturing facilities.

Submarine cable infrastructure, primarily optical-fibre systems, has been deployed through international partnerships. Notable projects include the Asia Direct Cable, launched in April 2025 by Viettel with global telecom partners, and ongoing plans for additional data cables such as the Vietnam-Singapore system.[128]

In the offshore wind sector, Chinese firms like Orient Cable and Hengtong have delivered 35 kV subsea cables for nearshore projects in the country, such as Binh Dai, Hiep Thanh, and Tra Vinh.[129] Further, ZTT Submarine Cable & System has delivered 110kV submarine cables for the subsea link between the mainland and the Con Dao Island.[130]

South Korean LS C&S Asia has signed a Memorandum of Understanding (MoU) with state-owned PetroVietnam Technical Services Corporation (PTSC) to explore subsea cable partnerships, though no local manufacturing facility is yet in operation.[131]

3.5. Supply chain for mooring systems

Key takeaways

- There is limited information on the supply of mooring system components for offshore wind in Asia. Projected growth in the floating offshore wind sector is expected to drive demand across all mooring system types, making the supply of both chain and synthetic ropes crucial.
- **South Korea:** South Korea has established domestic expertise in mooring systems, with DaiHan Anchor Chain as a key international player in the large-diameter chain segment, and other companies, including Franklin Offshore Korea and Samsung Heavy Industries, with the potential to contribute to the supply base.
- **Taiwan:** Taiwan currently lacks a developed supply chain for mooring systems to support offshore wind projects.
- **Philippines:** The Philippines currently lacks a developed supply chain for mooring systems to support offshore wind projects.
- **Vietnam:** Vietnam currently lacks a developed supply chain for mooring systems to support offshore wind projects.

The floating offshore wind sector in Asia-Pacific is projected to experience significant growth over the coming years, driving increasing demand for mooring systems. This includes traditional catenary

[128] Viet Nam News (2025) Largest-capacity submarine cable system in Viet Nam becomes operational – Link

[129] Offshore-Energy.biz (2020) Orient Cable cracks Vietnamese offshore wind market – Link

[130] Offshore-energy.biz (2025) Chinese firm delivers first kilometres of subsea cable for Vietnam – Link

[131] Vietnam Investment Review (2023) South Korean cable maker expands into Vietnamese market – Link

moorings, which rely primarily on chain, as well as taut and hybrid systems that incorporate high-strength synthetic ropes. Each system type has distinct material and component requirements, which are summarised in 0.

In this evolving market, competitiveness in the Asian Pacific market will increasingly depend not only on price, but on a balance between cost efficiency, durability, and performance under harsh offshore conditions, highlighting the importance of quality and reliability as key differentiators. While Chinese producers will dominate in cost and volume, Korean and European firms operate at a mid-scale level, leaving room for Japanese manufacturers to differentiate through safety-critical, high-reliability products, especially for hybrid mooring systems.

South Korea

South Korea has a strong industrial foundation for mooring system manufacturing developed through its oil and gas sector by companies such as Franklin Offshore Korea, Samsung Heavy Industries (SHI) and DainHan Anchor Chain Mfg. However, there is limited public information on its plans to expand this manufacturing capacity and technical know-how to supply the floating offshore wind market.

Franklin Offshore Korea

Franklin Offshore Korea is a subsidiary of Franklin Offshore, a Singapore-based provider of rigging a mooring equipment that for offshore energy sectors, including offshore wind farms and oil and gas platforms. Its portfolio includes drag anchors, mooring buoys, and synthetic ropes. Franklin Offshore has a cooperation agreement with the European company Lankhorst, granting Franking Offshore Korea exclusive distribution rights of its heavy lift synthetic rope slings in South East Asia, although is manufacturing is still based in Europe.[132]

DainHan Anchor Chain Mfg.

DainHan Anchor Chain Mfg, based in Incheon, South Korea, is a long-established manufacturer in the anchor and mooring chain market. It is recognised as one of the only international players capable of manufacturing large-diameter steel chains required for floating wind applications, competing with international companies as Asian Star in China, Vicinay in Spain, and Hamanaka Chain Mfg. in Japan.

The South Korean manufacturer produces anchors and mooring chains for ships and offshore oil and gas platforms, along with accessories like XX. Its products include high grade stud-link and studless chains certified by major classification societies, such as DNV, American Bureau of Shipping (ABS) and Bureau Veritas (BV). Its long experience and established production base give it a solid position in traditional maritime and offshore sectors.

As offshore wind, particularly floating wind, expands in the region and globally, DaiHan's expertise in high-strenght, large-scale chain manufacturing positions it well to adapt for future mooring solutions for floating wind turbines.[133]

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[132] Fraklin Korea (2025) Lankhorst synthetic rope - Link

[133] Daihan Anchor Chain MFG Co. LTD (2025) Technology Research & Development – Link

Samsung Heavy Industries

SHI is one of South Korea's leading shipbuilding and offshore engineering companies, with extensive experience in designing and constructing floating production systems, offshore platforms, and LNG facilities. The company has been developing innovative mooring technologies, including the 'One-side Spread' mooring system for floating LNG units, designed to enhance operational efficiency and reduce installation costs.[134] SHI's expertise in offshore engineering, coupled with its large-scale fabrication capabilities and R&D in floating structures, positions it well to apply these technologies to the floating offshore wind sector.

Taiwan

Taiwan does not have an established supply chain for offshore wind mooring systems, with only one company currently active in the supply chain.

Mooreast Taiwan Limited

In 2025, Mooreast, a Singapore-based company specialised in mooring solutions, established a commercial presence in Taiwan through its subsidiary Mooreast Taiwan Limited. The company provides a comprehensive range of mooring solutions anchors, chains and synthetic ropes. This move is part of a Mooreast's strategy to expand into the emerging floating offshore wind sector in Asia, however, there is no public information yet indicating that the company plans to establish a manufacturing base in Taiwan.

Philippines

Currently, the Philippines does not have domestic companies that are exclusively developing mooring systems for offshore wind projects.

Vietnam

Currently, Vietnam does not have domestic companies that are exclusively developing mooring systems for offshore wind projects.

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[134] Offshore-energy.biz (2022) ABS awards AIP to Samsung Heavy for FLNG mooring system – Link

Appendix 1: Offshore wind farms with HVDC systems

Table 19 provides a list of offshore wind farms with HVDC substations, providing an insight into the HVDC substation supply chain. The list of Wind Farm Name was generated using 4C Offshore database (June 19, 2025) for HVDC Converter Station with the following Wind Farm Status: Under construction, Pre-construction, Partial generation/Under construction, Operational, and Manufacturing.

Table 19. Offshore wind farms with HVDC substations

Wind Farm Name	Wind Farm Status	Substation Manufacturer	Manufacturing Location
EnBW He Dreiht[135]	Under construction	Topside: Dragados Offshore HVDC system: Siemens Energy	Topside completed in Puerto Real, Spain
Dogger Bank A[136]	Under construction / Partial generation	Topside: Aibel HVDC system: Hitachi Energy	Topside completed in Thailand and outfitted in Haugesund, Norway
Dogger Bank B[137] [138]	Under construction	Topside: Aibel HVDC system: Hitachi Energy	Topside completed in Thailand and outfitted in Haugesund, Norway
Dogger Bank C[139] [140]	Under construction	Topside: Aibel HVDC system: Hitachi Energy	Topside completed in Thailand and outfitted in Haugesund, Norway
East Anglia Hub – THREE [141] [142]	Under construction	Topside: Aker Solutions HVDC system: Siemens Energy	Topside fabrication in Norway

135 offshoreWIND.biz (2025) Installation of BorWin Epsilon Offshore Platform Underway in German North Sea – Link

136 offshoreWIND.biz (2022) Dogger Bank A Substation Topside Sails Out of Thailand – Link

137 Dogger Bank Wind Farm (2024) Second HVDC offshore substation platform installed at Dogger Bank Wind Farm – Link

138 Aibel (n.d.) – Dogger Bank Offshore Wind Farm – Link

139 Dogger Bank Wind Farm (2025) Dogger Bank Wind Farm and delivery partners complete installation of HVDC offshore substation platform at Dogger Bank C – Link

140 Aibel (n.d.) – Dogger Bank Offshore Wind Farm Link

141 Aker Solutions (2021) Aker Solutions Signs Contract for East Anglia THREE Offshore Wind Project – Link

142 Aker Solutions (n.d.) Yards and Fabrication – Link

Wind Farm Name	Wind Farm Status	Substation Manufacturer	Manufacturing Location
Hornsea Project Three[143 144]	Pre-construction	Topside: Aibel HVDC system: Hitachi Energy	Topside completed in Thailand and installation of high-voltage equipment in Haugesund, Norway
Sofia[145 146]	Under construction	Topside: Sembcorp Marine HVDC system: GE Renewable Energy's Grid Solutions	Topside fabrication at Batam, Indonesia HVDC equipment manufactured at Stafford, UK
Sunrise Wind[147 148]	Pre-construction	Topside: Aker Solutions HVDC system: Siemens Energy	Topside fabrication in Norway
Nordlicht I	Pre-construction	Not available	Not available

143 offshoreWIND.biz (2025) First Hornsea 3 Offshore Converter Station En Route to Europe – Link

144 Power Technology (2024) Hornsea 3 Offshore Wind Farm, North Sea – Link

145 4C Offshore (2021) Construction begins for Sofia substation – Link

146 GE Vernova (2021) GE Consortium Awarded Contract to Build State-of-the-Art HVDC System for RWE's Sofia Offshore Wind Farm – Link

147 offshoreWIND.biz (2021) Siemens Energy, Aker Solutions Join Forces on Sunrise Wind Project – Link

148 Aker Solutions (n.d.) Yards and Fabrication – Link

Appendix 2: Mooring system types

Table 20 describes three commonly used mooring system types and the materials associated with each design.

Table 20. Mooring system types and material demand

Mooring system type	Description	Material demand
Catenary Mooring Systems	Long, heavy chains lie in a curved profile on the seabed, with the chain's weight providing stability. Standard in oil and gas Floating Production Storage and Offloading (FPSO), they require very high chain volumes but are inefficient for deep-water offshore wind.	Mostly chain.
Taut Mooring Systems	Steeply angled, tensioned lines anchored with piles or suction anchors. Stability comes from line tension and elasticity, often combining chain with steel wire or synthetic fibre.	Mostly synthetic ropes, with lower total chain volume. This type of mooring system drives demand for large-diameter, high-strength chains. Well-suited for deep-water sites in Japan and South Korea.
Hybrid Mooring Systems	Combines chains in high-wear zones with lighter synthetic or wire ropes elsewhere. Reduces chain tonnage while maintaining reliability.	Us of both synthetic ropes and chain. Emphasis on quality and strength of key segments.

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