Offshore Wind

Can increased Chinese outward investment help Asian economies meet their climate and local manufacturing ambitions?

Policy Brief



Source: The First Wind Turbine of Vietnam Ca Mau AC Offshore Wind Power EPC Project Was Officially Hoisted, 28 September 2022 (http://en.fedi.powerchina.cn/col4809/art/2022/art_4809_1529307.html)

Introduction

Offshore Wind is an increasingly attractive option in many Asian economies. Facing high fossil fuel prices and uncertain future availability, it offers locally-generated electricity, at a fixed cost. It can also play an important role in meeting Net Zero and other decarbonisation plans.

Offshore Wind (OSW) is now a mature technology, notably in Europe and now also in Mainland China (which has become the world's largest installer and manufacturer). Globally, the equipment, services and expertise are generally available to expand its deployment. OSW projects are major undertakings, with modern wind farms now typically 500 to over 1000 MW in size, requiring tens of individual turbines. As such, both projects and production facilities are discrete in nature, i.e. there are a relatively small number of large projects and large orders. This creates a challenge in creating the sustainable, predictable pipelines of OSW projects and associated production orders that suppliers, installers and governments would prefer.

OSW projects are complex, requiring a wide range of goods and services. This leads to a further challenge – procuring everything needed at the right time – but also an opportunity: many of the goods and services needed are attractive expansion areas for economies looking to widen and deepen local economic activity. Blades and the components within nacelles (the pod housing the rotor, gearbox control systems and electronics) are highly complex, specific goods, where competing with established players will be very difficult. But there are many lower tech, less specific components needed, for example the huge steel towers and foundations needed, along with transformers, substations, cabling and a wide range of services from project design and financing to building and operating the ships needed to install and maintain OSW farms.

This report focuses on four of the most important economies in the region for future OSW deployment. Each of **Japan, The Philippines, South Korea and Viet Nam** have good wind resources around major parts of their coastlines. Each also has areas suitable for siting "fixed bottom" OSW, i.e. where the sea depth is low enough to allow for foundations to be secured directly to the seabed. "Floating" OSW is suitable in many more sites but has not yet been commercialised, and costs are likely to be significantly higher in at least the short-term.

OSW markets in all four focus economies are nascent. Japan and South Korea each have a few hundred MW of OSW installed (a very small fraction of the 90 GW now installed worldwide). Viet Nam has around 1000 MW of capacity installed in "near shore" (inter-tidal) areas, and The Philippines has recently launched its first auction for OSW ("GEA-5") but has no turbines deployed yet. The economies are actively considering how to balance their ambitions to deploy OSW at scale with their ambitions to provide some or all of the goods and services required locally. Each already has capacity in parts of the supply chain, including the shipping, steel and large engineering and construction companies which can supply OSW and many other sectors.

Several **Chinese turbine OSW "OEMs"** (Original Equipment Manufacturers, of which Envision, Ming Yang and Shanghai Electric are the largest) **are now in position to actively compete with established Western manufacturers** (notably GE Vernova, Siemens Gamesa and Vestas) in overseas markets. *Focus Economies* could simply import the blades and nacelles, encourage the manufacturers to set up domestic facilities with or without local co-ownership, or look to build their own independent companies. This *Policy Brief* examines the choices which they can make, including an emphasis on collaborative and cooperative solutions which may offer the best balance in meeting their climate and local manufacturing ambitions.

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Background to the Policy Brief

This *Policy Brief* presents research and analysis developed for a project: ***Helping key Asian geographies better understand where increased Mainland China Outward Investment in Offshore Wind could help meet their clean energy deployment and manufacturing ambitions***.

It is based on a wide range of information and analysis. These are detailed in **4 *Annexes* and 4 *Summary Cover Notes*** (for *Japan, The Philippines, South Korea* and *Viet Nam* respectively).

The project was undertaken by the *Geneva Platform for Resilient Value Chains*, an independent platform whose objective is: *Enabling ambitious clean energy deployment while accounting for local manufacturing ambitions and geopolitical tensions*[1]. The GPRVC is focused on supporting key clean energy value chains through dialogue and policies including Trade and Industrial Policy. The GPRVC helps to identify supply-side risks and develop solutions for their mitigation.

The project was conducted between September 2026 and October 2027 and was informed by a wide range of confidential discussions with key stakeholders, notably with companies involved in the Offshore Wind Value Chain and with government representatives. Visits were made to China, Japan, The Philippines, Singapore, South Korea and Viet Nam. The GPRVC project team are extremely grateful to everyone who so kindly shared their expertise and advice and for the hospitality shown towards us.

The lead author of the *Policy Brief* was Peter Wooders, Managing Director and Lead, Renewables, GPRVC. Other contributing analysts and authors were: Chang Liu (Lead Author of *Annex 4* on Chinese Manufacturers' Outward Investments); Ying Zhang (GPRVC Fellow and contributor to *Annex 1*); Jingle Fu (Contributor to *Annexes 1, 2 and 3*); and Yafei Li (Lead Author of *Annex 3*). All errors and omissions remain GPRVC's alone.

[1] https://www.linkedin.com/company/geneva-platform-for-resilient-value-chains/

A. Energy Context

1. Current high gas and oil prices – and concerns around supply reliability - have again brought the issues of energy affordability and security to the forefront in East and South-East Asia[2].

2. A more fractured, less open geopolitical environment has increased policymakers' focus on autonomy (energy security of supply)[3].

3. There are ongoing concerns that electricity prices to industry must be low enough to support the international competitivity of companies, and that electricity is affordable for the population[4].

4. In common with economies around the world, electricity demand is projected to increase significantly as energy and transport systems are progressively electrified and new sources of demand – including Data Centres – are built out[5].

5. Solar PV and Battery Storage have matured and their costs have plummeted over recent years; Solar PV + Batteries now represent the lowest cost of "firm" electricity in most countries globally[6]. Given also their modular nature and ease of installation, they are a clear priority for new electricity generation capacity.

6. The *4 Focus Economies* have essentially stopped building new coal-fired generation[7]. With LNG prices volatile and periodically high, land for Solar PV and Onshore Wind limited in many parts of the region, and nuclear expensive and slow to build, Offshore Wind is a key option to support increasing electricity supply[8]. It is also complementary to Solar PV, as it generates at night and often strongly in seasons where Solar PV generation is relatively low.

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[2] The Philippines declared a 12-month *National Energy Emergency* on 24 March 2026 (https://pco.gov.ph/wp-content/uploads/2026/03/20260324-EO-110-FRM.pdf); see also for example: https://moit.gov.vn/en/news/vietnam-holds-the-line-on-fuel-security-amid-regional-and-global-price-storm.html; and *"The Hormuz Implications for Energy Policymaking: Japan and South Korea"* https://www.csis.org/events/hormuz-implications-energy-policymaking-japan-and-south-korea

[3] See for example: https://www.cfr.org/articles/the-iran-war-turned-asias-fragile-energy-dependence-into-an-emergency

[4] See for example: https://manilastandard.net/opinion/columns/open-thoughts-by-orlando-oxales/314804471/keeping-the-lights-on-and-costs-down.html#google_vignette (The Philippines); and https://ieefa.org/resources/south-koreas-renewable-energy-pivot-can-mitigate-fossil-fuel-dependency-risks (South Korea)

[5] In Japan, despite a projected continuing decline in population, electricity demand is projected to reverse its decline over the next 20 years, "*driven by the rise of data centers and electrification of the transport sector"*; growth of over 5% per year is projected in The Philippines; South Korea's electricity demand could grow by a further 25-30 GW due to AI: both from the production of chips by its leading global manufacturers (Samsung Electronics and SK Hynix) and from data centres; both Viet Nam's population (now greater than 100 million) and economy are growing strongly, and electricity demand growth is projected to be of the order of 10% annually going forward *[see the 4 Country Cover Notes]*

[6] https://ember-energy.org/latest-updates/24-hour-solar-now-economically-viable-for-the-worlds-sunniest-regions/

[7] In 2025, Viet Nam added 700 MW of coal capacity. The other 3 economies added none. https://www.carbonbrief.org/new-coal-plants-hit-10-year-global-high-in-2025-but-power-output-still-fell

[8] Noting that the *4 Focus Economies* generally continue to follow an "all of the above" policy towards electricity generation, looking to promote Renewables but also other options (notably Nuclear Power and

7. Offshore Wind generation costs are significantly higher (generally double or more) than those of Solar PV and of Onshore Wind. Depending primarily on the costs of imported LNG, Offshore Wind is cheaper than natural gas at times of high import prices (for example during 2026 after the Hormuz crisis and during 2022 following Russia's full-scale invasion of Ukraine) and more expensive during low global natural gas price periods[9]. OSW is considerably cheaper per unit of electricity generated than nuclear power.

8. Based on reported costs from projects in 2025, IRENA reports a weighted average LCOE (levelized cost of electricity) for OSW of US$ 78/MWh (US cents 7.8/kWh). This average is heavily skewed by costs in China (US$ 56/MWh), which was responsible for 78% of capacity additions in 2025. Costs in Europe in 2025 were US$ 99/MWh, driven by higher project and financing costs than in previous years[10].

9. All *4 Focus Economies* possess good Offshore wind resources[11] and have at least some coastlines with waters shallow enough for fixed bottom OSW deployment[12]. 'Floating' technologies for use in deeper waters are under active development but remain significantly more expensive[13] – they are not yet commercialised.

10. Within the focus economies, some are making relatively slow progress towards their Net Zero commitments. Scenarios for them to meet these commitments include major scaling up of OSW[14].

LNG). As examples, in South Korea, the government has stated that it will respond to advanced-industry power demand by achieving 100 GW of renewable energy by 2030, while also using nuclear power (including Small Modular Reactors), ESS, hydrogen, and LNG; Japan has furthered agreements on energy security with Malaysia (https://www.thestar.com.my/news/nation/2026/06/10/malaysia-japan-agree-on-energy-security-nuclear-and-critical-minerals-cooperation#goog_rewarded)

[9] See for example: https://ieefa.org/resources/south-koreas-renewable-energy-pivot-can-mitigate-fossil-fuel-dependency-risks. Estimates are only on a financial basis, i.e. do not account for greenhouse gas emissions, local air pollutants or other external costs which have not been internalised

[10] https://www.irena.org/Publications/2026/Jul/Renewable-Power-Generation-Costs-in-2025. Lazard's well-respected annual comparisons, which use standardized assumptions rather than reported project costs, estimate OSW LCOE at US$ 107-167/MWh (https://www.lazard.com/research-insights/levelized-cost-of-energyplus-lcoeplus/). The UK's most recent Auction ("AR7") cleared at around GBP 90/MWh (around US$ 120/MWh)

[11] Wind regimes with relatively high average speeds and where wind speeds are above a minimum value for the majority of the year

[12] Estimates for Fixed Bottom and Floating wind potentials respectively are: Japan (70 GW and more than 1000 GW); The Philippines (178 GW, of which more than 90% is Floating); South Korea (78 GW and 546 GW); Viet Nam (261 GW and 338 GW) *[see the 4 Country Cover Notes]*

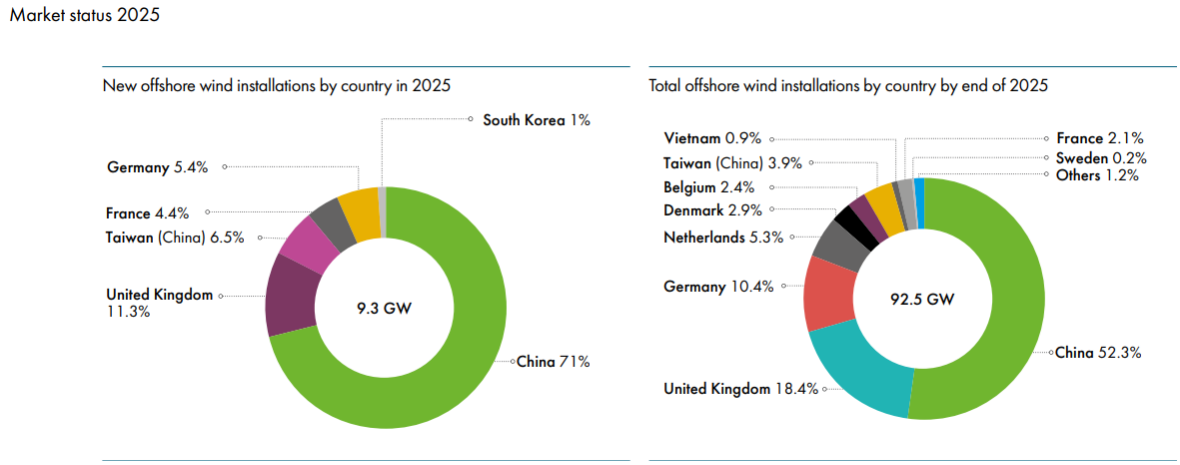
[13] E.g. the price awarded to successful "Floating" projects under the UK's AR7 Auction Round was 2.4 times that of the price awarded to successful "Fixed bottom" schemes (noting that, although the Floating projects are among the largest awarded anywhere in the world, their capacity is considerably smaller capacity than the Fixed bottom projects awarded, and the technology has not yet benefitted from economies of scale or standardization) - https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-7-results/contracts-for-difference-allocation-round-7-results-accessible-webpage

[14] OSW targets are: Japan (10 GW by 2030, 30-45 GW by 2040); The Philippines (3.3 GW in 2028-30 under GEA-5, 63 GW by 2040); South Korea (raise capacity of 0.35 GW to 10.5 GW by 2030, and to 45 GW by 2040); Viet Nam (6-17 GW by 2030–2035, up to 139 GW by 2050) *[see the 4 Country Cover Notes]*

B. Offshore Wind globally

11. Around 90 GW of Offshore Wind is now installed globally, with roughly 10% of this (9 GW) installed during 2025[15]. More than 70% of installations in 2025 were in Mainland China, which now accounts for more than 50% of global installed capacity.

Figure B.1: Offshore Wind Market status, 2025



Source: Global Offshore Wind Status Report 2026, Global Wind Energy Council (GWEC)[16]

12. Offshore Wind farms are increasing in their power generation capacity, as are the Turbines they use. A typical OSW farm is now at least 500 MW (0.5) and can be 1000 MW (1 GW) or more[17], with each Turbine typically having a capacity of 15 MW[18] (so at least 30 are needed for a typical modern OSW farm).

13. Starting in Denmark, the North Sea (Europe) was the first region to deploy OSW at scale[19] and continues to be a leading part of the global market. But it has been surpassed in scale by Mainland China, which now houses half the world's global capacity and has been responsible for well over half of additional capacity in recent years.

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[15] https://www.gwec.net/reports/globaloffshorewindreport#Download

[16] Ibid.

[17] https://www.irena.org/Publications/2026/Jul/Renewable-Power-Generation-Costs-in-2025. The UK's recent AR7 Auction round awarded 8.25 GW to just 6 Fixed bottom projects (https://windeurope.org/news/uk-awards-8-4-gw-in-europes-largest-offshore-wind-auction-ever/); recent Chinese farms have been in the 500-2000 MW size (https://english.news.cn/20260422/d8292d3f601c4ec3bbc31f4b5388ac89/c.html); Taiwan's latest Auction round for 3.6 GW of capacity received 2 bids (https://www.windtech-international.com/industry-news/taiwan-receives-two-bids-for-offshore-wind-round-3-3)

[18] Debate in Europe has heard strong calls for standardization over further innovation including larger turbines (e.g. https://www.energy-innovation.nl/en/knowledge-base/standardisation-over-size-the-future-of-offshore-wind-turbines/); however, China continues to develop ever larger turbines, e.g. https://www.windpowermonthly.com/article/1971759/china-commissions-first-commercial-scale-offshore-wind-project-18mw-turbines

[19] https://windeurope.org/about-wind/history/

14. With around 4 GW of installed OSW capacity, Taiwan is by far the leading economy outside Mainland China in the region. Japan and South Korea have a few hundred MW installed, Viet Nam has around three times as much capacity (approximately 1000 MW) in inter-tidal (near shore) waters and The Philippines does not yet have any[20].

15. All *4 Focus Economies* have ambitious targets for OSW. Some (notably Japan and South Korea) have also had a series of ambitious targets going back many years – having a target does not mean it will be realised[21]. Nevertheless there are a range of factors suggesting that deployment will be scaled-up in the coming years, for example South Korea has recently instituted plans for:[22]
    - expanding port capacity;
    - securing sufficient installation vessel capacity;
    - the early launch of a dedicated Offshore Wind Promotion Taskforce;
    - additional support for permitting, 'conflict resolution, and project execution';
    - streamlining a review of potential conflicts with military operations;
    - using competitive bidding linked to a pre-assessment process; and
    - a long-term roadmap for tenders for offshore wind[23].

16. Offshore Wind remains a much smaller market than Onshore Wind; globally, less than 10% of installed wind capacity is Offshore. The relative simplicity of foundations, installation and connection – and the less hostile environment – typically make Onshore Wind electricity generation half the cost of Offshore[24]. Economies which have land available for Onshore Wind across their land areas (including close to demand centres) and good Onshore Wind resources will in general favour it over Offshore Wind[25].

C. Building Offshore Wind Projects – the Supply Chain

17. Offshore Wind projects are major undertakings. Turbines are complex pieces of specialised equipment:
    - blades for modern 15 MW turbines are over 100m long[26] and constructed using advanced composites;
    - foundations and towers are major structural engineering endeavours;

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[20] 253.4 MW has been installed to date in Japan, approx. 350 MW in South Korea and approx. 1000 MW "near shore" in Viet Nam *[see the 4 Country Cover Notes]*

[21] See for example: https://www.rivieramm.com/news-content-hub/korea-reduces-offshore-wind-target-but-focuses-on-the-essentials-87114 (South Korea)

[22] https://www.rivieramm.com/news-content-hub/korea-reduces-offshore-wind-target-but-focuses-on-the-essentials-87114

[23] https://shinkim.com/eng/media/newsletter/3378 (a 10-year schedule for OSW was released on 30 June 2026)

[24] https://www.lazard.com/research-insights/levelized-cost-of-energyplus-lcoeplus/

[25] Japan and Viet Nam both had around 6 GW of Onshore Wind at the end of 2025, with South Korea having around 2 GW and The Philippines around 0.5 GW (https://ember-energy.org/data/electricity-data-explorer/). There are significant constraints from land availability and other factors to the large-scale expansion of Onshore Wind in all 4 Economies

[26] E.g. Blades for Vesta's "V236-15.0 MW" model is 115.5m long (https://www.vestas.com/en/energy-solutions/offshore-wind-turbines/V236-15MW)

- electricity substations are large and cables and connections high capacity and lengthy;
- installation presents a range of challenges and capital costs are high (typically-sized OSW farms cost at least $1 billion to construct[27]).

18. Major uncertainties around building out projects relate to obtaining permits and approvals (both on whether they will be obtained and on time taken), to the availability of goods and services (for example the need for specialised installation vessels), to the cost of capital and to the cost of commodities[28] (for example large quantities of steel are required[29]) and to obtaining a grid connection in a timely manner.

19. In Europe, the time taken to develop and install an OSW project has generally been of the order of 10 years[30]. The longest stage is generally obtaining the necessary permits and approvals (Stage #5 in *Figure C.1*), which often takes 4 years or more, and which can be a considerable source of uncertainty (and therefore a risk and disincentive to project developers). Similar concerns over timescales and processes have been raised in Japan, South Korea and Viet Nam, notably around securing offshore permissions from local fishers, from the Ministry of Defence and from local and Federal planning authorities[31], and, onshore, planning permission (and an associated schedule for construction) for the grid connection. Permits and approvals are generally obtained much more quickly in Mainland China.

20. Once permits and approvals are in place, the OSW *Pre-construction* phase (*Stage #6* in *Figure C.1* below) generally takes 1-2 years outside Mainland China (and less than a year within it).

21. The subsequent *Construction* phase then takes a further 1-3 years. Project developers are highly motivated to build to time and budget, given that their revenue source (typically some form of power purchase agreement) is independent of the cost of construction and does not start until they start generating. While there can be delays in construction because of supply chain shortages (e.g. availability of Offshore installation vessels or particular components), more serious issues come from the delays in connection to the electricity grid and to increases in the costs of capital and key commodities (such as steel). Mitsubishi Corporation cited rising costs as one of the key reasons for why it subsequently withdrew from the three OSW projects it won under Japan's OSW Round 1 in December 2021[32].

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[27] IRENA reports a global average of US$ 2,931/kW in 2025, which equates to around US$ 1.5 billion for a 500 MW capacity wind farm. Costs vary by region, with IRENA reporting costs of around US$ 1,500/kW in China and over US$ 4,000/kW in Europe (https://www.irena.org/Publications/2026/Jul/Renewable-Power-Generation-Costs-in-2025)

[28] See for example: https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/offshore-wind-strategies-for-uncertain-times; https://www.gwec.net/news/new-innovations-in-finance-can-half-the-cost-of-capital-for-offshore-wind

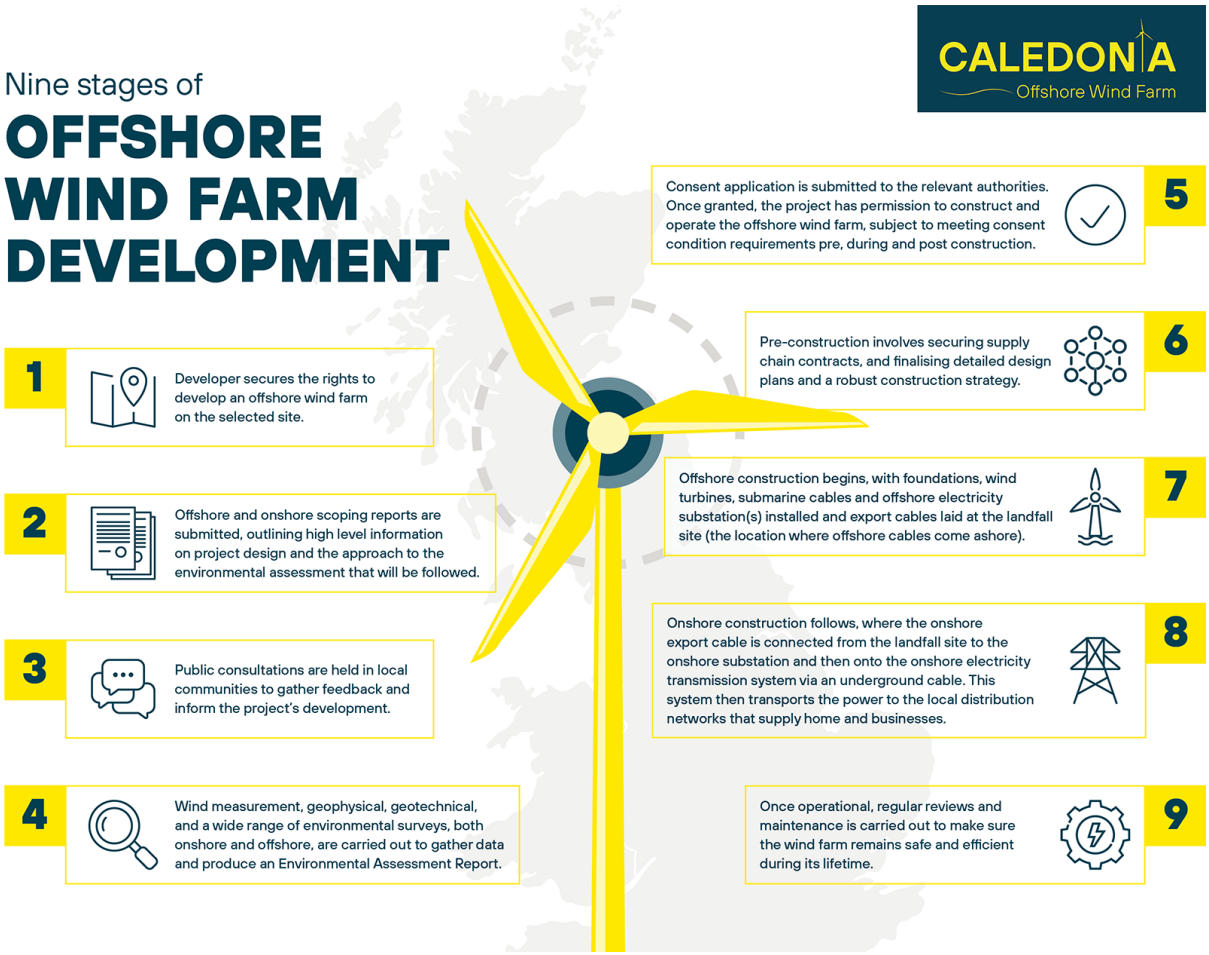
[29] Around 90% of an OSW turbine by weight is steel, with each larger turbines (15 MW) requiring around 200 tonnes (https://constructalia.arcelormittal.com/en/news_center/articles/steel-is-the-power-behind-renewable-energy)

[30] https://www.iberdrola.com/about-us/power/offshore-wind-energy/offshore-wind-park-construction

[31] Ibid. and https://www.chinaturbo.net/blog/how-long-does-it-take-to-build-a-wind-power-plant-1529836.html

[32] See *Japan Summary Cover Note* for further details

Figure C.1: Stages of Offshore Wind Farm Development



Source: What you need to know about the stages of offshore wind farm development, Caledonia Offshore Wind Farm [UK], 30 October 2024 (https://www.caledoniaoffshorewind.com/timeline-of-an-offshore-wind-farm-article/)

22. OSW systems are highly complex, featuring thousands of individual components. *Figure C.2* shows the main elements. *"Turbine"* is a general term which includes both the *Blades*, *Hub* and the *Nacelle* with the *Gearbox*, *Generator*, control systems and other components it houses, but also the *Tower* and *Foundation*, plus the *Transition piece* which connects these together.

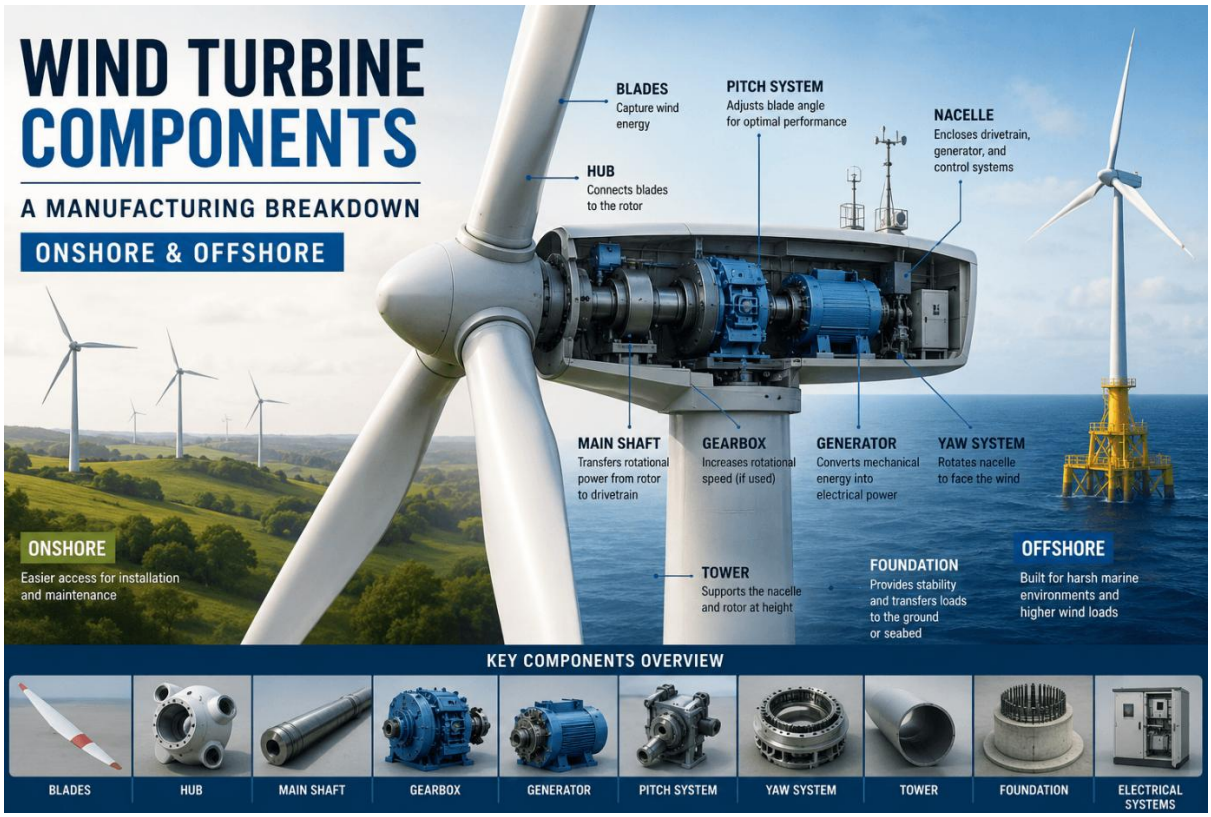
23. Some components – notably the *Nacelle* components and the *Blades* which connect to the *Nacelle* through the *Hub* - are highly specialised and technologically advanced and are manufactured only by a small number of companies[33]. *Towers*, *foundations*, *cables* and *transformers* are less technologically advanced and similar products are also used in other products and industries. Suppliers are more plentiful but some components (for example

[33] *Annex 1.4* indicates that Mainland China has a range of suppliers in all component categories (*Table 1.2*) but that Japan (*Table 1.3*) and South Korea (*Table 1.4*) have a limited number of suppliers, or potential suppliers, in only some of the high-tech categories, with Viet Nam and The Philippines having even fewer

transformers and electricity *substations*) may need to be made to order. *Ports* with the capacity to handle long *blades* and *ships* for transport and installation may not be available locally[34].

24. While this complexity presents challenges, it also presents opportunity. There are often local companies which already supply at least some of the lower tech components or could relatively easily move into them through their other construction, manufacturing, engineering, shipping or logistics operations[35].

Figure C.2: Main components of Offshore Wind



Source: https://www.zetwerk.com/blog/processes-materials/wind-turbine-components-manufacturing-breakdown/

25. Moving into the higher tech components contained within the *Nacelle* and into *Blades* is a much more difficult proposition for new entrants. Globally, a dozen or so Chinese manufacturers have been recently added to a small number of established European manufacturers[36]. They are all subject to relatively 'lumpy' market conditions – small numbers of large projects – and product continues to be innovated quickly, for example in

[34] One of the principal reasons for the postponement of The Philippines' GEA-5 OSW Auction Round in 2026 was the need to increase port readiness (https://www.rivieramm.com/news-content-hub/philippines-doe-recalibrates-timeline-for-first-offshore-wind-auction-89533)
[35] See *Section 1.4 of Annex 4*, which shows that all *4 Focus Economies* have established companies in sectors including Steel, Shipbuilding, Cables, etc.
[36] See *Annex 1*, particularly *Section 1.4*

the size of turbines (which continue to get larger) and in ongoing efforts to reduce costs and improve performance and reliability.

26. New or nascent markets – such as those in the *4 Focus Economies* – do not currently offer sufficient scale for dedicated *Nacelle components* and *Blade* manufacturers to set up and are unlikely to for some time. As an alternative to imports, local assembly plants could be set up for at least a part of some components. The experience of Siemens Gamesa (*Nacelle assembly*)[37] and Vestas (*Blades* and other components) in Taiwan[38] could serve as a precedent[39]. Similar arrangements could be made with either European or Chinese companies[40].

27. *Figure C.3* shows that *Turbines* represent roughly 40% of the cost of an OSW project, i.e. most of the value is from lower tech components and a wide range of services. And unlike fossil fuels, OSW generates fixed cost, low carbon[41] electricity which is not dependent on ongoing imports and is not subject to price volatility. As we see in the UK (one of the largest OSW markets in the world), scaling up OSW does not need to be dependent on the local manufacturing of high-tech components[42].

Figure C.3: Indicative TIC (total installed cost) estimates for OSM from selected market studies

[37] https://www.tgs4c.com/news/siemens-gamesa-new-taichung-facility-produces-first-nacelle-nid23971.html

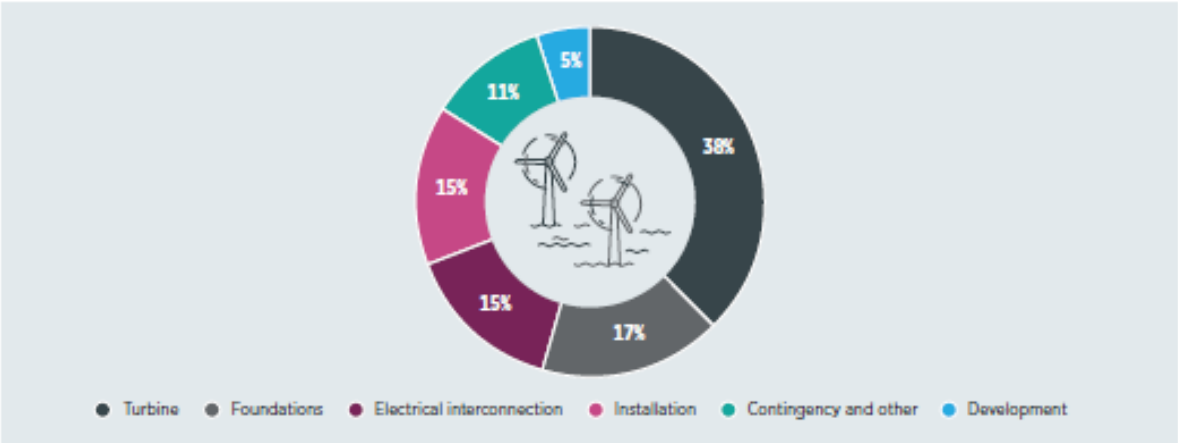
[38] https://www.offshorewind.biz/2022/04/25/vestas-and-tien-li-roll-out-first-offshore-wind-turbine-blade-in-taiwan

[39] Noting that both companies located part of their production to Taiwan in response to the governments' linking of market access to localisation (see *Case Study #4* in *Annex 4* for a full discussion of localisation in Taiwan, including the recent reduction in local content requirements). Other incentives (including financial) or constraints could be used in other economies. *Annex 4* details 12 *Case Studies*, focusing on the circumstances under which Chinese companies have made outward investments in manufacturing and the reasons behind them

[40] For example see SEWPG's (a Chinese SOE) recent technology licensing agreement for Onshore Wind turbine assembly in Oman (*Case Study #1* in *Annex 4*)

[41] Lifecycle (LCA) emissions are estimated by the IPCC to be between 8-14 gCO_2/kWh electricity generated, i.e. around 2% those from natural gas- or 1% those of coal-fired electricity generation (https://businessnorway.com/articles/carbon-footprint-of-a-wind-turbine-a-life-cycle-assessment)

[42] The UK has not become an OSW Turbine manufacturer to date, but has built out a wide range of local lower tech and services provision as it has deployed OSW at scale (see for example: https://www.renewableuk.com/media/rqvlqzu0/offshore-wind-industrial-growth-plan.pdf)



Source: (Alsubal *et al.*, 2021; BVG Associates, 2025; IRENA, 2016; Lacal-Arántegui *et al.*, 2018; MAKE Consulting, 2017; Musial, 2018; Smart *et al.*, 2016; Stehly Noonan *et al.*, 2020; Stehly Beiter *et al.*, 2020).

Source: *Renewable Power Generation Costs in 2025 (Figure 4.5)*, IRENA (2026). (https://www.irena.org/Publications/2026/Jul/Renewable-Power-Generation-Costs-in-2025)

28. Recent OSW projects in China have been delivered at significantly lower cost than in other economies *[see paragraph 8]*. Both the scale of the cost advantage (figures of between 10-50% are given in various sources[43]) and what is driving it (factors mentioned include: market volume [economies of scale]; process engineering advantages; integrated production arrangements (e.g. within Industrial Clusters); lower input costs, for example steel, concrete and labour; subsidies including those granted in Special Economic Zones or by local governments) are disputed to at least some extent.

29. But it is considered very likely that Chinese companies would offer either OSW projects or equipment at a significant cost discount to those from European or other global suppliers. One example is that Chinese *Foundation* producers (such as Dajin Heavy Industry) are capturing a growing share of overseas markets, driven by their large production capacities and their access to relatively cheap inputs (e.g. steel and labour)[44]. Mainland Chinese turbine manufacturing cost advantages would only be partly eroded by distance to market. The associated costs of transport, along with local content requirements, could be enough incentive to move manufacture locally in some cases.

30. A potential constraint to the use of Chinese turbines overseas is the lack of experience in their use outside Mainland China. New turbines must be certified in the markets they will be

[43] IRENA's 2025 weighted average saw Chinese systems 40% cheaper per unit of electricity generated than those in Europe (see *paragraph 8*); a recent Carbon Trust Policy Brief estimated the differential at around 30% and questioned whether this could be maintained in markets outside China (*https://www.carbonbrief.org/experts-will-chinese-wind-power-help-or-hinder-europes-climate-goals*); personal communication with confidential sources

[44] The Chinese share was estimated at 26% of the ex-APAC market in 2025 (https://www.westwoodenergy.com/news/westwood-insight-how-mainland-china-is-reshaping-the-offshore-wind-foundation-market)

used in and pass a range of other requirements to be "bankable" for non-Chinese investors[45].

D. Building Offshore Wind Projects – Project Development

31. In common with other Renewables, OSW is generally developed within distinct projects. A Project Developer takes the lead in securing approvals, finance, equipment and services (See *Figure C.1* for the project development cycle).

32. Projects in Europe are most often developed by large power companies (for example RWE of Germany was most successful in the UK's recent 8.5 GW OSW auction[46]) and/or investment funds (for example Copenhagen Infrastructure Partners has been active in the *Focus Economies*[47]). OEMs – Original Equipment Manufacturers – of *Turbines* or components such as *Blades* may also take stakes, as can utility companies (which may be Renewables-focused or also work on fossil fuel projects too)[48].

33. OSW Project Development in China has been dominated by large state-owned conglomerates such as China Three Gorges Corporation (CTG), State Power Investment Corporation (SPIC) and CNNOC (China National Offshore Oil Corporation). OEMs act as equipment suppliers and do not tend to take equity stakes. Local governments are generally involved in securing and/or providing finance[49].

34. In both Mainland China and Europe, OSW Project Developers tend to both build and operate projects, i.e. they look to recover their investment through project revenues rather than selling some or all of the equity after project construction has ended. This is different to Onshore Wind and other renewables projects, where project developers often sell at, or even before, construction has been completed[50].

35. It is not yet fully clear who would develop OSW projects in the *Focus Economies*, nor the consortia which would be arranged. Major local companies – either private or state-owned – would almost certainly play a role within project consortia, and these would often be conglomerates which also have shipping, steel manufacturing, more general power or infrastructure interests[51].

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[45] E.g. see the review in: https://specialty.ajg.com/natural-resources/the-bankability-of-chinese-turbines-in-the-journey-to-global-net-zero-targets-for-offshore-wind

[46] https://www.offshorewind.biz/2026/01/14/rwe-secures-almost-7-gw-as-uk-awards-8-4-gw-in-europes-biggest-ever-offshore-wind-auction

[47] e.g. https://www.offshorewind.biz/2026/06/29/philippines-govt-copenhagen-infrastructure-partners-talk-advancing-southeast-asias-first-offshore-wind-project (The Philippines) and https://www.offshorewind.biz/2025/08/25/denmarks-cip-inks-offshore-wind-agreement-in-vietnam (Viet Nam)

[48] See the 4 *Summary Cover Notes* and *Annex 1 Section 1.3* for details of the types of organisations which have been involved in projects to date and those which may do going forward

[49] See *Annex 4 Section 1.5* for details of which organisations have developed OSW projects in Mainland China in recent years (and that could therefore be leading contenders to develop projects overseas)

[50] For example see: https://www.stakelumconsultancy.com/post/stages-of-renewable-energy-project

[51] See *Annex 1 Section 1.3* and the 4 *Summary Cover Notes*

36. If European Project Developers take the lead and European Turbines are selected, their OEMs could also take an equity share, with local production potentially being a further incentive to encourage local government support. It is noted that European Project Developers are not constrained to use only European equipment – the organisations do not tend to be linked to OEMs in any formal or political way.

37. Conversely, it is considered unlikely that Chinese Project Developers would use European equipment. They would generally look to partner with strong local organisations in the power sector and those around heavy engineering to provide at least some of the larger supply chain components such as foundations, towers or cables. Such partnerships also help increase local political support.

38. There is almost no direct experience to draw on to indicate where Chinese Project Developers would seek to raise finance for overseas OSW projects but based on Chinese experience, we could expect a combination of public and private finance sources[52].

39. Security concerns have been raised with respect to projects which use foreign equipment or which have at least partial foreign ownership[53]. These concerns are generally strongest with respect to China. They tend to relate to control issues (i.e. equipment could be controlled from aboard) and to defence (OSW installations being able to track e.g. shipping or submarine movements). Disputes around the control of sea areas can exacerbate the concerns. While the major non-Chinese OEMs generally assemble their turbines outside Mainland China[54], large numbers of the components within them are sourced from within it.

40. How serious such concerns are – or are perceived to be – depends on the particular stakeholder in the particular economy. Ministries of Defence always have a say on OSW projects with respect to their siting, and stakeholders in South Korea and elsewhere have been working to ensure active and timely consideration of such concerns[55].

41. Concerns are stronger as the share of foreign ownership of the operating asset increases, especially if this is through organisations which are state-owned or in some way state-controlled. Importing only the equipment may represent a more acceptable proposition in some cases.

[52] See *Annex 1 Section 1.5* for further details
[53] E.g. https://www.janes.com/defence-intelligence-insights/defence-and-national-security-analysis/ming-yang-smart-energy-risks-for-philippines-us (The Philippines); https://en.yna.co.kr/view/AEN20241202011500315 (South Korea)
[54] GE Vernova's manufacturing capacity for the Asian market (including China) is largely located in Mainland China (including for market access reasons) (https://www.powerinfotoday.com/wind-energy/ge-renewable-energy-to-open-new-offshore-wind-factory-and-development-center-in-china/)
[55] See for example the review of international case studies on OSW and Ministries of Defence by the South Korean NGO SFOC in: https://forourclimate.org/research/621

E. Scaling up OSW in the Focus Economies

42. While there may be national and economic security issues in the *Focus Economies*, in volume terms the global supply chain is essentially sufficient to meet a progressive scaling up of OSW in them but additional investment will be needed if bottlenecks are to be avoided if demand grows as projected over the decade ahead[56].

43. There is also increasing experience around how OSW deployment can be scaled up, much of it directly applicable to the *Focus Economies* (for example Taiwan is one of the key examples[57]). Key issues include:
    - timely permitting and approval policies and regulations, including around grid connection;
    - logistical support (for example modifications to ports);
    - ensuring benefits accrue to the local fishing and coastline communities, helping ensure their support;
    - revenue certainty (length, price and other details of power offtake arrangements);
    - pre-announced Auction schedules with minimum volumes (ideally over long periods, e.g. 10 years[58].

44. It is highly beneficial to all suppliers – across the supply chain - if they have a consistent, relatively steady set of orders, whatever goods and services they provide. Such conditions are hard to deliver in what remain small, lumpy (small number of large projects) and competitive markets.

45. With a few years, we may expect each of the *Focus Economies* to be adding between 1 and 4 GW of OSW projects annually, which may represent 1 to 8 projects. Within such a pipeline of projects, it is hard to ensure that all local suppliers will be able to benefit from a consistent set of orders, especially if projects are granted through competitive processes such as Auctions.

46. Security (national, economic and security of supply) concerns and local manufacturing ambitions add a further level of complexity. These concerns motivate Economies to prefer certain suppliers (notably local ones) and/or to restrict others (e.g. those from certain countries or to avoid concentration risk [large shares of supply coming from one or a small number of countries]).

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[56] *Global Offshore Wind Report 2026*, GWEC (Global Wind Energy Council). https://www.gwec.net/reports/globaloffshorewindreport. GWEC note that there is an issue around whether manufacturing capacity and supporting infrastructure will be available for all components in all regions, in a timely manner

[57] See for example: https://www.openaccessgovernment.org/article/understanding-taiwans-offshore-wind-industry/168710/

[58] https://shinkim.com/eng/media/newsletter/3378 (a 10-year schedule for OSW was released on 30 June 2026)

47. There is evidence from a number of both European and Chinese suppliers in various parts of the OSW supply chain that margins are tight and profit levels unsustainably low[59].

48. Aggregating demand across multiple markets (for example through coordinated Auctions or potential regional supply chains) could help increase the volume of project pipelines and smooth suppliers' production and delivery schedules.

F. Balancing Local Manufacturing ambitions with OSW Deployment ambitions

49. OSW represents an attractive option to increase electricity capacity in all *4 Focus Economies*, noting their security of supply, affordability, price volatility, climate and industrial development aims.

50. Within the *4 Focus Economies*, Japan and South Korea in particular see OSW as a sector which they could (further) develop as an advanced manufacturing sector and which could also then drive exports[60]. The Philippines and Viet Nam have lower advanced industrial bases and are likely to adopt a more flexible position, looking to progressively build up their local manufacturing capacity while being more sensitive to costs (and therefore consumer electricity tariffs)[61].

51. In all *4 Focus Economies*, there are sensitivities with respect to Chinese ownership of projects and the use of Chinese high-tech equipment. These are driven by both national and economic security concerns[62].

52. The next set of OSW projects will see the start of the scale-up in Japan and South Korea and the first OSW projects in The Philippines and Viet Nam (with installation expected in 3-4 years' time). Principally due to security concerns and the lack of experience regarding overseas Chinese projects, it is considered unlikely that Chinese Project Developers would be allowed to lead this first set of new projects[63]. Rather, international investment funds or other international project developers, in combination with major local utilities and conglomerates, are likely to lead[64].

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[59] The IEA have shown declining profit margins for companies producing wind technologies in both China and the rest of the world over the decade 2015-25. Over the past 5 years, Chinese profit margins have averaged between 0 and 5% and those in the rest of the world have been negative (https://www.iea.org/data-and-statistics/charts/profit-margins-of-companies-producing-wind-technologies-by-country-of-company-headquarters-2015-2025)

[60] i.e. a similar approach to that which has been applied to sectors such as car-making and electronics over the years, which has often been delivered with large major 'local champion' conglomerates such as Mitsubishi, Hyundai and Samsung

[61] For further analysis see the *4 Summary Cover Notes* and *Annex 1 Section 1.1*

[62] Again see the *4 Summary Cover Notes*

[63] Perhaps with Viet Nam as an exception for one of the first projects

[64] See for example the MoUs signed by Copenhagen Infrastructure Partners in The Philippines (with the government) and in Viet Nam (with PTSC, a branch of PVN, the Oil & Gas SOE) [footnote 47]

53. Chinese equipment is likely to be used for some or large parts of projects, notably in The Philippines or Viet Nam where lower cost is likely to be weighted more strongly and where there are relatively lower levels of ambition to manufacture all components of OSW systems domestically[65].

54. Given the range of OSW goods and services required, Economies may choose various local supply preference strategies. Simplistically:
    - Services (project design, finance, project management, installation, etc.) is likely to be an area where Economies can already supply much of what is needed from local sources and will look to progressively increase this share, potentially even looking towards exports;
    - there is generally already low-tech component capacity, which again can be further developed[66];
    - high-tech component manufacture is hard to break into, even within highly advanced manufactured economies such as Japan and Korea. *Table C.1* illustrates, for South Korea, where there are leading companies which are involved – or have the potential to be involved in – the OSW supply chain. There are clearly several gaps. A similar picture can be seen in Japan.

Table C.1: Leading South Korean Companies involved in/with the potential to be involved in OSW

Part of Supply Chain	Companies (alphabetical order)
OEM (Original Equipment Manufacturer), Turbine Nacelles	Doosan Enerbility, Hyundai Wind Energy and Hyundai Heavy Industries, Unison, Samsung Heavy Industries
Gearboxes	
Generators	Doosan Enerbility, Hyosung Heavy Industries
Blades	
Power Convertor	
Towers	CS Wind, Dongguk S&C (supplying tower to GE and Siemens)
Castings	
Carbon Fibre	
Steel	Hyundai Steel, POSCO, SeAH Steel
Cables	Iljin and Taihan Cable & Solution, LS Cable, Taihan
Foundations	CS WIND Offshore, Hyundai Engineering & Steel Industries, Samsung Heavy Industries, SK Oceanplant

[65] E.g. in 2025, Envision (of China) signed a Turbine Supply Agreement with the EPC contractor PC1 Group, supplying 58.5MW wind turbine generators for the Libmanan Wind Power Project in Camarines Sur, Philippines, developed by Aboitiz Power Corporation (https://vietnamenergy.vn/envision-energy-secures-585mw-wind-turbine-contract-for-libmanan-wind-power-project-in-the-philippines-33814.html)

[66] From *Annex 1 Section 1.4*: The Philippines has a "hidden" advantage in its established industrial base, especially in steel industry. By modernizing existing steel mills and shipyards, The Philippines can pivot from traditional manufacturing to producing the heavy foundations and secondary steel parts that make up the backbone of offshore wind farms; Viet Nam has possesses a solid basis in heavy steel fabrication and can leverage its oil and gas legacy to export turbine foundations and towers

Part of Supply Chain	Companies (alphabetical order)
Jackets	SK Oceanplant
Installation Vessels	Hanwha Ocean, HD KSOE, Korea Shipbuilding Offshore Engineering, Samsung Heavy Industries

55. Economies have a range of tools to deliver the balance between cost, local manufacturing and supply chain preferences they are aiming for. Formally, *Trade* and *Investment Agreements* between Chinese and Asian economies tend to be relatively non-constraining, looking to reduce barriers to imports (such as import tariffs) and reducing discrimination around outward investment. *Table C.2* shows membership and relevance of the three major relevant multi-party agreements: the *CPTPP*, *RCEP* and the *ASEAN-China Free Trade Agreement 3.0*[67].

Table C.2: Overview of Main Agreements, their Membership and Relevance

Agreement Type	Agreement Name	Members/Coverage	Entry-into-force status	Relevance to OSW/Solar
Mega-regional	CPTPP	12 parties (Australia, Canada, Chile, Japan, Malaysia, Mexico, New Zealand, Peru, Singapore, Vietnam, UK); 5 in accession discussion (Costa Rica, Uruguay, Indonesia, Philippines, UAE)[68]	Entered into force in phases (2018-2023)	High: covers solar modules, batteries, heat pumps, etc.
Mega-regional	RCEP	15 parties (ASEAN 10[69] + China, Japan, Korea, Australia, New Zealand)	In force since 1 Jan. 2022	High: large tariff elimination coverage; single set of rules of origin
Bilateral/Regional upgrade	ASEAN-China FTA 3.0	ASEAN 10 + China	Signed 28 Oct. 2025	High: adds green investment and digital economy provisions

56. Less formally (and more politically), *Investment Screening and Conditionality*[70] can be significant in sectors and projects which economies consider "strategic" or "critical". These terms are defined and applied locally, and Chinese companies have been allowed to build –

[67] A full review of Trade and Investment Agreements is given in *Annex 2*

[68] https://en.wikipedia.org/wiki/Member_states_of_the_Comprehensive_and_Progressive_Agreement_for_Trans-Pacific_Partnership

[69] Timor Leste joined ASEAN on 26 October 2025 but has not yet joined all Agreements of which the other 10 ASEAN Members are party (e.g. RCEP, ASEAN-Cina FTA 3.0)

[70] *Investment Screening* is a state-level procedure where governments review, investigate, authorize, condition, prohibit, or unwind foreign direct investments (FDI). Criteria can include who is investing, the source of capital, and whether the transaction threatens public order, safety, or critical infrastructure. Conditionality then covers the conditions applied to FDI, e.g. that it can be no more than 50% of the total, comes with local employment requirements, etc.

and sometimes (partially) own – infrastructure, projects and manufacturing facilities in a wide range of economies.

57. The energy sector and infrastructure more generally (e.g. electricity grids) are often included within these categories, as are Offshore Wind projects (with their location in waters which generally have international access). *Table C.3* summarises the provisions which apply to OSW projects or manufacturing in the *4 Focus Economies*. The Philippines is generally open to investment in projects and manufacturing, with Viet Nam's rules still under development. Japan largely precludes foreign ownership stakes in OSW projects (and excludes SOEs from ownership) but is more open to manufacturing. South Korea combines regulatory review of foreign ownership with local manufacturing ambitions (locally-produced turbines have been favoured economically in recent OSW Auction rounds).

Table C.3: Investment Screening and Conditionality provisions in the 4 Focus Economies[71]

Economy	Summary of Investment Screening and Conditionality Provisions
Japan	Japan's investment screening framework varies depending on category: • Electricity generation and supply are designated sectors under the FEFTA (Foreign Exchange and Foreign Trade Act); general manufacturing (towers, foundations, most balance-of-system components) are not. Foreign investors in manufacturing in designated sectors may be given approval but even in this case will probably need to accept a range of conditions (e.g. no board seat, no business-transfer proposals in designated sectors, no access to sensitive non-public technology) • Foreign investment in projects is tightly regulated, even for minor shares (>1%) • The FEFTA includes provisions specifically targetting intelligence-sharing requirements (for example those required under China's *National Intelligence Law*) • Foreign SOEs are effectively excluded from all investment categories
The Philippines	The Philippines is highly open to foreign participation in projects and manufacturing equity, particularly for private investors. The principal constraint on Chinese participation is investor type rather than sector or nationality-linked classification. Foreign ownership can be 100% of projects
South Korea	South Korea's investment screening framework combines an administrative foreign-investment notification regime under the Foreign Investment Promotion Act (FIPA) with additional security-review triggers administered by the Ministry of Trade, Industry and Energy (MOTIE). Project companies owning grid-connected generation fall under FIPA at 10%, are exposed to own-initiative review, and must now also pass through the OSW zoning and auction framework, in which Korean public entities can access preferential support that foreign investors cannot. Manufacturing is screened under general FIPA criteria unless the facility holds or accesses an NCT (National Core Technology) or NAST (National Advanced Strategic Technologies), in which case the ITPA/NHTSIA (technology and strategic industries acts) gate applies regardless of stake size. Korea already has a largely domestic supply chain for substructures, towers and cables and is seeking to develop domestic 10–20 MW turbines, so the constraint on foreign manufacturing entry is competitive as much as regulatory

[71] See *Annex 3* for full details and analysis

Economy	Summary of Investment Screening and Conditionality Provisions
Viet Nam	OSW is categorised as a conditional sector by Viet Nam, with governance therefore depending heavily on permitting, licensing and grid-connection arrangements. Uncertainty remains around how rules and practices will be finalised and applied

58. Beyond *Investment Screening and Conditionality*, tools to encourage local production are available principally within three main categories:
    - subsidies to manufacturing investments or projects;
    - local content requirements or other ways of granting preference to local suppliers; and
    - import tariffs or other (defensive) trade protection measures.

59. These tools will tend to restrict choice and thereby increase costs, in at least the short-term. They may continue to do so in the longer-term if they are not successful in creating the space for local suppliers to build scale and efficiency[72]. Furthermore they may escalate trade tensions and lead to retaliatory measures from economies whose exports are restricted or made more expensive in the local market. Experience of Industrial Policy across sectors and economies shows many examples of failure, unintended consequences and increased costs to consumers[73].

G. Where could there be mutually-beneficial collaboration and cooperation?

60. The Chinese OSW sector has scale and cost advantages, surplus capacity and is still innovating quickly[74]. Arrangements in the *Focus Economies* which exclude it entirely are likely to lead to increased costs and reduced choice, at least in the short term.

61. Some Chinese OSW suppliers are looking at foreign markets, to drive volume and profit[75]. Both OSW projects and foreign manufacturing are major undertakings which payback over relatively long periods (e.g. a decade or more). Chinese companies therefore look for stable political environments where their investments would be relatively safe and where the risk of changes in terms and conditions is relatively low. They generally consider that neighbouring markets are amongst the most attractive as cultures are most easily understood and there are long-term diplomatic and economic ties. But they tend to be open

[72] See for example Ørsted's experience in developing projects in Taiwan and the local content provisions which have applied at various times (see *Case Study #4* in *Annex 4*)
[73] For a full analysis of how Industrial Policy has been applied, and how it could be going forward, see the accompanying GPRVC *Guidance Note - Industrial Policy: Where and how should Civil Society and other stakeholders engage and intervene?* October 2026
[74] See for example: *Global Offshore Wind Report 2026*, GWEC (Global Wind Energy Council). https://www.gwec.net/reports/globaloffshorewindreport
[75] For example: Goldwind acquired an idle Wind Turbine manufacturing plant in Brazil in 2024 (https://global.chinadaily.com.cn/a/202406/14/WS666b9b1fa31095c51c508e25.html); Ming Yang continues its efforts to build capacity in Europe even after its planned turbine manufacturing plant in Scotland was rejected (https://energywatch.com/EnergyNews/wind/article19367924.ece)

about where they could successfully invest globally, with where they would be most welcome a key consideration[76].

62. In common with Chinese outward investors, *Host economies* (of investments in manufacturing) want projects which operate over the long-term, with high load factors. Their key criteria for judging success include[77]:
    - employment creation;
    - tax and fiscal revenue;
    - support for local supply chain development;
    - fulfilment of local content requirements;
    - equity participation in the investment vehicle;
    - potential as a stepping-stone for deeper value chain integration; and
    - genuine transfer of manufacturing capability to the local economy.

63. Based on the 12 *Case Studies* reviewed in *Annex 4*, the cases where both the Chinese Outward Investor and Host Economy achieved positive outcomes share a common feature: **the host economy's policy framework was strong enough to enforce genuine localization, while the market was large enough to make compliance commercially rational for the investor rather than merely a cost of entry[78]**.

64. Taiwan has shown that bringing in foreign manufacturers of certain (high tech) components can drive an increase in local benefits, offering advantages (local market access and preference) to the foreign partner companies too[79]. Similar arrangements with European partners could be envisaged in the *4 Focus Economies*.

65. Similar arrangements with Chinese manufacturing partners are considered highly unlikely in Japan (noting also current political tensions) and would represent a divergence from normal practice in South Korea. In both Economies, relatively high labour and other input costs also present a barrier. Arrangements with Chinese manufacturing partners remain a more likely option in The Philippines and Viet Nam, noting their cost advantages but again also noting bilateral political tensions and local manufacturing ambitions (see *Table C.4*).

66. The Chinese suppliers anecdotally consulted with[80] have stated that they are open to exporting to all markets (generally their preferred solution) but are also willing to explore more flexible solutions. The three main options – in order of increasing risk and reward to the Chinese investor – are:

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[76] For a full discussion of the criteria Chinese investors judge success by, see *Section 4.2* of Annex *4*
[77] Ibid.
[78] *Section 4.4* of *Annex 4* gives more detail, noting that Chinese outward investment decisions rest of 6 key factors: (i) market size and genuine local or regional demand is the most fundamental threshold; (ii) the design quality of localization policy; (iii). risk-sharing structures with local partners; (iv) operating cost advantages; (v) the trade environment; (vi) the influence of bilateral political and associated commercial relations
[79] See for example: the details under *Case Study #4* of *Annex 4*; and https://www.openaccessgovernment.org/article/understanding-taiwans-offshore-wind-industry/168710/
[80] The set should be regarded as anecdotal rather than a representative group, statistically or otherwise

- acting as fabricators (making product under order for foreign companies). Chinese companies have for example already provided foundation pieces to Japan [and other economies including the UK] under such arrangements[81];
- equipment suppliers taking a share of project equity and/or helping to arrange project finance;
- manufacturing under licence (for example the Onshore Wind Turbine assembly plant in Oman which uses Shanghai Electric Wind Power Group's technology, expertise and supply chain links[82]) or within Joint Ventures.

67. Security considerations are a stated concern of certain stakeholders in certain economies[83]. Security risks can be reduced, including by:
    - mutual investigations of security risks can be undertaken under controlled conditions (see for example the secure laboratory set up by in conjunction with the UK's GCHQ [intelligence, security and cyber agency] to test Huawei's 4G hardware and software[84]);
    - Software and other control equipment can be produced or controlled outside China[85].

68. Based on the factors discussed previously in *Section G*, *Table C.4* summarises the potential role of Chinese Outward Investment in OSW manufacturing and projects in each of the *4 Focus Economies*.

Table C.4: Potential role of Chinese Outward Investment in OSW manufacturing and projects in the 4 Focus Economies[86]

[81] See [foonote 44] for experience, led by Dajin Heavy Industry
[82] See *Case Study #1* in *Annex 4* for more details
[83] See *[paragraph 39]*
[84] The "Huawei Cyber Security Evaluation Centre" (commonly known as "The Cell") was set up to alleviate British officials concerns the security risks from the use of Huawei hardware and software in the UK 4G network. It provided a fully isolated testing facility for the UK, located in a secure environment within the UK. Full details and background can be seen within Chapter 16 of: *House of Huawei: The secret history of China's most powerful company*, Eva Dou, Portfolio Penguin (2nd edition, 2025)
[85] Octopus Energy is a major supplier of renewable electricity and other services in the UK and other countries. It also owns and operates generation plant and had entered into a partnership with Ming Yang Smart Energy to develop Wind farms in the UK. It stated: *"As part of the agreement, Octopus will explore the implementation of software to create the highest levels of data protection and cyber security in combination with Ming Yang's cutting-edge offshore and onshore wind turbines."* https://octopus.energy/press/octopus-partners-with-wind-turbine-manufacturer-ming-yang-to-supercharge-the-uks-path-to-clean-cheap-energy/ 11 September, 2025
[86] See the *4 Summary Cover Notes* and *Annex 1* for full details and analysis

Economy	Summary of Investment Screening and Conditionality Provisions
Japan	Three channels appear most promising: • *Equipment supply*. Outside FEFTA, but subject to certification, ESPA disclosure (Economic Security Promotion Act [2022], with its requirements around security of electronic and control systems) where the buyer is a designated operator, and auction supply-chain scoring • *Manufacturing and industrial-park investment*. Foreign-owned or joint-venture plants for foundations, towers and selected components, supporting the 65% local-content and floating-wind objectives. Outside the designated electricity sectors at entry, subject to post-acquisition call-in • *Technology licensing*. Licensing turbine technology to a Japanese manufacturer falls outside FEFTA entirely, since it is neither an acquisition nor an investment
The Philippines	The Philippines is open to investors in projects and manufacturing to companies from all countries. As a major potential investor or equipment supplier, China could play a major role in the Philippines OSW sector going forward
South Korea	Politically, South Korea's ambitious OSW plans are predicated on the assumption that local companies will supply a large majority – if not all – of the components needed. It is not clear that local companies will be able to supply the high-tech elements (large turbines [>8 MW], blades or nacelles and their components). South Korea could form joint ventures with Chinese or European companies or could look to Chinese companies to fabricate parts in China. Direct purchase from China is also possible. Major ownership of projects by Chinese entities appears unlikely in at least the medium-term
Viet Nam	China will almost certainly be an important partner for Viet Nam as it builds out OSW. China will be available to supply price-competitive hi-tech components and may increasingly invest in their manufacturing within Viet Nam, for local and export markets. Chinese project developers are unlikely to develop the first OSW projects but may play a significant role going forward, probably in (junior?) partnership with large, strategic local companies

69. Regional arrangements have also been proposed, for example the GWEC is recommending that Asian regional cooperation is increased[87], with reference to the success of the *North Seas Energy Cooperation* arrangements in Europe[88]. The nature of links to the Chinese supply chain within such regional cooperation (including the regional supply chain) remains unclear – proposals to date tend to emphasize the benefits from a set of economies with smaller markets linking together rather than their relationship with the Chinese market.

70. A number of simpler cooperation options are also available, some of which can be delivered domestically and others which are less contentious than investment partnerships:
    - Increasing demand for OSW and strengthening enabling conditions in any economy helps boost market scale;

[87] See for example: GWEC's South East Asia Taskforce (https://www.gwec.net/policy/taskforces/south-east-asia); and a panel GWEC co-convened with *Enterprise Singapore* on *"Mobilizing Capital to Accelerate Offshore Wind Projects in Asia"* (https://www.linkedin.com/posts/gwecasia-windenergy-windpower-ugcPost-7506243165377617920-zOgN/)

[88] https://energy.ec.europa.eu/topics/infrastructure/high-level-groups/north-seas-energy-cooperation_en

- given that is in the interest of all economies that project pipelines are smooth and predictable, coordination of when Auctions will take place and for what quantities would be mutually beneficial[89];
- increasing the harmonization of equipment sizes and standards[90], safety standards and protocols, and labour, social and environment standards is similarly beneficial;
- economies can choose to reduce import tariffs, local content requirements and other trade restrictions, either unilaterally or within agreements with China and other partners (which could include terms around security of supply or wider economic aims).

H. Next steps: Working out realistic positions; Dialogue and Trust-building

71. The Chinese OSW market has largely built up independently from markets in the rest of the world. There has been very little investment from Chinese companies in foreign manufacturing and projects to date, and very little by foreign companies in Chinese manufacturing facilities (notably those which serve Chinese domestic markets) or projects.

72. Chinese suppliers now have the capacity and experience to contribute to the build out of OSW overseas, including in the *Focus Economies*. Significant cost reductions compared to European suppliers are likely to be available.

73. Outside China, meetings and dialogues around the role of China in the green transition often do not include Chinese representatives[91]. Similarly in Mainland China, some discussions may also be short of the full range of counterparts who could help narrow down options for collaboration into those with the most realistic potential. Initiatives to increase understanding and dialogue are clearly indicated.

74. To prepare for closer dialogue with China, Economies need to prepare their positions across the range of aspects and options. A realistic assessment of the parts of OSW supply chains that could be manufactured locally – now and in future years - is needed as a foundation. In general, Services and lower tech components will be easier to source domestically or from non-Chinese sources than will higher tech components (*Nacelle components* and *Blades*).

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[89] Again see GWEC's call for increased South-East Asia regional cooperation [footnote 85]

[90] Standardization has become a big topic of debate in Europe, see for example: https://www.rolandberger.com/en/Insights/Publications/Standard-beats-size-in-Europe-s-offshore-wind.html. Many panels and discussions at Wind Energy Hamburg (September 2026, https://www.windenergyhamburg.de/) made similar calls. In general, products and systems tend towards standardization after an initial period of high innovation and competition leads to mass market deployment and a focus on cost reductions (*Technology life-cycles in the energy sector — Technological characteristics and the role of deployment for innovation*, Joern Huenteler et al, Science Direct (2016) https://www.sciencedirect.com/science/article/pii/S004016251500284X). For complex systems (OSW appears to meet these characteristics), innovation – including across parts of the sub-system – can continue almost indefinitely

[91] *"There is no conversation about manufacturing, industry, robotics, electrification, renewables, or critical materials without China in the room"*. https://www.linkedin.com/posts/lena-thiede-7841688b_amnc26-share-7471099021651050497-ZwM-/

Similarly, realistic assessments of security risks – and what would be acceptable within domestic politics - are needed. Specifically, examples include:

- The Philippines has a strong domestic steel industry which has attracted foreign investment from China and South Korea in particular[92]; it has also built up its Services sector with Renewables projects and the IMF is amongst organisations which consider that this can be further strengthened and expanded, including for exports[93]. Policies to support the expansion of steel and services include supporting finance provision through green and other bonds[94], the Tatak Pinoy (Proudly Filipino) Act[95] and skills programmes[96];
- Viet Nam possesses a solid base in heavy steel fabrication – which can be further leveraged for OSW - and can also leverage its oil and gas legacy to export turbine foundations and towers. PTSC (Petroleum Technical Services Company), the offshore services arm within the Petro Viet Nam (PVN) SOE group, is becoming increasingly involved in OSW, including providing wind power bases for Taiwan (China) and offshore substations for the Baltica 2 project in Poland[97].

75. Many options to increase collaboration without moving into sensitive or contentious issues exist [see the list in *paragraph 70*] and can be followed immediately.

76. Many components in "European" or other non-Chinese systems are either manufactured under offshoring arrangements in China or contain a wide range of Chinese sub-components. Blanket exclusions of Chinese components would increase costs, likely highly significantly.

77. Options for the *4 Focus Economies* to benefit further from China's supply chain are available now and will increasingly be so. Cooperative arrangements can vary in their level of ambition regarding:
    - product import;
    - assembly or manufacturing under licence or within joint ventures; and
    - ownership of OSW projects or manufacturing plants by Chinese entities overseas.

[92] As noted previously *[see paragraph 50]*
[93] https://www.imf.org/-/media/files/publications/selected-issues-papers/2026/english/sipea2026005.pdf
[94] Ibid.
[95] A legislative pillar designed to build domestic "mother industries," encourage local value-adding, and reduce import dependency in critical manufacturing sectors like steel (e.g. within: https://pco.gov.ph/news_releases/pbbm-lauds-steelasia-for-reviving-ph-steel-industry-bringing-jobs-to-filipinos/)
[96] IMF (Ibid.)
[97] From *Annex 1 Section 1.4*: Vietnam can also leverage its unique status as the world's 11th largest steel producer to further build its capacity of supplying steel for offshore wind market. So far, its steel industry has already attracted investment from international players such as POSCO and JFE Steel. By clustering manufacturers and suppliers in regional hubs like Hai Phong, Quang Ninh, Thai Binh, Ba Ria–Vung Tau, Ninh Thuan, and Binh Thuan, the country aims to close technological gaps. Research shows that the transition from basic steelwork to advanced manufacturing could create up to 55,000 green jobs, transforming Vietnam into a primary offshore wind manufacturing hub for Southeast Asia

78. Markets in the *4 Focus Economies* are small and largely nascent. There is time over the next few years to further explore how increased Chinese overseas investment in manufacturing and projects can be balanced within the *Focus Economies'* climate, local manufacturing and security goals.