

LOCAL SUPPLY CHAIN DEVELOPMENT PATHWAYS FOR OFFSHORE WIND IN GUJARAT

**Ocean Energy
Pathway**

In partnership with

 **BVG**Associates

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Contents

Contents	2
Executive summary	3
1 Introduction	10
2 Capacity projection and supply chain demand analysis	11
2.1 Offshore wind in India	11
2.2 Deployment projection	12
2.3 Demand projection	13
2.4 Component, vessel, and infrastructure demand	17
3 Supply chain assessment	32
3.1 Methodology	32
3.2 Supply chain assessment	34
3.3 Supply chain assessment summary	46
3.4 Supply chain assessment conclusions	48
4 Supply chain development pathways	49
4.1 Economic impact analysis	53
4.2 Supply chain barriers and supports	55
4.3 Recommendations	59
Appendix A Assumptions used in demand modelling	60
Appendix B Supply chain categories	61
Appendix C Stakeholder engagement	62
Appendix D Case study: GERMI	63
Appendix E Economic impact assessment methodology	64
	65

Executive summary

Offshore wind is a globally established industry with clear industrial and economic benefits. India has significant offshore wind resource potential and has set ambitious plans across Tamil Nadu and Gujarat.

Supply chain demand assessment

This study is based on a projected deployment volumes of 25.5 GW across India, of which 5 GW is expected in Gujarat. At this level of deployment, the market is expected to reach a scale sufficient to support the development of key supply chain infrastructure. This includes production facilities for major components, such as nacelles, towers, blades, foundations, cables, and offshore substations, as well as port upgrades. Their development requires significant lead times and high upfront investment, making the establishment of a clear and sustained development pipeline essential to enable investment.

Table A Component, vessel, and infrastructure demand for 25.5 GW of offshore wind in India.

Component	Unit	Market volume	Number of facilities
Turbine blade	Number of blades	3,504	2
Turbine tower	Number of towers	1,168	1
Turbine nacelle	Number of nacelles	1,168	2
Foundations	Number of foundations	1,168	1
Array cable	Array cable (km)	1,752	1
Offshore export cable	Export cable (km)	3,852	1
Offshore substation	Number of substations	51	2
Foundation & turbine installation vessels	Number of installation vessels	5	N/A
Cable lay vessel	Number of installation vessels	5	N/A
Port infrastructure	Quayside length (km)	2.4	1-2 large installation ports
	Laydown area (Hectares)	96	

Supply chain assessment

The supply chain assessment shows that Gujarat has a strong foundation to participate in the offshore wind industry. Existing capabilities in engineering, project development, onshore infrastructure, and offshore fabrication provide a platform for localisation, particularly in development, project management, and operations and maintenance (O&M). Many of these activities could be delivered locally with relatively modest investment focused on skills and capability development.

There is a strong opportunity for localisation in turbine supply, as well as in the manufacturing of onshore substations. There is also significant transferability from the onshore wind sector, creating strong potential for low-cost manufacturing. However, realising these opportunities will require targeted support, partnerships, and coordinated planning. Table B provides the assessment framework and Table C provides a summary of the results.

Table B Supply chain assessment framework.

Description	Score
Significant investment is required across supply chain infrastructure, workforce skills, and R&D capabilities.	1
Significant investment is required; however, a strong existing industrial base exists.	2
Moderate investment is required, primarily focused on targeted workforce development or R&D capabilities.	3
The existing supply chain already provides the required products and services for offshore wind, supported by a strong track record.	4

Table C Summary of supply chain assessment.

Level 1	Level 2	Score
Development and project management	Project management	3
	Environmental surveys	3
	Site investigations	3
	Engineering	3
Manufacturing	Nacelle and hub	2
	Blade	2
	Tower	2
	Foundation	2
	Array cable	2
	Export cable	1
	Offshore substation	4
	Onshore substation and electrical equipment	4
Installation and commissioning	Turbine	1
	Foundation	2
	Offshore cable	1
	Onshore cable	4
	Offshore substation	2
	Onshore substation	4
Operations and maintenance	Wind farm operation	3
	Turbine maintenance and service	3
	Balance of plant O&M	3
	Vessels	3

Supply chain development pathways

Based on the assessment of Gujarat's supply chain capabilities, three potential pathways for developing Gujarat's offshore wind supply chain were considered. These pathways reflect different levels of ambition, investment, and supply chain focus. An overview of the pathways is presented in Table D and the associated economic impacts are presented in Table E and Table F.

Table D Overview of supply chain pathways.

Pathway	Description
Core strengths	Under this pathway, Gujarat focuses on areas of the supply chain where there is strong logic for local delivery and where existing capabilities are well established. Over time, the supply chain grows organically in these core areas, although gaps remain in more specialised activities, particularly offshore installation and balance-of-plant manufacturing.
Strategic investment	The strategic investment pathway involves large, targeted investments in enabling infrastructure and manufacturing facilities where local supply has clear advantages, for example based on Gujarat's established onshore wind manufacturing base, the state's industrial strengths in steel and heavy manufacturing, and existing onshore cable production capabilities.
Self-sufficiency	Under the self-sufficiency pathway, early and substantial action is taken to maximise local content and strengthen the local value chain. Gujarat quickly achieves the ability to deliver high or very high local content across all major supply chain areas. This is driven by the localisation of offshore wind-specific products and services within the state by both existing Indian supply chain companies and international companies that choose Gujarat as a base for their offshore wind operations.

Table E Lifetime employment impacts in Gujarat for Indian project pipeline by supply chain pathway.

Total FTE years in Gujarat			
	Core strengths	Strategic investment	Self-sufficiency
Development and project management	5,100	6,500	8,400
Manufacturing	74,700	283,700	376,500
Installation and commissioning	6,100	8,600	40,300
O&M	40,100	48,800	98,300
Decommissioning	10,900	35,300	67,900
Total	136,900	382,900	591,400

Table F Lifetime GVA impacts in Gujarat for Indian project pipeline by supply chain pathway.

Total GVA in Gujarat (₹ crore)			
	Core strengths	Strategic investment	Self-sufficiency
Development and project management	1,030	1,310	1,680
Manufacturing	16,400	61,400	81,200
Installation and commissioning	983	1,590	9,040
O&M	7,920	9,470	16,600
Decommissioning	889	2,880	5,550
Total	27,300	76,600	114,000

Supply chain barriers and supports

The key barriers to supply chain development include:

- Lack of pipeline visibility and strength, delaying investment and decisions on infrastructure.
- Low awareness of supply chain opportunities.
- Insufficient port infrastructure, with long lead times creating a risk of future delivery and logistics bottlenecks.
- Competitiveness challenges among local suppliers due to limited experience in offshore wind markets.
- Barriers to private investment in manufacturing, driven by high capital costs and long payback periods.
- Regional skills gaps, particularly for specialised technical and manufacturing roles.
- Limited offshore wind experience within the local supply chain, slowing market entry and capability development.
- Underdeveloped R&D ecosystem, limiting innovation and localisation of solutions suited to local conditions.

The key support and enablers include:

- Establishing a clear and credible project pipeline to provide long-term visibility and unlock investment.
- Strengthening regulatory and delivery frameworks to improve confidence in project timelines and execution.
- Early investment in port infrastructure, including phased development of offshore wind hub ports offering collocated marshalling facilities and fabrication space.
- Improved signposting of opportunities across the supply chain, supported by industry bodies and agencies.
- Targeted programmes to develop supply chain readiness via business support programmes to inform regional companies about the standards, certifications, and market entry strategies they will need to compete in the sector.
- Financial incentives and policy support to crowd in private investment, particularly for manufacturing.
- Coordinated workforce development and skills planning to address capability gaps.
- Facilitating knowledge transfer and partnerships with experienced international suppliers.

Strengthening offshore wind R&D capability via demonstration projects and industry–academic collaboration.



Recommendations

This report recommends the following:

- Supply chain companies will be reluctant to make significant investments into ports, vessels and production facilities until there is a clear, long-term project pipeline in India. Visibility of a market that they are confident can deliver average volumes between 0.5 GW and 1.5 GW annually over a period of 5-10 years will provide appropriate volume to unlock investment and mitigate concerns of boom-bust cycles.
- Creating a suitable offshore wind port within Gujarat can be seen as a foundational investment as fabrication facilities for large components tend to be collocated with suitable quaysides for loading out large scale components. Prioritizing the phased development of an offshore wind port limits the size of the upfront investment and lays the foundations for wider sector investments in manufacturing capacity.
- To access the higher local content pathways, a stable pipeline should be supported by a framework that can offer incentives at the right level to crowd-in significant private investment in manufacturing. Examples of successful mechanisms include grants, tax credits and duty exemptions for qualifying investments.
- To ensure Gujarat can leverage its existing supply chain capabilities, an effort should be made to ensure that opportunities within the sector are clearly signposted and that suppliers are clear on the relevant codes, standards and commercial / financial criteria they will need to meet to be able to successfully operate in the sector. Industry trade associations, as well as public sector economic development agencies can play a key role in preparing the supply chain for future offshore wind development within India.
- Across all pathways, the success of Gujarat-based suppliers would be bolstered by knowledge transfer between existing suppliers and Gujarat businesses looking to participate in the sector. Knowledge transfer can be achieved through the establishment of joint-venture partnerships for initial projects, as well as other tools such as the organisation of trade missions and delegations to visit successful suppliers in established markets.
- The R&D environment within Gujarat should be strengthened to allow technologies to be trialled under representative offshore conditions to help de-risk new approaches. National and state-level innovation programmes need to support industry-specific R&D. A key challenge is the development of low wind speed turbine technology that enables the cost-effective development of offshore wind in Gujarat.
- A co-ordinated, national approach to supply chain development should be established based on the regional supply chain specialisms of India's main offshore wind states. Collaborative development of complementary supply chain capacity removes the need for states to compete against each other.



1 Introduction

India is taking important steps to develop a domestic offshore wind industry as part of its broader energy transition. The Government of India has identified potential development areas off the coasts of Gujarat and Tamil Nadu, with Gujarat expected to play a central role in early deployment. The state benefits from a favourable offshore resource and existing industrial capabilities, positioning it well to support the development of the sector.

The development of offshore wind presents a significant opportunity for Gujarat to strengthen its industrial base, generate employment, and increase gross value added (GVA). Realising these benefits will depend on developing supply chain capability and creating the conditions required to attract investment in manufacturing and associated infrastructure.

This report was commissioned by Ocean Energy Pathway to assess how a regional offshore wind supply chain could develop in Gujarat. It aims to:

- Assess the scale and timing of offshore wind deployment and the resulting supply chain demand.
- Assess Gujarat's existing industrial capabilities and readiness to participate in the offshore wind sector.
- Identify pathways for supply chain development considering different levels of ambition.
- Quantify the associated economic impacts in terms of employment and GVA.
- Provide recommendations to support the development of a competitive local supply chain.

The report is structured as follows:

- Section 2: Capacity projection and supply chain demand analysis.
- Section 3: Supply chain assessment.
- Section 4: Supply chain development pathways and economic impact analysis.

This work follows a similar report published by OEP in February 2025, which established the extent of the offshore wind supply chain in the region of Tamil Nadu and its scope for future development. This study also quantified the socio-economic benefits possible within Tamil Nadu and India under different supply chain development scenarios.ⁱ

ⁱ Tamil Nadu Offshore Wind Manufacturing Supply Chain Investment Study, Ocean Energy Pathway (OEP), February 2025, available online at <https://oceanenergypathway.org/publications/>

2 Capacity projection and supply chain demand analysis

2.1 Offshore wind in India

Though India has no offshore wind capacity allocated or installed as of 2025, the Ministry of New and Renewable Energy (MNRE) and the National Institute for Wind Energy (NIWE) have been developing plans to establish a domestic offshore wind industry for over a decade.

In 2023, the Government of India set out ambitions to allocate sea bed leases for 37 GW of offshore wind capacity by 2030. The Government plans to exploit the available offshore wind resource in the waters off the states of Gujarat and Tamil Nadu, with eight sites off each state identified for offshore wind development through the Facilitating Offshore Wind in India (FOWIND) research project.

Early surveys show the waters off Gujarat have a wind resource between 6.8 m/s and 7.0 m/s at 120 m above sea level and average water depths between 17 m and 43 m below lowest astronomical tide (LAT).ⁱⁱ Sites off Tamil Nadu have wind resource of between 7.1 m/s and 8.2 m/s at 120 m above sea level, with water depths between 11 m and 53 m below LAT.ⁱⁱⁱ The realisation of offshore wind projects in India, and especially in Gujarat, will require turbine manufacturers to offer variants of their platforms designed for the lower (IEC Class II and III) wind speeds. The production of these units represents a possible avenue for supply chain localisation within India.

In 2023, a strategy paper published by MNRE outlined the framework under which offshore wind projects will be developed. The framework set out three models for allocating project capacity, with 37 GW of capacity due to be allocated across a seven-year programme of sea bed auctions.^{iv} These auctions will adopt the following different models:

- **Model A:** 1 GW of capacity will be allocated in wind zones where MNRE and NIWE have already carried out detailed site surveys off Tamil Nadu and Gujarat. Agencies will procure offshore wind capacity through power purchase agreements (PPAs), which will be supplemented by Viability Gap Funding (VGF). The VGF scheme is administered by the Department of Economic Affairs, which is part of the Ministry of Finance, and provides financial support in the form of grants to economically desirable but commercially unviable infrastructure projects.
- **Model B:** 14 GW of capacity will be allocated in identified zones. Site exclusivity will be granted to developers for a fixed period, during which time they will carry out site survey and consenting without any central financial assistance or VGF support.
- **Model C:** 22 GW of capacity will be allocated in identified zones. It provides non-exclusive site leases without VGF support, and developers will carry out site survey and consenting work

ⁱⁱ Pre-Feasibility Study for Offshore Wind in Gujarat, FOWIND Consortium, May 2015, available online at <https://mnre.gov.in/en/off-shore-wind/>.

ⁱⁱⁱ Pre-Feasibility Study for Offshore Wind in Tamil Nadu, FOWIND Consortium, May 2015, available online at <https://mnre.gov.in/en/off-shore-wind/>.

^{iv} Strategy Paper for Offshore Wind Energy Projects, NIWE for MNRE, September 2023, available online at <https://mnre.gov.in/en/off-shore-wind/>.

without central financial assistance of VGF support.

Table 1 shows the timetable that was established for auctions under this framework.

Table 1 Auction timetable from MNRE strategy paper.

	Model A (GW)	Model B (GW)	Model C (GW)	Total (GW)
2024	0.5	4.0	0.0	4.5
2025	0.5	3.0	0.0	3.5
2026	0.0	3.0	4.0	7.0
2027	0.0	3.0	4.0	7.0
2028	0.0	1.0	4.0	5.0
2029	0.0	0.0	5.0	5.0
2030	0.0	0.0	5.0	5.0
Total	1.0	14.0	22.0	37.0

As of early 2026, India had issued offshore wind tenders totalling 4.5 GW, comprising 4 GW off the coast of Tamil Nadu and 0.5 GW off Gujarat, in line with 2024's auction timetable set out by the Ministry of New and Renewable Energy (MNRE) in its offshore wind strategy.

However, these tenders failed to attract developer interest even when extension to bidding deadlines were granted. The tenders were subsequently cancelled by the Solar Energy Corporation of India (SECI), which was running the sea bed allocation process.

The lack of participation has been attributed to limited financial incentives on offer, high perceived regulatory risks in the Indian market and a perception that India's offshore wind policy frameworks remain underdeveloped. The auction processes have also been hindered by broader headwinds facing the global offshore wind sector over the past two years, which have prompted developers to reassess their portfolios and re-evaluate their appetite for early-stage development positions in emerging offshore wind markets. Changes to India's existing policy and market framework are therefore required to advance the buildout of the country's significant offshore wind potential.

2.2 Deployment projection

While MNRE's 37 GW offshore wind target provides an important long-term signal of ambition, this remains highly aspirational. It is currently a target that is not underpinned by a policy or regulatory framework that can deliver a significant volume of commercially viable projects.

The deployment projection for this study is shown in Figure 1 and sees India reach a cumulative

capacity deployment of 25.5 GW by 2043. This projection reflects the absence of participation in initial tenders and broader headwinds affecting the development of early-stage markets globally.

The projection assumes a slow initial ramp-up, with first deployments occurring in 2032 in Tamil Nadu and 2034 in Gujarat. Development is largely concentrated in Tamil Nadu, with 5 GW allocated to Gujarat in recognition of the regions lower wind speeds. These regions are regarded as being the most likely for development in the near term given the size of the resource that exists of each coast, and the early-stage work done through the FOWIND project to stimulate development in these states.

From the mid-2030s onwards, national deployment rates reach a steady 2-3 GW a year. This projection may still be optimistic and is contingent on swift and consistent progress in site leasing and market development. The time horizon applied allows time for sufficient policy and framework development, and the cumulative capacity deployed under this projection reflects India's size, resource potential and long-term ambitions to deploy offshore wind.

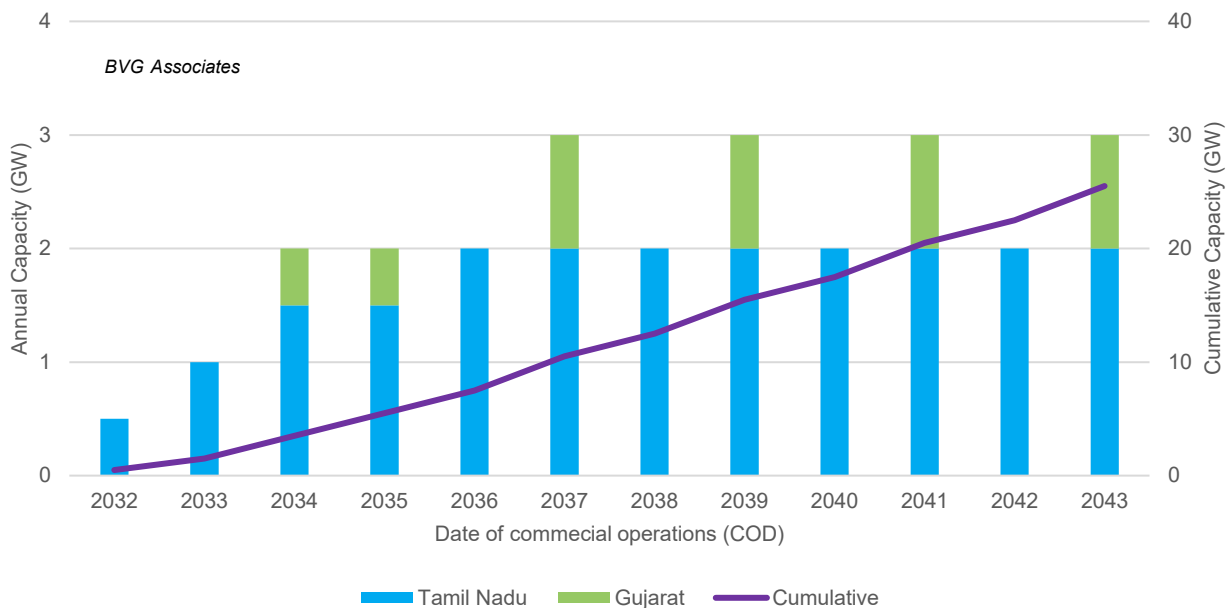


Figure 1 Annual and cumulative capacity projection for India

2.3 Demand projection

2.3.1 Components

This section introduces the primary components used to construct an offshore wind farm, each of which is built in a specialised facility. A brief description of these primary components is provided across Table 2, Table 3 and Table 4 below.

Table 2 Primary wind turbine components.

Component	Description	Photo
Turbine nacelle	Supports the rotor and houses generation equipment which converts rotational energy from rotor into three-phase AC electrical energy.	
Turbine tower	Steel tubular structure that supports and provides access to the turbine nacelle.	
Turbine blade	Aerodynamic foil made from composite material. Blades capture wind energy, with modern offshore turbines adopting rotor designs based on three-blades.	

Table 3 Primary foundation components.

Component	Description	Photo
Monopile	Steel tubular foundation that is driven or drilled into the sea bed and supports the turbine. Monopiles are typically used in water depths up to 50 m and this may increase to 60 m in future.	
Transition piece	A shorter tubular component that provides the connection interface between the turbine tower and the monopile.	
Jacket	A three-legged or four-legged steel lattice foundation fixed to the sea bed using steel pin piles or suction buckets. These are adopted for projects in deeper waters than monopiles, or in areas exposed to natural hazards, such as earthquakes.	

Table 4 Primary transmission components

Component	Description	Photo
Array cable	Medium voltage subsea cable that exports power from turbines to the offshore substation.	
Export cable	High voltage subsea cable that exports power from the offshore substation to shore.	
Offshore substation	Offshore transformer platform that collects power from turbines. AC or DC technology can be used, with technology selection driven by factors such as platform capacity and export cable route length. AC is assumed to be adopted within the Indian market.	

2.3.2 Installation vessels

This section outlines the main installation vessels used to install offshore wind components. These vessels are highly specialised and the global fleet of dedicated assets is small.

In addition to these installation vessels, many less specialised support vessels, such as rock dumping vessels, platform supply vessels and installation support vessels, are also required to support installation. The demand for support vessels has not been modelled as part of this analysis.

The construction of a fleet of specialised installation assets for the Indian market could act as a driver of supply chain growth and dovetails with the National Shipbuilding Mission which aims to revitalise India's shipbuilding industry. Under the mission, approximately \$8 billion will be made available in support through the Shipbuilding Financial Assistance Scheme (SBFAS) and the Shipbuilding Development Scheme (SbDS), with the aim of expanding India's domestic shipbuilding capacity to 4.5 million gross tonnes annually.

Both schemes will run until March 2036, with extensions envisaged to 2047. The SBFAS will provide financial assistance of between 15% and 25% of total vessel costs, including for specialist vessels. While the SbDS will focus on building and improving the capacity of India's shipbuilding industry.^v

^v Guidelines for shipbuilding assistance, Ministry of Ports, Shipping and Waterways, 27 December 2025, available online at <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2209139®=3&lang=2>

Table 5 Indicative requirements for turbine installation ports

Parameter	Indicative requirement
Distance from wind farm (km)	350
Entrance width (m)	65
Air draft (m)	Unrestricted
Access channel width (m)	150
Access channel depth (m below mean low water springs)	7.5
Landside area (ha)	12
Quay length (m)	300
Quay depth (m below chart datum)	7.5

Table 6 Indicative requirements for foundation installation ports

Parameter	Indicative requirement
Distance from wind farm (km)	250
Entrance width (m)	65
Air draft (m)	80
Access channel width (m)	150
Access channel depth (m below mean low water springs)	8
Landside area (ha)	12
Quay length (m)	300
Quay depth (m below chart datum)	8

2.4 Component, vessel, and infrastructure demand

The offshore wind projection shown in Figure 1 presents when India's offshore wind capacity is expected to reach its commercial operations date (COD). Based on the typical construction timelines and component volumes required to realise 1 GW of offshore wind capacity, the component, vessel and infrastructure demand projections below indicate when this demand will materialise respective to the forecast commercial operations date.

Component demand projections also display the typical viable throughput of a single component production facility, with typical throughput data based on patterns observed in established and emerging offshore wind markets.

Assumptions used to model component demand are outlined in Appendix A.

2.4.1 Turbine nacelle

Nacelle production facilities integrate large pre-manufactured components of the wind turbine nacelle, such as the gearbox, generator, bearings, nose cone and yaw systems. Turbine electrical systems are also installed and tested. Nacelles are then shipped out from the facility typically using roll-on/roll-off vessels at an adjacent quayside.

There are over 10,000 components required to assemble a nacelle, and almost all are produced by external suppliers. This can make the localisation of nacelle fabrication challenging as it is reliant on a broad base of global and regional suppliers and requires complex logistics. Recent supply chain analysis by GWEC has highlighted the need for an expansion of nacelle production within the APAC market from 2030 to meet growing demand for components^{vi}.

In Europe, established nacelle production facilities in Germany and Denmark are operated by Siemens Gamesa and Vestas and sit within an

Case study: Taiwanese nacelles

In 2020, Siemens Gamesa began construction of a nacelle production facility at Taichung Harbour. The facility began production in 2021 and supplied 8 MW nacelles for Orsted's 900 MW Greater Changhua 1 & 2 projects.

The investment was supported by a combination of factors, including a strong and visible offshore wind project pipeline, investment at Taichung Harbour, and local content requirements introduced by the Taiwanese Government which targeted around 60% local content. Together, these measures provided the confidence needed to establish local manufacturing capacity.

Although the local content requirements were removed in November 2024, continued domestic market growth has supported the expansion of the facility to approximately triple its original capacity supporting production of larger, 14 MW nacelles for Northland Power's 1 GW Hai Long Project. The long-term viability of this facility may be challenged as the domestic market growth slows, highlighting the importance of a strong domestic pipeline in underpinning the creation of new production facilities.



Credit: Siemens Gamesa

^{vi} Mission Critical: Building the Asia Pacific wind energy supply chain, GWEC, November 2024, available online at <https://www.gwec.net/news/apac-supply-chain-report-2024/>

established supply chain for nacelle production. These facilities serve both European and global markets. Taiwan is an example of an emerging offshore wind market that has managed to establish a degree of nacelle production to meet increasing demand for components.

Demand forecast

Demand for nacelles typically arrives two years ahead of a project's date of commercial operations, when turbine pre-assembly and commissioning of turbines is carried out in a project's installation port ahead of turbine installation. A nacelle production facility would be expected to have a throughput of around 65 units per year.

Based on these assumptions and our deployment forecast for India, the market within Tamil Nadu and Gujarat could create sufficient demand for an operational nacelle production facility by 2031, with demand for nacelles expected to more than double to over 120 units in 2035 and 2037. A graph showing the timing and scale of demand for nacelles within the Indian market is shown in Figure 2.

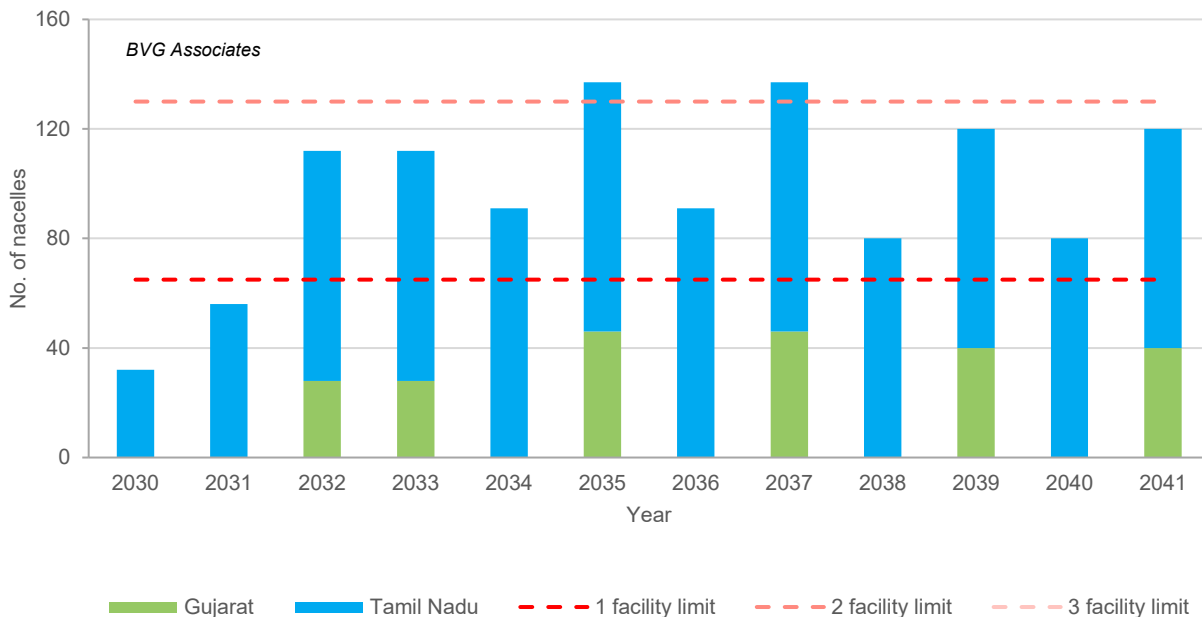


Figure 2 Projected demand for nacelle production.

2.4.2 Turbine tower

A turbine tower for a 14 MW offshore wind turbine typically consists of four sections, with bottom sections around 10 m in diameter and upper sections around 6 m in diameter. Total tower height varies with hub height but can be expected to reach around 150 m, with an overall mass of approximately 1,200 t.

During fabrication, raw steel plates are cut, rolled and welded into sections which are blasted and coated inside long covered production halls. Tower production is outsourced by turbine suppliers to specialist manufacturers like GRI, Haizea, Welcon, CS Wind, Dajin Heavy Industries, and Windar Renewables. While these fabricators produce the large structural sections, a range of subcomponents, such as bolts, ladders and lifts and cable internals, are all part of the turbine tower. These are procured from sub-suppliers.

Demand forecast

Demand for towers typically arrives two years ahead of a project's COD, when turbine pre-assembly work begins. A tower production facility would be expected to have a throughput of 150 towers annually, assuming its business case is entirely built on offshore wind towers. The higher throughput requirement relative to nacelle production reflects the capital intensive and lower margin nature of tower production operations.

Based on these assumptions and our deployment forecast, the market within Tamil Nadu and Gujarat is not projected to create a standalone business case for a dedicated offshore tower facility for India's domestic market. However, demand is significant and would create additional capacity for larger-diameter offshore tower production capacity within facilities producing components for the onshore wind market.

Demand is projected to peak in 2035 and 2037 when around 140 towers will be required annually. A graph showing the timing and scale of demand for towers is shown in Figure 3.

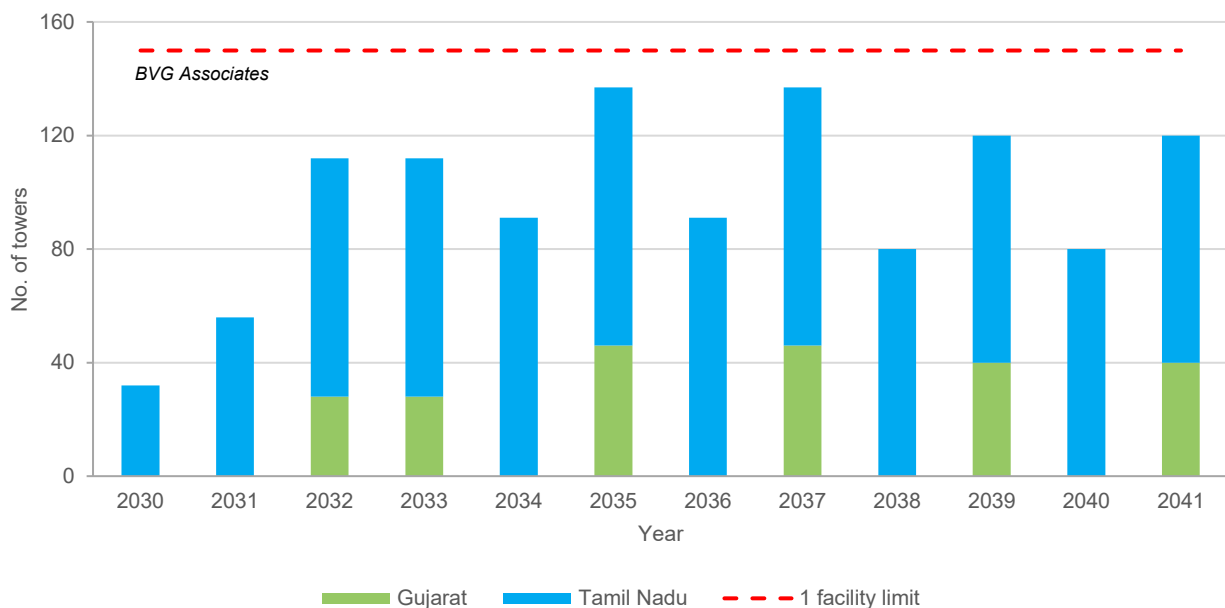


Figure 3 Projected demand for tower production.

2.4.3 Turbine blades

At blade production facilities, large moulds are positioned within production halls. Within the moulds, layers of carbon fibre are added, in addition to root bases and structural reinforcements. Each half blade shell is then infused with resin under vacuum and cured. Lightning protection is added to each half shell of the blade and the two halves are joined, before being coated and fitted with leading edge protection.

A wind turbine blade for a 14 MW turbine is around 110 m long. The production of blades is labour intensive and requires significant storage space for finished products. Leading offshore wind turbine fabricators, Siemens Gamesa and Vestas, both control blade production directly, while GE Renewable Energy relies on its subsidiary LM Wind Power. Companies have successfully localised blade production within new and emerging markets (see case study).

Case study: Vestas JV production of larger blades

In 2020, Vestas and Tien Li Offshore Wind formed a joint venture for the manufacture of offshore wind turbine blades. A facility was established in Taichung Harbour in Taiwan, initially producing blades for a V174 rotor diameter variant of its 9.5 MW offshore turbine platform which has been used at several Taiwanese projects. The turbine variant features a rotor that is 10 m wider in diameter than the equivalent model widely used across northern European sites and was conceived to enable a higher energy yield at lower wind speed sites.

Demand forecast

Demand for blades typically arrives two years ahead of a project's commercial operations date when turbine pre-assembly work begins. A production facility would be expected to have a throughput of around 140 blades annually.

Based on this assumption and our deployment projection, the market within Tamil Nadu and Gujarat is expected to create sufficient demand for a blade factory from 2031, with demand for blades peaking at around 400 blades annually in 2035 and 2037. Offshore wind turbines optimised for lower wind speeds seen off Gujarat will likely be required to enable the development of projects in Gujarati waters. These turbines are likely to be larger rotor diameter variants of existing models. This could create demand for a specific facility equipped with moulds to produce these components.

A graph showing the timing and scale of demand is shown in Figure 4.

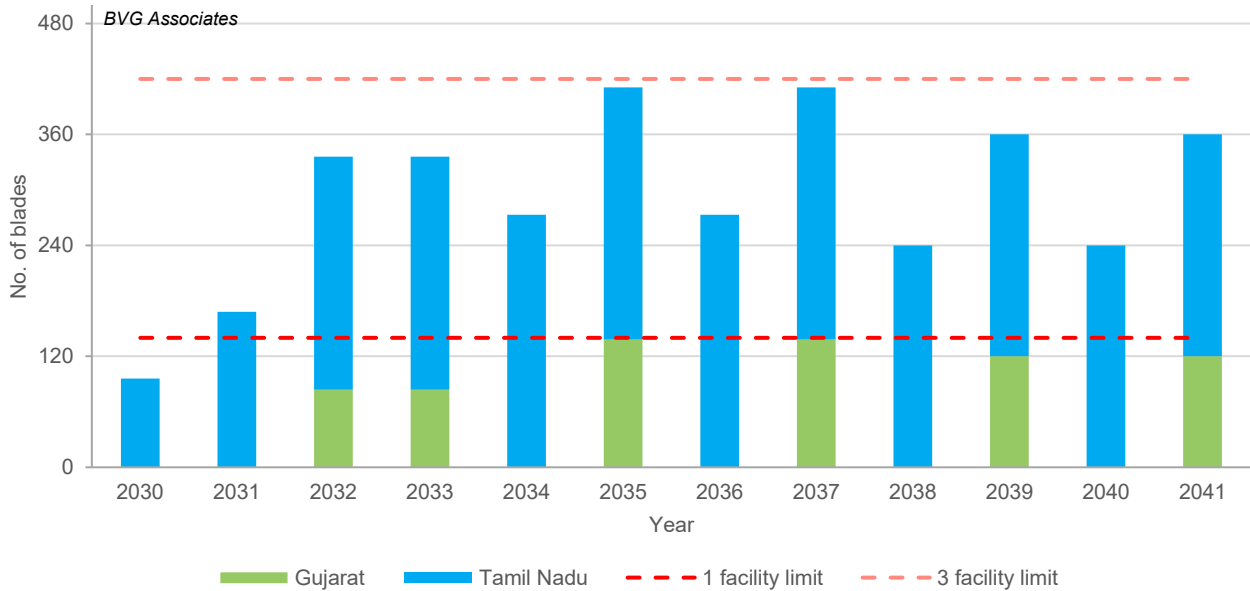


Figure 4 Projected demand for blade production.

2.4.4 Foundations

Offshore wind foundations are produced in large, specialised manufacturing facilities. The two principal fixed-foundation designs are monopiles and jackets. The choice between using monopiles and jackets depends on site conditions, such as sea bed geology, water depth, metocean conditions and seismic risk.

Monopiles are fabricated from rolled steel plate, which is pre-cut, welded and milled before being formed into cylindrical or conical sections known as cans. These cans are then welded together into monopile sections and transported using self-propelled modular transporters to assembly areas where they are further welded into complete monopiles. Once assembled, the monopiles are coated for corrosion protection and moved to external storage yards.

Some monopile designs incorporate a separate transition piece, which provides the structural connection between the foundation and the tower with access systems, such as ladders, boat landings and platforms. Others use an integrated monopile design and are essentially extended monopiles, with access systems attached after the structure has been driven into the sea bed. Monopile serial production facilities are large industrial environments, requiring long production halls fitted with gantry cranes, heavy-duty rolling and welding machinery, and significant quayside storage areas for finished structures.

Jacket foundations follow a different fabrication process. These lattice structures are formed from narrower diameter tubular legs and welded bracings, which are assembled in fabrication yards before the completed jackets are upended. Jackets can have three or four legs and are fixed to the sea bed with pin piles or suction buckets. Manufacturing locations for monopiles require large areas comprising covered fabrication halls as well as uncovered fabrication, upending and storage areas with direct quayside access.

Turbine foundation production facilities focus on manufacturing the primary steel structures, while ancillary elements, such as ladders, boat landings, davit cranes, platforms, and cathodic protection systems, are typically supplied by subcontractors.

Demand forecast

Demand for offshore wind substructures typically arrives three years ahead of a project's COD. A serial production facility for offshore wind substructures would be expected to have a throughput of around 125 foundations annually. Based on these assumptions and our deployment forecast, the market within Tamil Nadu and Gujarat is expected to create sufficient demand for a substructure manufacturing facility from 2034. A graph showing the timing and scale of demand is shown in Figure 5.

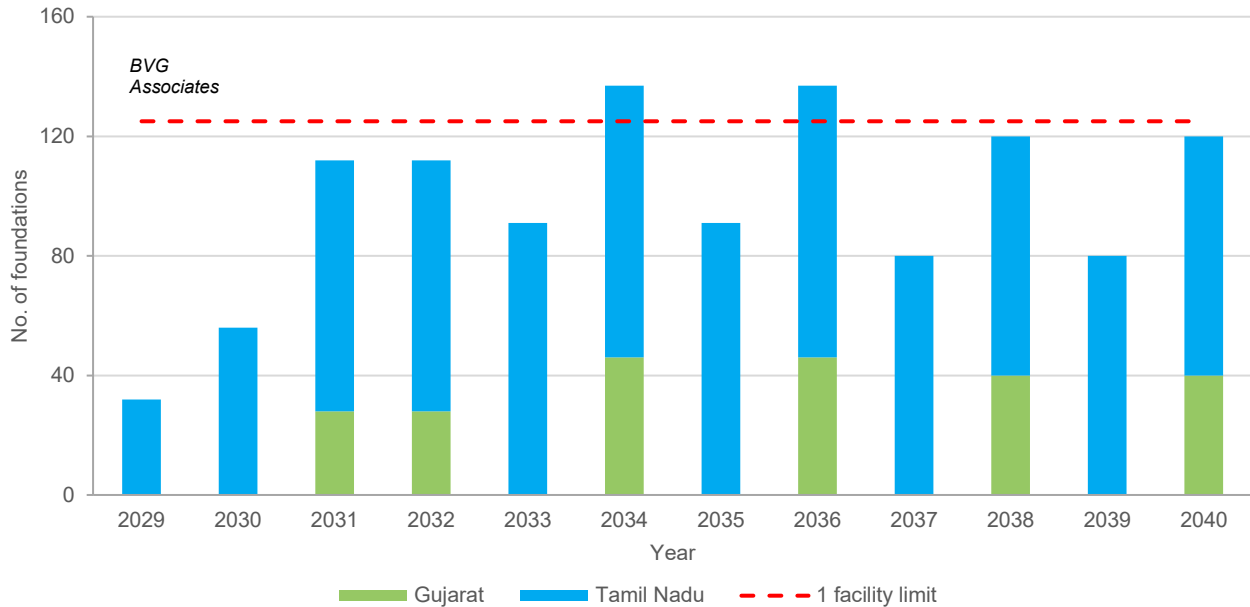


Figure 5 Projected demand for foundations.

2.4.5 Array cable

During production of subsea array cables, three cable cores are bundled together with insulation, armouring and fibre optic communication lines. Completed cables are spooled onto large cable carousels fitted onto specialist cable lay vessels.

Companies fabricating subsea array cables typically produce other forms of power cable, but operate dedicated facilities for subsea products. Array cables are commonly rated at 66kV, but leading suppliers are developing 132kV array cables. These higher rated cables will enable a larger number of higher capacity turbines to be connected along a single array string.

Demand forecast

Demand for array cable depends on the cable circuit layout of an individual project and the spacing between individual turbines. It is typical for spacing between turbines to be between 5-10 times the rotor diameter of the installed turbines. We have assumed 1.5 km of array cable will be required per turbine installed.

Demand for array cables arrives around two years ahead of project COD with array cable installation occurring after foundation installation and before turbine installation. There is a degree of overlap between these installation campaigns. A typical facility producing array cables would have a throughput of around 250 km annually.

Based on these assumptions and our deployment forecast, the market within Tamil Nadu and Gujarat would create sufficient demand for an array cable production facility by 2035 with demand peaking around 200 km of array cable product annually in 2035 and 2037. A graph showing the timing and scale of demand is shown in Figure 6.

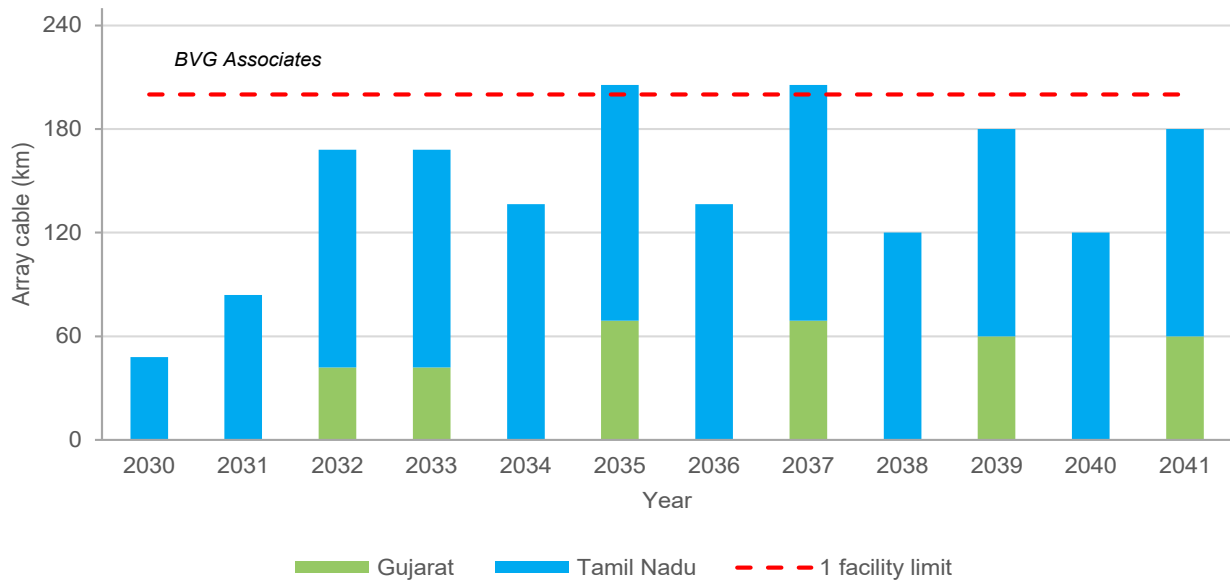


Figure 6 Projected demand for array cable.

2.4.6 Export cable

Export cable facilities produce high voltage subsea cables that run between the offshore and onshore substation. Export cables consist of cable cores, armouring, cable protection and fibre optic communication lines that are bundled together in a single cable. These products are then spooled onto large cable carousels fitted on specialist installation vessels. Companies fabricating export cable typically produce these products for use onshore or offshore, for example for the interconnector market, but typically operate dedicated facilities that focus on subsea products.

Export transmission systems can use high voltage alternating current (HVAC) or high voltage direct current (HVDC) technology to bring power to shore. We anticipate HVAC solutions will be adopted within Tamil Nadu and Gujarat because all zones identified across Tamil Nadu and Gujarat in the FOWIND study are within 75 km of shore. Offshore wind HVAC export cables are typically rated between 220 kV and 275 kV.

The number of export cables and the voltage selected installed for each project depend on the design of its transmission system, but typically multiple cable circuits are installed to export power and provide a degree of redundancy.

Demand forecast

Export cable demand depends on project specific factors including the final design of the transmission system and the length of the export cable corridor route into the landfall point. We have assumed that each 1 GW of offshore wind will require 150 km of export cable across two export cable circuits.

Demand for export cables arises around three years ahead of a project's COD. Offshore

transmission infrastructure is typically installed before foundations and turbines to enable developers to export power from projects as quickly as possible once turbines are installed. A facility producing offshore wind export cable would be expected to have a throughput of 350 km of cable annually.

Based on these assumptions, the market within Tamil Nadu and Gujarat would create sufficient demand for an export cable production facility by 2034. Demand peaks between 2034 and 2040, when total annual volumes will reach 450 km of export cable. A graph showing the timing and scale of demand is shown in Figure 7.

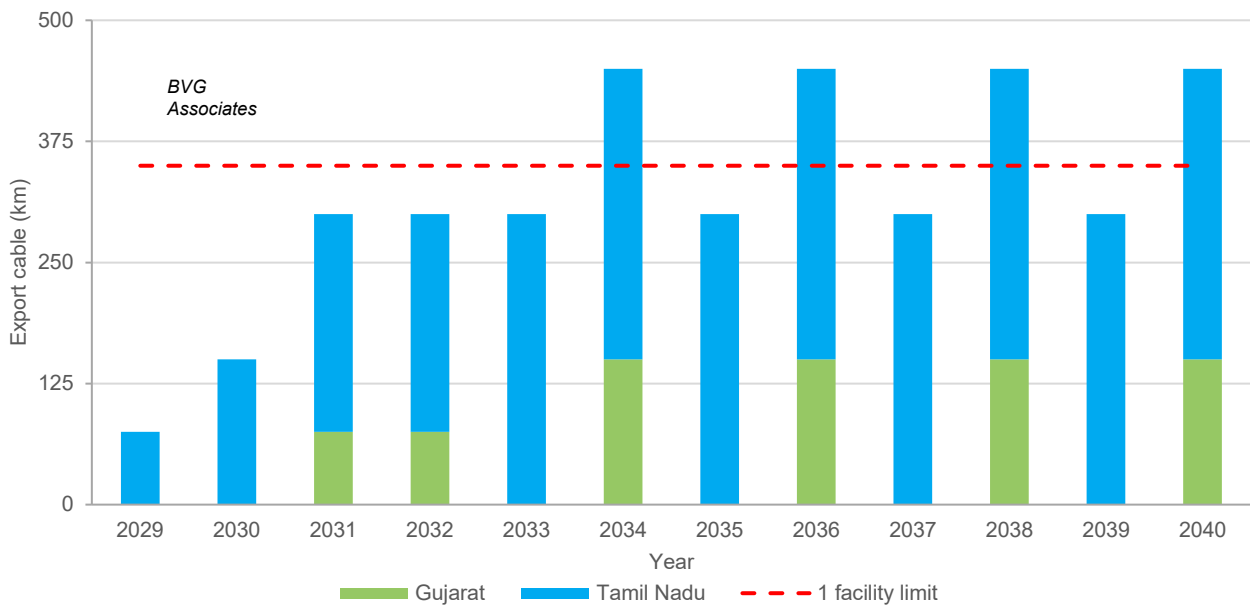


Figure 7 Projected demand for export cable.

2.4.7 Offshore substation topsides

Offshore wind substation topsides are large multi-floor steel structures that are built in large fabrication halls or shipyards that often supply offshore platforms for both the renewables and offshore oil and gas industries. The primary steel sections for the topside are built, assembled and coated, before critical equipment, such as transformers, switchgear, communication and control systems and safety systems, are integrated within the platform. Internal equipment installed on the platform is provided by sub-suppliers. Once fully assembled, offshore substation topsides are loaded out onto heavy lift installation vessels or barges to be transported to installation sites.

Designs for offshore wind substation topsides vary according to the design and specifications of transmission systems for individual projects. We anticipate HVAC solutions will be adopted for the Indian market based on the relative distances to shore identified for sites in Tamil Nadu and Gujarat within the FOWIND study, as all sites are located within 75km of the coast. Monopile or jacket foundations for each substation topside could also be produced in the same yard, depending on the supply chain capacity and contractual set up of a given project.

Demand forecast

The number of offshore wind substations required by each project depends on the final design of a project's transmission system, with designs optimised for each wind farm.

We have assumed that each 1 GW of offshore wind capacity installed will require two offshore substation topsides. Demand for offshore substations arises three years ahead of COD. Offshore substations are typically installed at the beginning of the offshore installation process as this enables power from installed turbines to be exported to the grid as early as possible. Dedicated fabrication yards focused on offshore substation topsides can be expected to have a throughput of three platforms per year.

Based on these assumptions, we see demand for offshore wind substations arising from 2029, with sufficient demand for a dedicated production facility from 2031. Overall demand peaks between 2034 and 2040, with annual demand reaching six platforms annually. A graph showing the timing and scale of demand is shown in Figure 8.

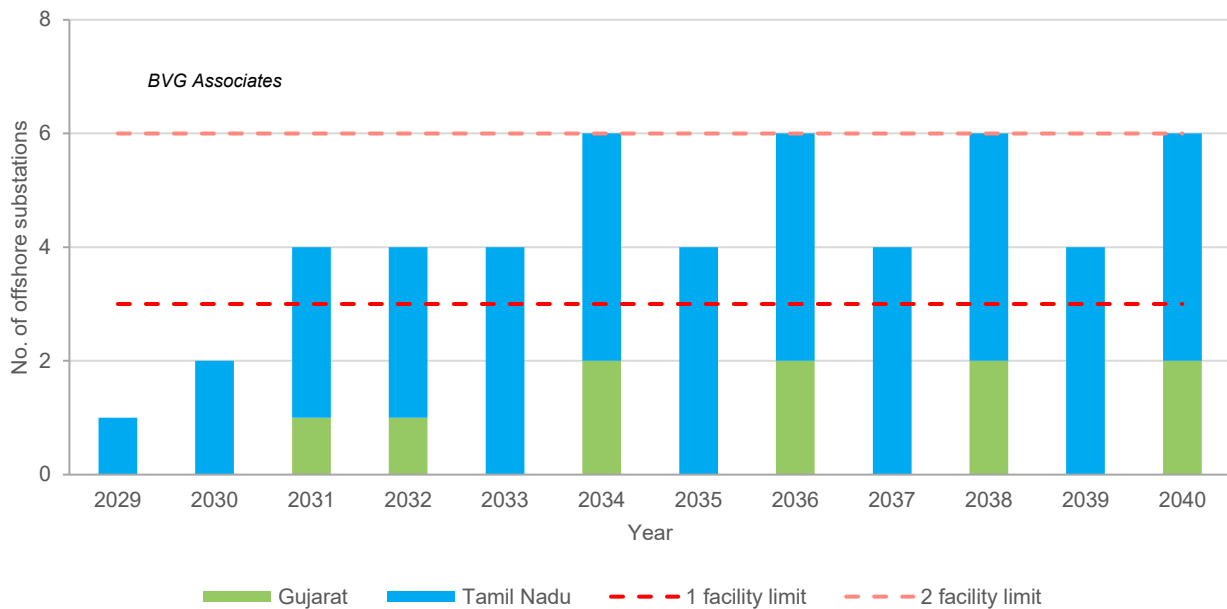


Figure 8 Projected demand for offshore substation topsides.

2.4.8 Foundation and turbine installation vessel

Specialist crane vessels are required to install turbines, foundations and substations. Designs for these vary, with floating crane vessels capable of installing both foundations and offshore substations, and jack-up vessels used to install wind turbines and foundations.

The vessel strategy for a given project depends on the availability of vessels, as well as the mass and size of project components. Projects usually use separate vessels for foundation installation and turbine installation, but additional vessels may be required depending on the installation schedule, the dimension of components, contractor performance and the availability of vessels.

As offshore wind markets globalise, new installation vessels have been built to install offshore wind components in new markets. Some installation contractors have also moved existing installation assets to new markets to fulfil regional pipelines of offshore wind installation contracts. For large crane vessels, redeployment between EMEA and APAC regions is not straightforward, as the vessels are too large to pass through the Suez Canal and therefore must transit around the Horn of Africa. The time required for this journey, and costs associated with it, mean that crane vessel operators will not redeploy their assets without a multi-year pipeline of project work to fulfil.

The extent to which new assets need to be built to serve a given market is driven by the limited number of assets available globally, the costs associated with moving existing vessels between different geographic regions and in some cases cabotage restrictions such as the US Jones Act, which requires that vessels transporting components between two points in the US must be US built, owned and crewed. While cabotage restrictions do not directly affect Indian offshore wind development for installation assets, their existence elsewhere can create barriers to mobility within the overall market reducing the supply of available installation assets that can be readily relocated to India.

Demand forecast

Vessels capable of installing foundations are typically mobilised to begin installing foundations two years ahead of a project's COD. Turbine installation is typically carried out the following year, with demand arising one year ahead of a project's COD. Based on the modelled assumptions, demand for installation vessels starts in 2030 when at least one installation vessel will be required to be operational in the Indian market. Demand peaks between 2035 and 2041 with five vessels on active installation duty within the Indian market each year. A graph showing the timing and scale of demand is shown in Figure 9.

Case Study: Green Jade

European offshore installation contractor DEME partnered with Taiwan's CSBC shipyard, which builds civilian and military vessels, to build a floating crane vessel for the emerging APAC market. The keel of this vessel, which is named 'Green Jade', was laid in 2020 at CSBC's Kaohsiung yard, in Taiwan.

At 216 m long with DP3 positioning and a 4,000-tonne crane, Green Jade was launched in 2024 as the first Taiwan-built and Taiwan-flagged offshore wind installation vessel. It will handle transport and installation of jacket foundations and turbines at CIP's 300 MW Zhong Neng and Northland Power's 1,044 MW Hai Long wind farms in Taiwan.



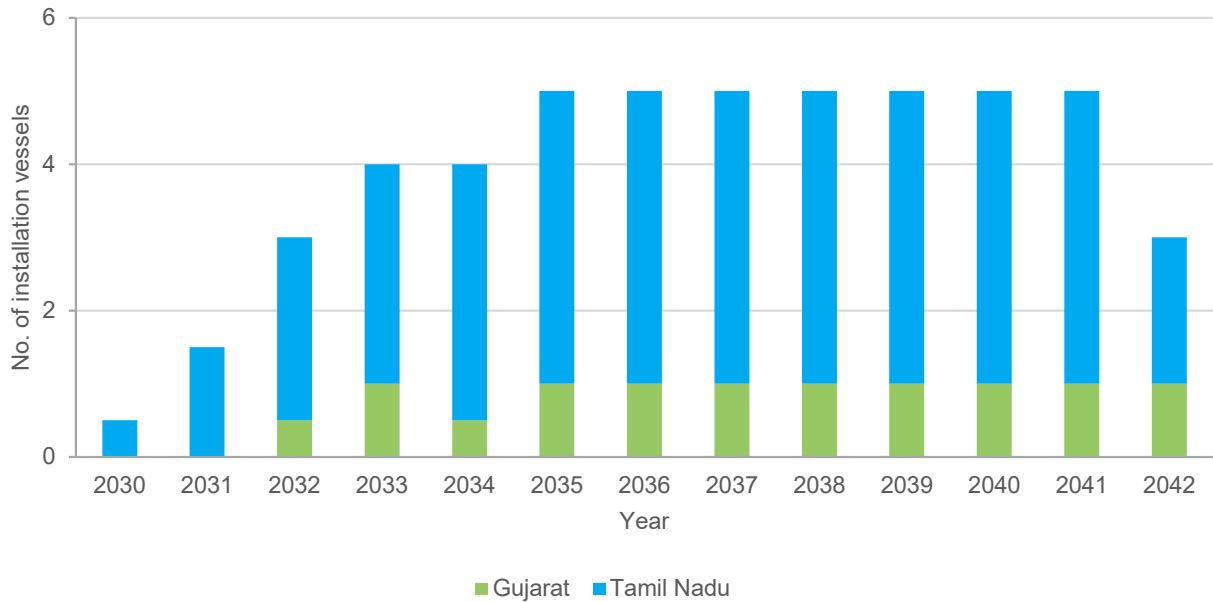


Figure 9 Projected demand for foundation and turbine installation vessels.

Cable lay vessel

Export cables are installed by state-of-the art cable lay vessels that are designed, built and operated by suppliers of subsea cables or independent marine contractors. These vessels are optimised for long-distance, deepwater operations and designed to carry large payloads often from multiple cable carousels. These vessels have the deck space and auxiliary infrastructure, such as moonpools and A-frames to support the latest generation of work-class remotely operated vehicles (ROVs). Several leading suppliers have commissioned these vessels to be built since 2017 to serve the both the offshore wind and interconnector markets.

Less specialised assets are required to install array cables. While custom newbuild vessels operate in the array cable market, there are also recent examples of contractors converting vessels from other markets into dedicated array cable installation assets.

Demand forecast

Assets capable of installing export cables are typically mobilised three years in advance of a project's COD. High voltage cable is one of the first parts of a wind farm installed to enable power from installed turbines to be exported as early as possible. Array cable installation is typically carried out the following year in between the start of foundation installation and the start of turbine installation. Based on the modelled assumptions, demand for installation vessels arrives in 2029, and peaks between 2034 and 2040 when five vessels are required annually.

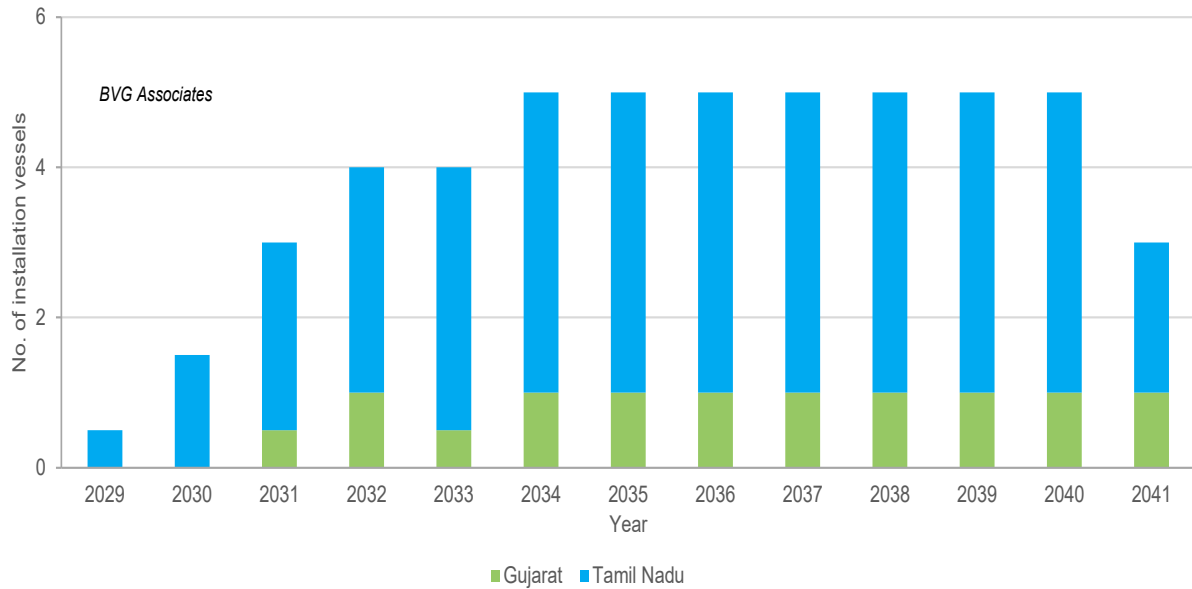


Figure 10 Projected demand for cable lay vessels.

Port infrastructure demand

Port infrastructure supports the marshalling, storage and pre-assembly of turbines and foundations during the construction of projects. The installation of foundations and turbines is commonly carried out from separate ports. Ports that meet the specific threshold criteria can strike commercial deals to support both activities.

The production of large critical infrastructure such as turbine components or foundations is commonly situated adjacent to quayside space capable as serving as an installation port, meaning that construction and installation activities are often collocated.

Demand forecast

Demand for foundation installation ports typically arises around two years before COD, with foundation installation ports occupied for between 9 and 12 months. Demand for turbine preassembly and installation ports starts around a year later. Given the transit distance between Gujarat and Tamil Nadu, each state will need sufficient port capacity to service its own regional offshore wind market.

Demand for port capacity is projected to emerge in Tamil Nadu from 2029 and Gujarat from 2031. Gujarat is likely to require 24 ha of suitable laydown area and 0.6 km of installation quays at the peak of demand in 2036, 2038 and 2040 while Tamil Nadu will require 72 ha of suitable laydown area and 1.8 km of installation quays at the peak of its demand between 2035 and 2040. The timing and scale of demand is shown in Figure 11.

Demand for port space is modelled here as scaling linearly with installed capacity. While this is unlikely to be a perfect relationship due to differences in project technology specifications, component delivery schedules and installation strategies it is important to assume proportional scaling when planning port upgrades as port space is a rival commodity. Where quay space and laydown area is allocated to one project, it cannot be used by another project during the same

period.

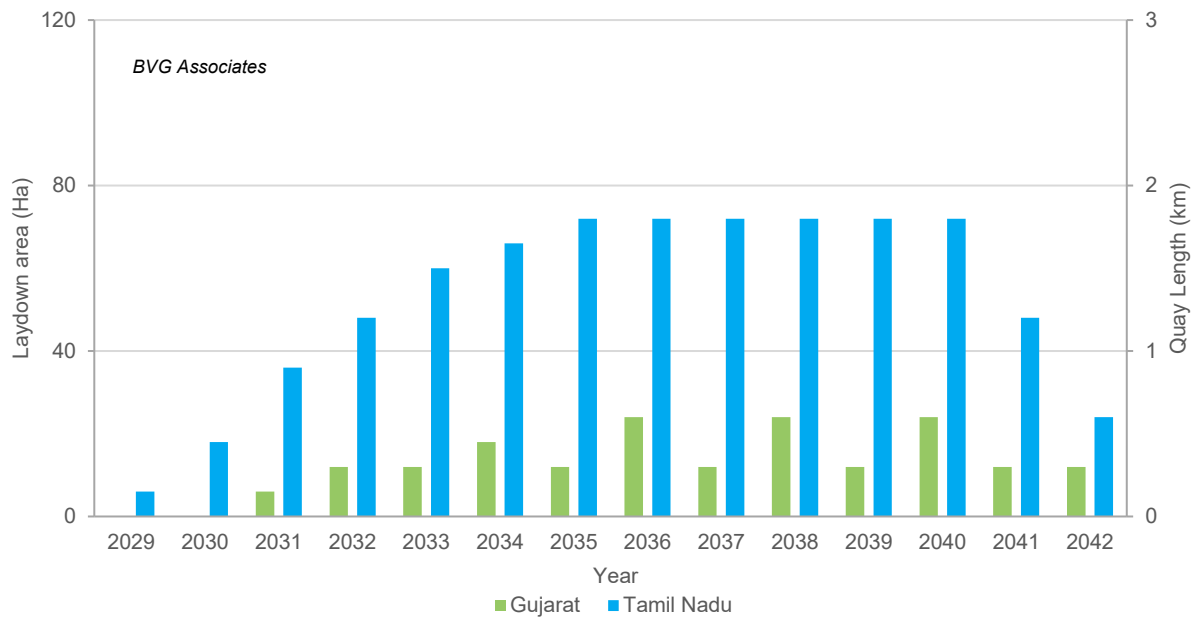


Figure 11 Projected demand for port infrastructure.

2.4.9 Demand from export markets

Offshore wind supply chains are typically first established to meet the needs of the domestic offshore wind sector, reflecting the significant investment and political support required to enter the sector. Over time, supply chain companies can prove themselves to be competitive in regional and global markets.

Outside of India, BVGA's median (P50) forecast for offshore wind deployment anticipates that a cumulative total of 528 GW will be installed in the period 2027-2043. This forecast excludes the Chinese offshore wind market, which is the world's largest, owing to the significant barriers that non-Chinese companies face when selling into China.

While this represents a significant opportunity for Indian suppliers, geographic and policy-related factors mean that some export markets will be more challenging to serve than others. For example, long transport distances and local content requirements can reduce the competitiveness of international suppliers in some projects and markets. However, Asian suppliers already provide major components for offshore wind projects installed in Europe, where significant capacity additions are expected in future in the established markets of the UK, the Netherlands, Germany and Denmark, as well as emerging markets in Ireland, the Baltic Sea and southern Europe. Similarly, European suppliers have successfully captured export opportunities in the APAC market and are expected to continue to operate in this area with market growth driven by capacity additions in Taiwan, Japan and South Korea.

The export market share that is ultimately obtainable by Indian companies will be determined by the competitiveness of India's supply chain relative to its international competitors. If the emergent Indian supply chain can prove itself, it has significant opportunities to sell products and services into a global marketplace.

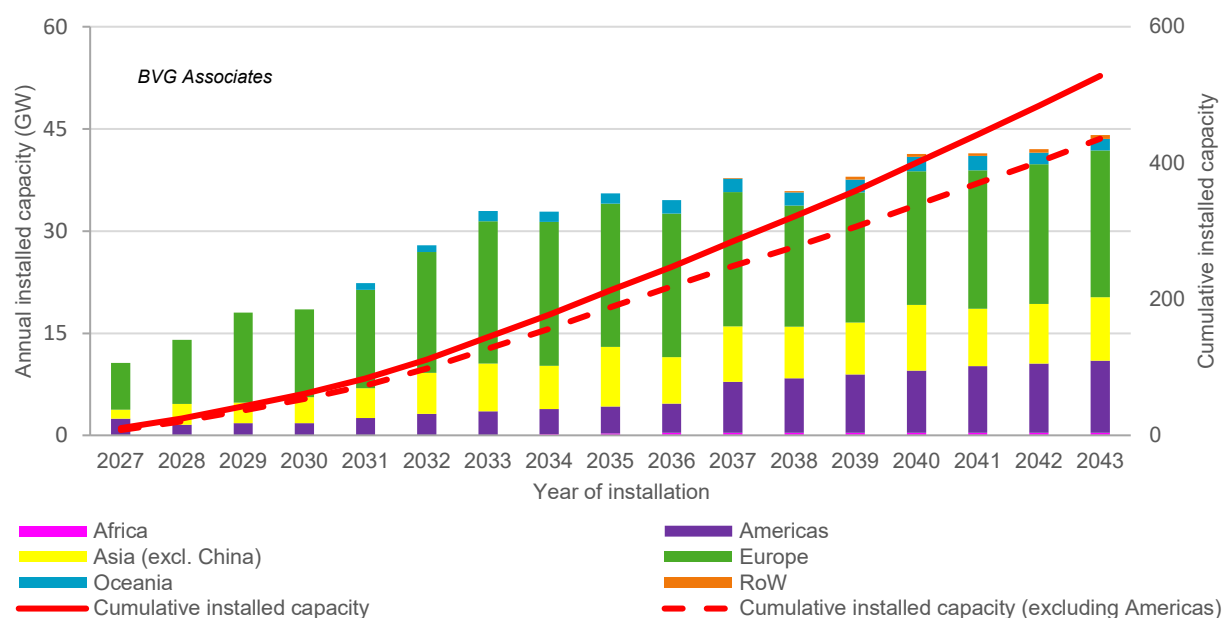


Figure 12 Total market demand outside India 2027 -2043.

2.4.10 Demand analysis: conclusions

In attempting to meet the Government of India's 37 GW offshore wind deployment target, there is a clear opportunity to develop a domestic supply chain for tier 1 components. The projection shows demand for these components emerging from 2028. The following bullet points contain key takeaways from the demand analysis, highlighting expected demand growth, infrastructure requirements, and lessons from mature markets.

- If an auction timetable can allocate 25.5 GW of capacity, then India's offshore wind market is large enough to support the development of several fabrication facilities for major components provided investors have good visibility of projects' demand.
- The realisation of these facilities will create opportunities for other regional sub suppliers that are involved in the production of subcomponents.
- Significant suitable space within ports will be required in both Gujarat and Tamil Nadu. Given the distance between the two states, each state will require its own portside infrastructure to support installation of projects to reduce time lost to transit and weather delays. This analysis has focused on the core infrastructure requirements in terms of quay length and laydown area, but infrastructure suitability will also need to consider other critical port-specific factors such as turning circle availability, air gap restrictions (such as bridges), channel navigability, and road and connectivity.
- Port demand and manufacturing capacity can be developed concurrently through the establishment of offshore wind hub ports that can support both component fabrication and installation.
- If manufacturing facilities are not realised in India to meet emerging demand, then this demand may be displaced and be met by established supply chains in APAC and Europe, which will limit India's abilities to create a strong domestic manufacturing base for offshore

wind.

- Any manufacturing capacity realised within India has the potential to ease regional supply chain bottlenecks for critical components within the APAC offshore wind market, improving the deliverability of offshore wind projects regionally.
- The creation of a local supply chain for major components is likely therefore to open export opportunities for suppliers, with significant long-term markets in both APAC and Europe possible destinations for Indian produced components.



3 Supply chain assessment

This chapter provides an assessment of the readiness of potential suppliers within the Indian state of Gujarat to form part of an Indian offshore wind supply chain.

3.1 Methodology

To understand Gujarat's capability in supplying the offshore wind industry, we have segmented the offshore wind supply chain into five level 1 categories, further subdivided into 23 level 2 categories. These categories cover:

- Development and project management.
- Turbine supply.
- Balance of plant.
- Installation and commissioning.
- O&M.

A detailed breakdown of the level 1 and level 2 categories is presented in Appendix B.

Each level 2 supply chain category was scored from 1 to 4, based on its readiness to supply offshore wind services and scale of investment. This framework, developed by BVGA and previously used to assess offshore wind supply chains in Europe, Asia, and North America, is shown in Table 7.

Table 7 Supply chain assessment framework.

Score	Description
1	Significant investment is required across supply chain infrastructure, workforce skills, and R&D capabilities.
2	Significant investment is required; however, a strong existing industrial base exists.
3	Moderate investment is required, primarily focused on targeted workforce development or R&D capabilities.
4	The existing supply chain already provides the required products and services for offshore wind, supported by a strong track record.

Progression towards supply chain maturity will not progress uniformly across different supply chain areas. Progress will be shaped by existing industrial capabilities, the prevailing strength of the business ecosystem and presence or absence of policy signals such as local content mandates.

In some areas of the offshore wind supply chain progress towards higher scores can be realised

more quickly. This is most likely where investment requirements are modest and companies can leverage adjacent experience to quickly pivot towards offshore wind. In these cases, a Gujarat supply chain could emerge within 12-18 months. In contrast, segments that are dependent on significant capital investment in manufacturing infrastructure or port facilities will follow longer development pathways, with 3-5 years representing a reasonable indicative timetable from a standing start.

3.1.1 Key data inputs

A combination of desk research and direct engagements with potential suppliers, ports and enabling organisations in offshore wind helped to support this analysis. A full list of stakeholders engaged is provided in Appendix C. The assessment also draws on previous supply chain studies and publicly available resources undertaken by BVGA and MEC+, including:

- MEC+, ORE Catapult and UKRI India supply chain assessment report.
- MEC+'s work on offshore wind supply chain with MNRE, and GWEC and FOWIND's supply chain, port infrastructure and logistics study.

For each supply chain area an attempt has been made to establish:

- The level of existing capability to supply offshore wind projects.
- The scale and type of investment required to enable participation.
- The key barriers to supply chain and infrastructure investment.

Does scoring consider market size?

Part 1 of this study models supply chain demand under a 25.5 GW by 2043 deployment scenario across Tamil Nadu and Gujarat, outlining the drivers of localisation across different supply chain segments. The maturity scoring presented here measures the current capability and readiness of the Gujarat supply chain and is not tied to a specific market volume.

In any emerging offshore wind market, the key factor shaping supply chain development is the presence of visible, sustained demand and a credible long-term market outlook. However, once this signal is established, deployment volume primarily affects the scale of supply chain capacity that emerges. In other words, a pipeline averaging 1 GW annually across Gujarat and Tamil Nadu per year will support a supply chain sized to that level of demand, whereas a large pipeline can drive proportionately greater investment.

The scoring applied is therefore relevant across different deployment scenarios. While future market volumes influence the timing and extent of supply chain capacity development, they do

3.2 Supply chain assessment

3.2.1 Development and project management

Development and project management includes activities required to secure planning consents, such as the environmental impact assessment, as well as the design, engineering and project management of the wind farm. Developers often rely on local planning lawyers, surveyors, and ecological assessment firms as specific local knowledge is required.

Project management

Project management includes managing the collection and interpretation of surveys, submission of planning consents and any design work, and managing the construction of the project through to operations. Project management is done with proximity to the project site and is predominantly undertaken in-house by wind farm developers.

Gujarat has a well-established onshore wind sector and a strong engineering and construction industry that provides similar project management services. This includes onshore wind developers, engineering firms working on large infrastructure and energy projects. Gujarat has no companies with direct offshore wind project management experience, but companies from related sectors can enter the market with moderate investment in the workforce. This includes building relevant specialised commercial and technical capabilities for offshore wind.

The overall score for project management	3
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Environmental surveys

Environmental surveys are undertaken to establish baseline environmental and social receptors and to assess how an offshore wind project may impact them. Their primary purpose is to support environmental impact assessment (EIA), permitting, and stakeholder engagement.

The surveys include bird, fish, marine mammal, habitat, marine navigation, aviation impact, socio-economic impact, commercial fishing, archaeology, noise analysis, landscape and visual assessments. These assessments are typically delivered by specialist technical consultants or large professional services firms. Many require local knowledge and expertise, creating strong opportunities for domestic companies to participate in the offshore wind supply chain.

Gujarat has a well-developed ecosystem of organisations capable of delivering the full range of environmental surveys required for offshore wind projects. These include Ecosurvey Consultants, Seatech Marine Services, AECOM India, ERM India, and WAPCOS, all of which have experience in providing similar assessments for port, coastal infrastructure, and energy developments.

Specialist ecological and wildlife inputs can be supported by ecology consultancies, while national institutions including the National Institute of Ocean Technology (NIOT), Indian National Centre for Ocean Information Services (INCOIS) and National Environmental Engineering Research Institute (NEERI) provide metocean data, oceanographic analysis, and environmental research that underpin offshore assessments. Together, these organisations enable most offshore wind environmental survey scopes to be delivered domestically.

The overall score for environmental surveys	3
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Site investigations

Site investigations are undertaken to understand physical site conditions and manage engineering and construction risks. Their purpose is to support technical design, installation planning, and project risk assessment, particularly for foundations, cables, and offshore structures. For projects along the Gujarat coast, site investigations must account for monsoon variability, cyclonic events, mobile seabed conditions, and near-shore geological complexity.

Site investigation activities in Gujarat are driven by coastal and offshore infrastructure sectors such as ports and harbours, refinery-linked marine facilities, offshore oil and gas assets, subsea pipelines, coastal protection works, and marine construction. These sectors rely on marine geophysical and geotechnical surveys and metocean data collection. Baseline datasets and long-term measurements are often generated by government and national research institutions.

More specialised offshore survey activities are typically contracted to international survey contractors, many of which are headquartered in Europe or Singapore and operate through Indian subsidiaries or project offices. Within Gujarat, companies such as Ecosurvey Consultants and Seatech Marine Services have delivered marine geophysical surveys, nearshore geotechnical investigations, and hydrographic works in support of port and offshore infrastructure projects. National institutions including NIOT, INCOIS and NEERI provide metocean measurements, oceanographic data, and environmental baseline studies that underpin many such developments.

Gujarat also hosts a large base of local consultants and service providers that support site investigation campaigns. With appropriate partnerships with international offshore survey contractors, access to specialised vessels and equipment, and upgrades to offshore procedures and quality assurance systems, local consultants could progressively take on larger execution roles. This positions Gujarat's site investigation ecosystem as capable of scaling into offshore wind with relatively low to moderate barriers, primarily driven by collaboration and capability enhancement.

The overall score for site investigations	3
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Engineering

Engineering studies establish a project's technical feasibility, design basis, and risk profile. These studies define the engineering parameters required for layout development, technology selection, and cost and schedule estimation, and enable quantitative assessment of structural, electrical, and installation risks in accordance with applicable standards.

Engineering activities typically include interpretation of site investigation data. This includes the development of design criteria and load cases, covering preliminary and detailed engineering of foundations, turbines, electrical systems, and offshore substations. It also assesses installation methods, marine logistics, and operational constraints.

These studies are usually delivered through collaboration between international offshore wind specialists and local engineering firms. International firms provide offshore wind design expertise while local organisations contribute knowledge of site conditions, ports, vessels, and regulatory requirements. This combination supports practical design and early identification of project risks.

In Gujarat, companies such as Larsen and Toubro Engineering Services and Engineers India Limited deliver engineering services for offshore and coastal energy infrastructure and can act as lead engineering partners during the screening, pre FEED, and FEED studies. Their experience in offshore oil and gas, marine structures, coastal terminals, and large power infrastructure allows them to deliver core development stage engineering although some wind-specific design aspects may require collaboration with international specialists.

The overall score for engineering	3
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3.2.2 Turbine supply

The principal components of an offshore wind turbine are the blades, nacelle, and tower. These components are typically manufactured at separate facilities before being transported and integrated together.

Nacelle and hub

The nacelle is the main functional unit of a wind turbine. Gujarat already hosts nacelle manufacturing capability for the onshore wind market. Inox Wind operates a production facility for 3 MW rated turbines near Ahmedabad, while Adani Wind produces components for turbines rated up to 5.2 MW in Mundra.

Gujarat has a developing tier-2 supply base for nacelle components through experience in adjacent industrial sectors. For gearboxes, Elecon Engineering Company, headquartered in Anand, has designed and supplied gearboxes for onshore wind turbines, primarily for smaller platforms up to approximately 2 MW, alongside extensive experience in industrial power transmission applications.

For other drivetrain components such as generators and power converters, Gujarat hosts significant electrical manufacturing capability, although currently oriented toward non-wind sectors. Companies including ABB India, Siemens Energy India, and CG Power and Industrial Solutions operate manufacturing facilities in the state producing generators, drives, and power electronics for power generation, industrial, rail, and grid applications. While these products are not wind-dedicated, the underlying capabilities in large rotating machines, power electronics, and quality systems closely parallel nacelle requirements.

Gujarat has a strong base in casting and forging for heavy engineering applications. Companies such as ISGEC Heavy Engineering manufacture large castings and forged components for the waste heat recovery, coal power, as well as oil and gas sectors. Electrosteel Castings supplies large ductile iron castings for water infrastructure projects, and Amtek Auto (legacy operations) has served automotive and rail markets. For forgings, firms including Larsen & Toubro Heavy Engineering, ISGEC, and Laxcon Steels provide large, high-integrity forged components for power, oil and gas, and transport sectors.

This existing manufacturing ecosystem demonstrates a broad base of adjacent capability in Gujarat for nacelle-related components. With targeted investments in upgrading manufacturing infrastructure, companies active in these parallel sectors could transition into the offshore wind nacelle supply chain.

The overall score for nacelle and hub	2
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Blade

Gujarat has an established manufacturing base for wind turbine blades serving the onshore wind market. Existing turbine and suppliers such as LM Wind Power, Siemens Gamesa Renewable Energy, Vestas, Suzlon, Inox Wind, Senvion, Envision Energy, and Adani operate blade manufacturing facilities capable of producing blades for onshore applications. While these blade lengths are smaller than those typically required for offshore wind projects, the core blade manufacturing processes, such as composite lay-up, resin infusion, curing, and finishing, are the same across onshore and offshore wind.

The principal capability gap lies in blade size, weight, and mould design. Blades for the current generation of 15 MW class offshore wind turbine are around 110 metres long and have a mass of 70 tonnes. As a result, existing suppliers would need to invest in upgrading manufacturing infrastructure, including larger moulds, expanded factory halls, higher-capacity handling and lifting systems, and enhanced quality control processes. These longer blades may not be able to be moved by road, in which case new dedicated quayside manufacturing investments would be needed. In addition, dedicated blade testing facilities and structured knowledge transfer for offshore-specific aerodynamic, structural, and fatigue design would be required.

The overall score for blade	2
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Tower

Gujarat has an established manufacturing base for wind turbine towers serving the onshore wind market. Key suppliers with offices and manufacturing presence in the state include Suzlon, Inox Wind, Senvion, Cubuilt, and Windar. Existing facilities in Gujarat are typically capable of producing tower sections with diameters of up to 5.0 m and conical sections of up to 5.5 m, which are suitable for current onshore turbine platforms.

Among these suppliers, Suzlon, Senvion, and Windar have exported onshore wind towers and related components to global markets, demonstrating established quality systems, welding and fabrication capability, and experience. In addition, Windar benefits from direct offshore wind experience through its parent company, which is actively engaged in supplying large-diameter towers and offshore structural components for international offshore wind projects. This provides a clear pathway for knowledge, design practices, and manufacturing process transfer to support a transition towards offshore wind tower production in Gujarat.

The main capability gap for offshore wind towers in Gujarat is their size and structural requirements. Offshore wind towers commonly require section diameters exceeding 6.0 m, thicker plates, higher fatigue resistance, and enhanced corrosion protection systems suitable for marine environments. Local suppliers would need larger rolling and welding equipment, upgraded handling and lifting systems, expanded storage and quay-side logistics, and offshore-specific coatings and quality control. If towers cannot be transported by road, new quayside manufacturing would be required.

Gujarat has a well-developed industrial capability in lifts, ladders, and mechanical and safety

equipment that is directly relevant to wind turbine tower internals, supported by the state's strong base in heavy engineering, fabrication, and industrial services.

Companies such as TK Elevator, KONE, and Johnson Lifts operate pan-India industrial businesses supported by regional fabrication, installation, and service partners in Gujarat. These systems are analogous to wind tower service lifts used in taller onshore turbines and can be adapted for tower-internal elevator solutions with appropriate certification, redundancy, and fatigue validation.

Overall, Gujarat's existing industrial base demonstrates a strong foundation for tower and tower-internal access and safety systems. However significant capital investments in production capacity would be required to serve the offshore wind market.

The overall score for tower	2
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3.2.3 Balance of plant

Balance of plant includes all the components of the wind farm, except the turbines. This includes turbine foundations, array cables, export cables, onshore substations and offshore substations.

Foundation

Offshore wind projects typically utilise either jacket foundations or monopile foundations, depending on site conditions, water depth, and turbine size. Gujarat's existing heavy engineering and offshore fabrication capabilities are well aligned with jacket foundation manufacturing. Larsen & Toubro are a main supplier in this sector, operating a major port-adjacent fabrication facility at Hazira. This facility has proven experience in the fabrication of jacket foundations and large offshore structures for international oil and gas and marine infrastructure projects. Gujarat also hosts other heavy fabrication and EPC contractors with offshore exposure through oil and gas and port infrastructure projects, though at a smaller scale compared to Larsen & Toubro. Those offshore activities are typically focused on modules, piles, and sub-assemblies.

The state's capability is currently stronger for jacket foundations than for monopiles. Serial production of monopiles for modern offshore wind projects typically requires specialised facilities equipped with large-scale plate rolling, automated welding stations, and direct quayside access. Such facilities are not currently present within the state. However, Gujarat's extensive experience in the oil and gas sector means these capabilities could be developed within an ecosystem that has a trained and relevant workforce. This includes auxiliary service companies experienced in blasting, coating, welding and NDT.

Overall, Gujarat is well positioned to support jacket foundation manufacturing for India's offshore wind projects. With targeted alignment to offshore wind-specific design codes, certification requirements, and serial production practices, the state presents relatively low barriers to localisation for jacket foundations.

The overall score for foundation	2
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Array cable

Array cable supply includes the provision of conductors, insulation systems, metallic screens, armouring, and external sheathing to ensure structural integrity and electrical performance during installation and long-term operation.

Gujarat has developed a strong manufacturing base for power cables, supported by its established electrical equipment industry, access to ports, and experience in supplying cables to demanding sectors such as oil and gas, telecommunications, and power transmission. This industrial ecosystem has enabled the development of cable manufacturing facilities with capabilities in medium-voltage design, quality control, and export-oriented production - capabilities that align closely with the requirements of offshore wind array cables.

Within this ecosystem, key suppliers with manufacturing facilities in the state include Apar Industries, Sterlite, and Polycab. Among these, Apar has supplied 33 kV subsea cables for oil and gas and telecommunications applications, demonstrating experience with specialised insulation systems, armouring, and quality requirements relevant to subsea environments.

Overall, existing facilities manufacturing 33 kV cables for oil and gas and telecom sectors in Gujarat provide a strong foundation for offshore wind array cable localisation. With targeted investments in upgraded conductor manufacturing, insulation and screening systems, testing infrastructure, and certification to offshore wind standards, these facilities could be adapted to manufacture subsea array cables at higher ratings, presenting low barriers to entry for this segment of the offshore wind supply chain.

The overall score for array cable	2
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Export cable

Gujarat has developed a strong manufacturing base for high- and extra-high-voltage power cables to support other sectors such as long-distance power transmission, oil and gas, and industrial infrastructure. However, export cables for offshore wind represent a significantly higher technical threshold compared to array cables, due to higher voltages, larger conductor sizes, and more stringent subsea qualification requirements. Domestic experience in manufacturing and supplying subsea export cables at 132–220 kV and above remains limited.

Overall, localisation of offshore wind export cables would require significant additional investment. This includes development of subsea-specific HV insulation systems, large-scale vertical or horizontal continuous vulcanisation lines, specialised armouring and handling equipment, advanced testing facilities, and certification to international offshore wind and subsea cable standards. As a result, barriers to entry for export cable manufacturing are materially higher than for array cables, and localisation is likely to be a medium- to long-term opportunity rather than an early-stage supply chain segment.

The overall score for export cable	1
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Offshore substation

Offshore substations are made up of three principal elements, each with distinct manufacturing and supply chain requirements.

- The substation platform or topside, which comprises the structural support, deck, and housing for electrical and auxiliary systems
- The electrical equipment, with power transformers as the primary components, supported by switchgear, protection, control, and auxiliary systems, and
- The substation foundation, usually a jacket structure.

Gujarat has existing capabilities across all three elements. Larsen & Toubro has extensive experience designing and fabricating substation platforms for both the oil and gas and offshore wind. These capabilities are supported by its major fabrication facilities at Hazira, which have established track record of supplying both domestic and international oil and gas projects. Larsen & Toubro is actively involved in the fabrication and delivery of offshore wind substations and topsides for European projects.

Gujarat also hosts a strong electrical equipment manufacturing base. Key suppliers include Hitachi Energy India, Siemens Energy India, CG Power and Industrial Solutions, TBEA Energy India, and Voltamp Transformers. These companies have extensive experience supplying equipment to domestic and international transmission networks and industrial power markets.

Overall, Gujarat has many of the capabilities needed to support offshore substation manufacturing. The fabrication of topsides and foundations is the most practical opportunity for localisation, building on the state's existing manufacturing base and supply chain.

The overall score for offshore substation	4
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Onshore substation and electrical equipment

The civil works and structural elements of onshore substations are well established within India's transmission sector and are routinely delivered by domestic EPC contractors. The electrical equipment package, which includes transformers, cables and control systems is similarly supported by a mature domestic manufacturing base.

Overall, Gujarat's existing manufacturing and EPC supply chain provides a robust and readily deployable foundation for onshore substation development for offshore wind projects.

The overall score for onshore substation and electrical equipment	4
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3.2.4 Installation and commissioning

This section focuses on the capability of existing vessels and service providers to carry out installation and commissioning activities in offshore wind. It focuses on the capability of Gujarat-based companies to deliver transport and installation services for cables, turbines, foundations and substations.

Turbine

While India has experience in offshore construction and marine operations through the oil and gas and port infrastructure sectors, there are currently no regional marine contractors with assets that have the requisite lifting capacity or deck space required to install offshore wind turbines.

Some offshore wind turbine installation activities closely mirror those in the offshore oil and gas sector. These include heavy lifting, marine logistics, positioning and alignment of large structures, bolting and welding, and system commissioning.

These services represent only a small proportion of the turbine installation phase. Offshore wind introduces unique technical requirements, including turbine-specific lifting sequences, tighter tolerances, serial installation methods, and specialized commissioning procedures. While the existing workforce provides a strong foundation, targeted training and re-skilling will be needed to familiarise personnel with offshore wind standards, equipment, installation processes, and project execution models.

Significant upgrades to supporting infrastructure will also be needed. This includes ports, quays, and storage areas to handle large turbine components, as well as specialised vessels like WTIVs for offshore installation. Heavy-lift cranes, handling equipment, transport logistics, and temporary offshore support facilities will also need improvement to ensure safe and efficient operations

The overall score for turbine installation	1
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Foundation

India has strong experience in offshore construction through the oil and gas and port infrastructure sectors, particularly in piling, jacket installation, and subsea works. EPC contractors such as Larsen & Toubro, Reliance Industries, and Afcons Infrastructure operate heavy-lift crane barges, piling spreads, and marine support vessels that can support some activities for jacket foundation installation. However, there are very few vessels in India specifically designed or optimised for offshore wind foundation installation. Over time, localisation opportunities may arise though would require targeted vessel upgrades and supporting port infrastructure.

Whilst there is some expertise from the oil and gas sector, foundation installation requires specialised knowledge of offshore wind installation processes and introduces new documentation, and certification standards. Heavy-lift operations in offshore wind differ from those in oil and gas by the need to execute a series of large lifts across multiple positions, rather than the planning of an installation campaign around a small number of very large lifts.

The overall score for foundation installation	2
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Offshore cable installation

India has relevant experience in subsea cable installation through the oil and gas, telecommunications, and marine infrastructure sectors, particularly in nearshore and shallow-water environments. Indian marine contractors have access to barges, support vessels, trenching equipment, and survey capabilities that can support elements of array and export cable installation, such as nearshore works, cable protection, and landfall construction. This provides a foundation for partial localisation of cable installation activities in early offshore wind projects.

However, there is currently limited availability of Indian-owned, purpose-built offshore cable-lay vessels with large integrated carousels and high-capacity burial systems suitable for full-scale offshore wind deployment, especially for long-distance export cables. As a result, early offshore wind projects in India are expected to rely on foreign-flag specialised vessels for the primary cable-laying scope.

The overall score for offshore cable installation	1
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Onshore cable installation

Gujarat has strong, well-established capability in onshore HV and EHV cable installation, supported by extensive transmission, industrial, and coastal infrastructure development. EPC contractors such as Larsen & Toubro, Kalpataru Power Transmission, and Sterling and Wilson have executed large-scale underground and overhead transmission projects in Gujarat, including substation connections, and complex horizontal directional drilling crossings.

Overall, the localisation potential for onshore export cable installation in Gujarat is high, with minimal technical barriers compared to offshore scopes. While offshore wind projects introduce additional interface requirements at landfall, the core capabilities are already mature and widely available within the state.

The overall score for onshore installation	4
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Offshore substation

Gujarat has high adjacent capability for offshore substation installation through its offshore oil and gas and marine infrastructure sectors. Indian EPC contractors such as Larsen & Toubro, Reliance Industries, and Afcons Infrastructure have executed offshore platform and jacket installations involving heavy lifts, marine logistics, and offshore hook-up works. These capabilities are directly transferable to offshore substation installation, particularly for structural placement and integration activities.

However, there is currently limited availability of Indian-owned, wind-optimised heavy-lift vessels suitable for offshore substation installation at scale. As a result, early offshore wind projects are expected to rely on foreign-flag heavy-lift vessels, with Indian EPC contractors acting as installation integrators and marine execution leads.

Gujarat also benefits from a skilled offshore workforce developed through decades of oil and gas, port, and heavy marine infrastructure activity. This workforce provides a strong foundation for offshore substation installation activities. However, offshore wind projects introduce additional

requirements related to wind-specific electrical systems, offshore substations layouts and wind-industry certification and documentation standards. Training, certification, and early project exposure will therefore be required to fully transition Gujarat's existing workforce to offshore wind substation installation roles.

The overall score for offshore substation	2
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Onshore substation

Gujarat has a mature and well-established capability for onshore substation installation, supported by decades of transmission and industrial power infrastructure development. EPC contractors such as Larsen & Toubro, KEC International, Kalpataru Power Transmission, and Sterling and Wilson routinely execute large HV and EHV substations across Gujarat. These firms have proven capability in transformer erection, high-voltage switchgear installation, protection and control system integration, and end-to-end testing and commissioning in coordination with utilities.

Gujarat also benefits from a deep and readily available skilled workforce for onshore substation installation. The state hosts experienced civil engineers, electrical engineers, protection and control specialists, commissioning engineers, cable jointers, technicians, and site supervisors with extensive exposure to HV and EHV transmission projects. This workforce is familiar with Indian grid standards, utility procedures, safety management systems. As a result, the workforce capability for onshore substation installation is already well aligned with offshore wind project needs, requiring minimal additional training beyond project-specific interfaces and export-cable coordination.

Overall, onshore substation installation in Gujarat represents one of the lowest-risk and most fully localised segments of the offshore wind supply chain, with strong EPC capability, established manufacturing support, and a skilled workforce readily available to support early and large-scale offshore wind deployment.

The overall score for onshore substation	4
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3.2.5 Operations and maintenance

Wind farm O&M begin after commissioning and handover from the installation phase and include the activities required to operate, monitor, and maintain turbines and associated electrical infrastructure over the project life. For offshore wind projects, O&M is typically organised from an onshore base, often at a nearby port, from which personnel, spares, and equipment are mobilised, and offshore access is planned around metocean conditions.

Project developers usually award long-term turbine service contracts to turbine suppliers for 15 years, which may further subcontract marine logistics and specialist repair works. Offshore wind O&M relies on a distinct set of vessels compared to installation, primarily crew transfer vessels (CTVs) for routine access, service operation vessels (SOVs) for sustained offshore maintenance campaigns, and other support vessels for inspection and emergency response. In this section, the availability of these vessels and the offshore-capable technical workforce in Gujarat is assessed to understand the localisation potential for offshore wind O&M activities.

Wind farm operation

Gujarat has a strong foundation for wind farm operations, built on its extensive onshore wind portfolio and long-standing experience in managing complex offshore oil and gas assets. Wind turbine original equipment manufacturers (OEMs) and operators operate established control centres and operational teams in the state.

For offshore wind, Gujarat's ports and coastal infrastructure provide a natural base for onshore operational control functions. Existing experience from offshore oil and gas operations supports advanced operational practices such as marine coordination, weather window management, permit-to-work systems, and emergency response planning, all of which are directly applicable to offshore wind farm operations.

Gujarat also benefits from a skilled operational workforce, including control room engineers, performance analysts, electrical engineers, and offshore operations coordinators from onshore wind and offshore industrial operations. While this provides a strong starting point, offshore wind introduces additional operational requirements such as wind-specific asset performance optimisation, offshore grid code compliance, integrated marine–electrical operational planning, and asset management, hence upskilling of the existing workforce will be required.

The overall score for wind farm operations	3
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Turbine maintenance and service

Turbine maintenance and service refer to the activities required to maintain wind turbines in a safe, reliable, and efficient operating condition throughout the project's operational life. Gujarat has a strong foundation for turbine maintenance and service in onshore wind. Wind turbine OEMs and service providers in this space maintain established service teams, spare-parts logistics networks, and regional maintenance hubs in the state, supporting such activities. There is some experience from offshore oil and gas maintenance, in offshore safety management, permit-to-work systems, lifting operations, and emergency response planning.

However, turbine maintenance and service introduce specific offshore wind requirements, such as blade repair in marine conditions, offshore access systems, high-voltage safety, and turbine-specific service procedures. While Gujarat's existing workforce provides a strong foundation, targeted upskilling, offshore wind-specific training, and certification will be needed to fully develop local capabilities for turbine maintenance and service.

The overall score for turbine maintenance & service	3
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Balance of plant O&M

Balance of plant (BoP) O&M refer to the activities required to inspect, maintain, and ensure the continued integrity and performance of non-turbine assets within a wind farm throughout the project's operational life. These assets include foundations, transition pieces, array and export cables, offshore and onshore substations, and associated structural, electrical, and protection systems.

The scope of BoP O&M typically includes structural inspections of foundations and transition

pieces, corrosion and scour monitoring, inspection and maintenance of offshore and onshore substations, monitoring of array and export cables, and execution of repair or intervention activities as required.

Gujarat has a strong foundation for BoP O&M, built on extensive experience in offshore oil and gas infrastructure maintenance, port operations, and marine engineering. Contractors and service providers in the state are experienced in offshore structural inspections, corrosion management, subsea surveys, and marine coordination, supported by established safety and quality management systems. These capabilities are directly transferable to offshore wind BoP O&M, particularly for foundation and substation structures. However, targeted upskilling, offshore wind-specific training, and procedural alignment will be required to fully transition local capabilities to offshore wind balance of plant O&M activities.

The overall score for balance of plant O&M	3
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Vessels

For O&M activities, vessel requirements are primarily driven by the need for regular crew access, inspection, and intervention at offshore wind farm sites. Routine O&M activities involve the transfer of technicians, tools, and spares between port and site, typically using CTVs for day operations and SOVs for campaigns requiring extended offshore presence.

Dedicated crew vessels are critical for offshore wind O&M due to continuous monitoring requirements and the need for rapid response to faults. In addition, offshore supply vessels are used to transport equipment and consumables, while heavier installation or heavy-lift vessels may be required for major maintenance activities such as large component replacement.

India benefits from the availability of a broad range of general-purpose offshore vessels, supported by its oil and gas, subsea telecommunications, and marine construction industries. Several vessel operators active in India have fleets and operational experience relevant to offshore wind O&M. These include international companies such as Boskalis, Jan De Nul, Van Oord, McDermott, Subsea 7, Sapura Energy, Subcon, and Hyundai Heavy Industries. Many Indian operators such as Larsen & Toubro, Reliance Industries, Essar, Afcons Infrastructure, and Greatship Group also have vessels suitable for some O&M activities.

While SOV's and CTV's are available domestically, a gap remains in the availability of installation and heavy-lift vessels required for major maintenance activities, such as replacement of turbine components. As a result, early offshore wind projects are likely to depend on foreign-flag installation vessels for these infrequent but critical interventions.

O&M activities also require strong local involvement, given the importance of familiarity with site-specific metocean conditions, port logistics, and regulatory requirements. Although workforce demand during the O&M phase is high, skill gaps exist in offshore wind-specific procedures, certifications, and advanced maintenance techniques.

The overall score for vessels	3
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3.3 Supply chain assessment summary

Table 8 outlines the results of the supply chain assessment.

Table 8 Summary of supply chain assessment

Level 1	Level 2	Score
Development and project management	Project management	3
	Environmental surveys	3
	Site investigations	3
	Engineering	3
Manufacturing	Nacelle and hub	2
	Blade	2
	Tower	2
	Foundation	2
	Array cable	2
	Export cable	1
	Offshore substation	4
	Onshore substation and electrical equipment	4
Installation and commissioning	Turbine	1
	Foundation	2
	Offshore cable	1
	Onshore cable	4
	Offshore substation	2
	Onshore substation	4
Operations and maintenance	Wind farm operation	3
	Turbine maintenance and service	3
	Balance of plant O&M	3
	Vessels	3

SWOT Analysis

Strengths

- Gujarat benefits from existing brownfield port infrastructure with upgrade potential and a mature industrial base. This provides a strong basis for the development of a supply chain that can manufacture major components.
- The state's established industrial ecosystem is built on long-standing strengths in steel fabrication, petrochemicals, precision engineering, marine logistics, and manufacturing.
- Onshore wind Blade manufacturing, tower production, and turbine assembly facilities are already operational in India, including within Gujarat, through internationally successful companies familiar with advanced manufacturing standards and international best practices
- Gujarat offers a skilled and experienced renewable-energy workforce and is home to companies that can pivot into the sector.
- Both regional and national governments have demonstrated tangible long-term interest in supporting offshore wind development in the state.

Weaknesses

- Offshore turbines, blades, nacelle and +66kV subsea cables are not manufactured locally and new facilities come with significant start-up costs.
- With limited offshore-specific manufacturing and no specialised vessels, Gujarat will depend heavily on foreign expertise in the short term. The lack of domestic industry has the potential to expose developers to supply-chain delays and increases their vulnerability to currency fluctuations.

Opportunities

- India is projected to install 25.5 GW by 2043 and is well positioned to supply emerging APAC markets. With targeted investment in infrastructure and capability suppliers have the opportunity to capture domestic and export demand.
- PGCIL approved ₹42-45 billion for two transmission projects in Gujarat, including one dedicated to offshore-wind.
- The Government of India allocated ₹66 billion under the offshore-wind VGF scheme for early-stage upgrades at two ports in Gujarat and Tamil Nadu. MNRE has also indicated that it will work with Pipavav Port for initial development in Gujarat.
- A further ₹74.5 billion was made available in VGF funding for initial offshore wind project development. This figure may be raised to make the development of initial projects more attractive.

Threats

- Gujarat is projected to account for around 20% of India's offshore wind deployment and commence its build out later than Tamil Nadu. This brings the risk of supply chain investment being prioritised elsewhere unless a co-ordinated approach to supply chain development can be established between the two states.
- Mature manufacturing centres in China, Taiwan, South Korea, and Europe already offer large-scale, certified production. Gujarat must compete with these hubs to attract investments from suppliers.
- Slow finalisation of India's offshore wind guidelines around grid responsibility, port support, and procurement mechanisms creates uncertainty for developers and suppliers. These delays may stall port upgrades, postpone manufacturing commitments, and reduce investor confidence.
- Lack of policy-related incentives for to attract inward investment from major international supply chain companies.

Figure 13 SWOT analysis of Gujarat's offshore wind supply chain.

3.4 Supply chain assessment conclusions

Gujarat has strong foundations for offshore wind supply chain development. Its ports, marine infrastructure, offshore oil and gas activity, heavy engineering base, and onshore wind manufacturing provide a solid platform that can be adapted for offshore wind. Stakeholders recognise this opportunity but note that port and manufacturing infrastructure will need upgrades to handle large components and associated marine logistics.

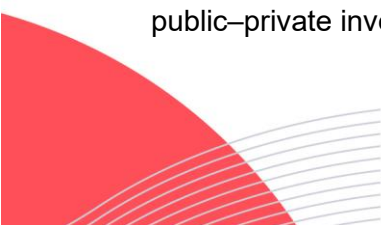
A key threat to the development of a considerable regional supply chain is the relatively small size of the local market modelled within our projection. This is compounded by Gujarat's considerable distance from other planned Indian offshore wind development in Zones off the coast of Tamil Nadu. This may make it difficult for private supply chain companies to develop credible business cases to underpin major investments in new facilities and infrastructure without appropriately dimensioned support mechanisms.

The capability assessment indicates investment in skills and R&D can act as a catalyst for supply chain growth across the next 12-24 months as the Indian market continues to mature. These investments are typically small and incremental, making them easier to undertake despite market uncertainty. These could be used to strengthen capabilities development and project management service supply chains which hold strong potential for localisation and are first services required by developers once sites are allocated.

In turbine supply, there is existing manufacturing capability from the onshore wind sector, however additional investment will be required to scale of facilities and build expertise for offshore wind. Gujarat has balance of plant capability for foundations and onshore electrical infrastructure, drawing on its industrial and oil and gas experience, but lacks export cables and offshore substations that fully meet offshore wind standards. Significant involvement in the installation phase will require major upgrades to vessels and port infrastructure, as well as specialised offshore wind expertise, although existing experience in port logistics and marine coordination provides a useful starting point.

Across stakeholder consultations, there was strong interest and appetite for the offshore wind sector. Investment decisions related to capacity upgrades were described as early-stage, reflecting uncertainty around demand visibility and long-term policy direction. While government intent to support port infrastructure development has been communicated, stakeholders noted that the current level of market maturity and project certainty is insufficient to trigger large-scale private sector investment. A stable and predictable project pipeline was consistently identified as the most critical enabler for unlocking sustained supply chain investment. A market that can deliver average volumes between 0.5 GW and 1.5 GW annually over a period of 5-10 years would provide appropriate volume to unlock investment and mitigate concerns of boom-bust cycles. In terms of workforce, some companies have begun targeted training and upskilling programmes, but there is broad agreement that coordinated, industry-wide workforce development will be needed to support offshore wind scale-up.

Overall, Gujarat is well positioned to localise a share of the offshore wind value chain across development, engineering, balance of plant manufacturing, onshore infrastructure, and operations and maintenance. With clearer long-term policy signals, a visible project pipeline, and coordinated public-private investment, the state can progressively expand its role within the industry.



4 Supply chain development pathways

This phase outlines three different supply chain development pathways that could be followed within Gujarat and provides an economic analysis of the socio-economic benefits that offshore wind could bring to the state. It also identifies the levers that can be used to support supply chain development within Gujarat. Each pathway is described in terms of capability, and the expected level of Gujarat content for projects within the state as indicated in the scale below. Indicative content levels were derived for three milestone years, 2030, 2035, and 2040.^{vii}

Low content	Medium content	High content	Very high content
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The core strengths pathway (lowest overall local content).

Under this pathway, Gujarat focuses on areas of the supply chain where there is a strong logic for local delivery and where existing capabilities are well established. Over time, the supply chain grows organically in these core areas. However, gaps remain in more specialised activities, particularly offshore installation and balance-of-plant manufacturing, where Gujarat has limited experience. There is limited opportunity to capture activity in Tamil Nadu market, as most activities in this scenario are locally focused.

The strategic investment pathway (balanced overall local content).

This involves large, targeted investments in enabling infrastructure and manufacturing facilities where local supply has clear advantages, for example based on Gujarat's established onshore wind manufacturing base, the state's industrial strengths in steel and heavy manufacturing, and existing onshore cable production capabilities. This scenario sees stronger growth in lower-tier supply chain companies over time, driven by strategic investment, supporting policies and targeted incentives in supply chain segment where a clear economic rationale exists. As a result, there is increased opportunity to capture opportunities in Tamil Nadu, specifically for the manufacturing of components.

The self-sufficiency pathway (highest overall local content).

Under this pathway, early and substantial action is taken to maximise local content. Gujarat quickly achieves the ability to deliver-high or very high local content across all major supply chain areas. This is driven by the localisation of offshore wind-specific products and services within the state by both existing Indian supply chain companies and international companies that choose Gujarat as a base for their operations. External support from suppliers elsewhere is limited to the early stages or specialised expertise. In this scenario these suppliers are drawn to Gujarat as they see a large and know they can count on significant government support incentives

^{vii} Each pathway is described in terms of capability, and the expected level of Gujarat content for projects within the state. Indicative content levels were derived for three milestone years, 2030, 2035, and 2040. To understand the total potential benefit to Gujarat (local), it was necessary to estimate the proportion of the Tamil Nadu market that could be captured by companies based in Gujarat. This contribution is excluded from content levels expressed and treated separately. We assumed that when Gujarat businesses invested in capability in offshore wind, where possible they would invest to meet demand from projects in both Gujarat and Tamil Nadu. For manufactured products export to Tamil Nadu is viable but for local construction services and maintenance, for example, this is not practical. This was factored into the analysis.

Table 9 Core strengths supply chain capability.

	Content level in year			Capability
	30	35	40	
Development and project management				Gujarat hosts regional headquarters for some offshore wind developers, with efforts split between offices in Gujarat, elsewhere in India, and international locations. By 2035, Gujarat-based companies play a dominant role in planning and consenting, survey work, and site investigations. Growth is organic, with no additional investment assumed to increase capability.
Manufacturing				There is limited investment in new manufacturing capacity. A blade facility is established by 2035, but towers, nacelles and their subsystems are manufactured and assembled outside the state. All balance of plant components is imported, except for the onshore substation which is manufactured and constructed in Gujarat.
Installation and commissioning				Investment in port infrastructure enables marshalling and pre-assembly activities to take place locally for projects in Gujarat. All onshore installation activities are also undertaken locally, but the primary installation of turbines, foundations, substations, cables and decommissioning activities are undertaken by specialist international contractors, with support from local suppliers for auxiliary services such as rock-dumping and subsea support activities.
Operations and maintenance				Both existing ports and upgraded ports are used for O&M bases, CTVs, SOVs, and small support vessels are operated from. Local contractors undertake routine turbine and balance of plant inspections. Major component exchange and repair activities are still led by suppliers outside the state.
Decommissioning				Onshore activities and ancillary services undertaken locally. Offshore removal and activities are led by contractors outside state, with some local support.

Table 10 Strategic investment supply chain capability

	Content level in year			Capability
	30	35	40	
Development and project management				Gujarat-based companies play a dominant role in site identification, consenting, environmental surveys, and impact assessments from 2030, and by 2040 local companies are leading with limited support from elsewhere in India. Over time, there is stronger growth in lower-tier supply chain companies, driven by strategic investments across the supply chain.
Manufacturing				Targeted investment enables Gujarat to develop the capability to produce all turbine primary components for Indian offshore wind projects from 2035. A small number of specialised components, such as control systems and advanced composites are still sourced from outside the state. Additional strategic investments are made in areas aligned with Gujarat's industrial strengths, including the establishment of an array cable manufacturing facility. The remainder of balance of plant components, including foundations, export cables and offshore substations, are manufactured outside the state, where production is more economical.
Installation and commissioning				Investment in port infrastructure enables marshalling and pre-assembly activities to take place locally for Gujarat-based projects. However, no major additional investment is made to enable full local delivery of offshore installation activities. These are led by experienced international contractors, supported by Gujarat-based suppliers for localised services. All onshore installation activities are undertaken by local civil and electrical engineering firms.
Operations and maintenance				Both existing ports and upgraded ports are used for O&M bases, CTVs, SOVs, and small support vessels are operated from. Local contractors undertake routine turbine and balance of plant inspections. In this scenario, there is growing participation in major component exchange and repair activities.
Decommissioning				Onshore activities and ancillary services undertaken locally. Offshore removal and activities led by contractors initially, with capability growing over time.

Table 11 Self-sufficiency supply chain capability

	Content level in year			Capability
	30	35	40	
Development and project management				Major developers establish dedicated bases in Gujarat by the early 2030s, employing a predominantly local workforce. Local suppliers lead all development and management activities from an early stage, with local content steadily increasing through 2040. Vessel capabilities are in place by 2035, allowing Gujarat-based companies to carry out all necessary offshore survey work.
Manufacturing				Early investment enables the state to meet the full component demand of the Indian offshore wind market. It is assumed that the maximum number of facilities is developed to enable Gujarat to meet the full component demand of the Indian offshore wind market. The timing of facilities coming online aligns with the volumes outlined in the Phase 1 report. By the mid-2030s, all turbine component facilities are operational, including two blade factories, one tower manufacturing facility, and two nacelle assembly facilities. Both array and export cable facilities are established early in 2030, along with monopile production in late-2030s.
Installation and commissioning				Significant investment in port infrastructure and vessel capability allows Gujarat-based companies to progressively carry out major offshore installation and commissioning activities. While full local delivery is not immediate, major installation capacity is established quickly, with external support only where necessary. The primary installation of all major components is carried out by companies in state.
Operations and maintenance				Local ports are used for O&M bases. By 2030, local contractors undertake most routine turbine inspections and balance of plant activities. Major component exchange and repair activities use international vessels to start with increasing local participation from 2035. All other CTVs, SOVs, and small support vessels are operated from local ports.
Decommissioning				Local suppliers primarily lead onshore and offshore decommissioning activities, with some support from outside state on turbine and foundation removal.

4.1 Economic impact analysis

Economic impacts are quantified as gross value added (GVA) and full-time equivalent (FTE) years of employment generated by Gujarat-based businesses in serving the Indian offshore wind market. GVA is the value generated by any unit engaged in the production of goods and services, and one FTE year is one full-time job for one year. The FTE year unit is the only means of expressing employment in a way that comparisons can be made because the duration of individuals working on the wind farm will vary considerably and, in many cases, their commitment to the project will be less than 100% at any point in time. This analysis distinguished between direct and indirect impacts, where:

- Direct impacts are associated with the developers and their major contractors.
- Indirect impacts are associated with the non-major suppliers to the project partners and the suppliers to the project's major contractors.

This analysis is based on a projected 25.5 GW pipeline. This includes 20.5 GW in Tamil Nadu and 5 GW in Gujarat, with deployment expected between 2032 and 2043^{viii}.

4.1.1 Methodology

The economic impact assessment uses a methodology developed in-house by BVGA for the offshore wind sector that is widely used across the industry. The approach was developed because conventional analyses relied on generalised government data that did not map well onto relatively new sectors such as OSW. The methodology is based on content calculations made possible through BVGA's understanding of how costs break down within packages and how the value chain typically sources products and services. The economic model used the following inputs:

- Project cost data modelled on a representative hypothetical project in Gujarat
- Deployment projection
- Content percentage estimates for each pathway
- Typical salary levels in the local market, costs of employment, and profit margins

The detailed economic impact methodology is presented in Appendix E.

^{viii} Economic impacts cover all aspects of the development, manufacturing, operation, and decommissioning of an offshore wind farm, including the electricity export system up to and including the onshore substation. The impacts related to construction of new port or manufacturing facilities are not modelled, but the impacts arising from their operation to supply Indian offshore wind projects are modelled.

4.1.2 Results

FTE years

Table 12 and Table 13 present the total FTE years and GVA generated in Gujarat over the lifetime of the Indian offshore wind project pipeline, including both direct and indirect effects. T

- The core strengths pathway is expected to create approximately 136,900 FTE years of employment and generate ₹27,300 crore of GVA
- The strategic investment pathway is projected to generate around 382,900 FTE years of employment and generate ₹76,600 crore of GVA.
- The self-sufficiency pathway is expected to produce 591,400 FTE years of employment and generate ₹1,14,000 crore of GVA.

In both the strategic investment and self-sufficiency pathways, manufacturing represents a significant share of job creation, highlighting the scale of economic opportunity for the state.

Table 12 Lifetime employment impacts in Gujarat for Indian project pipeline by supply chain pathway.

Total FTE years in Gujarat			
	Core strengths	Strategic investment	Self-sufficiency
Development and project management	5,100	6,500	8,400
Manufacturing	74,700	283,700	376,500
Installation and commissioning	6,100	8,600	40,300
O&M	40,100	48,800	98,300
Decommissioning	10,900	35,300	67,900
Total	136,900	382,900	591,400

Table 13 Lifetime GVA impacts in Gujarat for Indian project pipeline by supply chain pathway.

Total GVA in Gujarat (₹ crore)			
	Core strengths	Strategic investment	Self-sufficiency
Development and project management	1,030	1,310	1,680
Manufacturing	16,400	61,400	81,200
Installation and commissioning	983	1,590	9,040
O&M	7,920	9,470	16,600
Decommissioning	889	2,880	5,550
Total	27,300	76,600	114,000

4.2 Supply chain barriers and supports

This section considers the main barriers to offshore wind supply chain growth in Gujarat and outlines the key mechanisms through which the development of domestic supply chains can be supported. For each barrier and support, we assess its impact on supply chain growth and outline its relevance to each pathway. Table 14 summarises the key barriers, supporting interventions, their relevance across the different supply chain development pathways.

Industry engagement highlighted that supply chain growth in Gujarat will depend on addressing a series of interconnected barriers relating to market visibility, infrastructure investment, and workforce capability. The proposed interventions are relevant across all pathways, but their scale and emphasis will vary depending on the level of localisation being pursued.

The most critical enabler identified is the creation of a visible and credible project pipeline. Supply chain companies are unlikely to invest in the infrastructure, capability development, and business growth to bring offshore wind products and services to market without confidence in the scale and timing of future offshore wind projects.

This was followed by the role of ports, which are a key enabler during project installation. Investment in suitable port infrastructure represents a major catalyst for supply chain development, with the long lead times associated with port upgrades and development making early action a priority. Both factors provide the foundation for supply chain investment decisions and are particularly important under the strategic investment and self-sufficiency pathways, which require significant capital investment and long-term market confidence.

Other interventions focus on ensuring Gujarat-based businesses are positioned to compete

effectively within the offshore wind market. These include increasing awareness of supply chain opportunities, improving business readiness, developing a skilled workforce, facilitating knowledge transfer from established offshore wind markets, and strengthening the regional innovation ecosystem. While these measures may be less transformational individually than pipeline visibility or infrastructure investment, collectively they build the capabilities needed to maximise local participation and capture greater economic value from offshore wind deployment.



Table 14 Summary of key barriers and supports

Barrier	Key support	Impact	Relevance to pathways
Lack of pipeline strength and visibility	Establish a visible project pipeline and robust delivery mechanism, to provide market participants confidence that projects will progress through consenting, FID and construction.	Very high	Relevant to all pathways. However, larger volumes and greater delivery certainty are required to unlock manufacturing investment under the strategic investment and self-sufficiency pathways . Industry engagement suggests a sustained market of 0.5 -1.5 GW per year over 5 -10 years would provide sufficient confidence to support major capital investment.
Lack of awareness of offshore wind opportunities	Signpost opportunities throughout the project lifecycle through business groups and industry networks.	Moderate	Relevant to all pathways, but particularly the core strengths pathway, where many opportunities lie in less visible professional, technical and support services.
Lack of suitable port space	Prioritise early port infrastructure development, including phased investment plans and public-private funding models.	Very high	Relevant to all pathways. Core strengths require sufficient marshalling capability, while strategic investment and self-sufficiency pathways require the realisation of 1–2 hub ports integrating manufacturing, storage and load-out facilities.
Poor competitiveness among Gujarat-based businesses	Deliver supply chain readiness programmes that improve understanding of offshore wind requirements, standards and commercial dynamics.	Moderate	Relevant to all pathways. Support can be tailored to the specific supply chain opportunities emphasised within each pathway.

Difficulty attracting investment in manufacturing capacity	Provide state-backed grants, investment incentives and tax measures to crowd in private capital.	Very high	Relevant to all pathways. Stronger incentives are required under the self-sufficiency pathway, where localisation is sought in areas with no existing industrial base.
Regional skills gaps	Undertake skills gap assessments and implement coordinated workforce planning with industry, colleges and training institutions.	Moderate	Relevant to all pathways. Manufacturing skills requirements are particularly significant under strategic investment and self-sufficiency pathways, where workforce shortages could delay project delivery and investment.
Limited offshore wind experience	Facilitate knowledge transfer through trade delegations, strategic partnerships and joint ventures.	Moderate	Relevant to all pathways. The importance of partnerships and industry learning increases under higher-growth pathways.

4.3 Recommendations

- Supply chain companies will be reluctant to make significant investments into ports, vessels and production facilities until there is a clear, long-term project pipeline in India: Visibility of a market that they are confident can deliver average volumes between 0.5 GW and 1.5 GW annually over a period of 5-10 years will provide appropriate volume to unlock investment and mitigate concerns of boom-bust cycles.
- Creating a suitable offshore wind port within Gujarat can be seen as a foundational investment as fabrication facilities for large components tend to be collocated with suitable quaysides for loading out large scale components. Prioritizing development (perhaps across multiple phases) of an offshore wind port will lay the foundations for wider sector investments in manufacturing capacity.
- To access the higher local content pathways, a stable pipeline should be supported by a framework that can offer incentives at the right level to crowd in significant private investment in manufacturing. Examples of successful mechanisms include grants, tax credits and duty exemptions for qualifying investments.
- To ensure Gujarat can leverage its existing supply chain capabilities, an effort should be made to ensure that opportunities within the sector are clearly signposted and that suppliers are clear on the relevant codes and standards as well as the commercial and financial criteria they will need to meet to be able to successfully operate in the sector. Industry trade associations, as well as public sector economic development agencies can play a key role in preparing the supply chain for future offshore wind development within India.
- Across all pathways, the success of Gujarat-based suppliers would be bolstered by knowledge transfer between existing suppliers and Gujarat businesses looking to participate in the market. This knowledge transfer can be achieved through the establishment of joint-venture partnerships for initial projects, as well as other tools such as the organisation of trade missions and delegations to visit successful suppliers in established markets.
- The R&D environment within Gujarat should be strengthened to allow technologies to be trialled under representative offshore conditions to help de-risk new approaches. National and state level innovation programmes need to support industry specific R&D priorities. The creation of one or more small-scale demonstration projects of between 1 and 10 turbines would provide an avenue for the supply chain to develop and mature technological solutions needed to make offshore wind in India a success. A key challenge is the development of low wind speed turbine technology that enables the cost-effective development of offshore wind in Gujarat.
- A co-ordinated, national approach to supply chain development should be established based on the regional supply chain specialisms of India's main offshore wind states. Collaborative development of complementary supply chain capacity removes the need for states to compete against each other.



Appendix A Assumptions used in demand modelling

Table A.1 Turbine evolution

Component	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Assumed turbine rating	16	16	18	18	18	22	22	22	22	25	25	25	25

Table A.2 Component assumptions

Component	Assumption
Blades	Three per turbine, required two years before COD
Nacelle	One per turbine, required two years before COD
Tower	One per turbine required two years before COD
Array cable	1.5 km per turbine, two years before COD
Foundations	One per turbine, three years before COD
Jack up vessel	One per GW - one year before COD
Floating crane vessel	One per GW - two years before COD
Export cable (offshore)	250km per GW, three years before COD
Offshore substation	Two per GW, three years before COD
Cable laying vessel (export)	One vessel per GW - three years before COD
Cable laying vessel (array)	One vessel per GW - two years before COD
Ports (laydown)	12 hectares required for each GW in each of the three years before COD
Ports (quayside)	300m of quay required for each GW in each of the three years before COD

Appendix B Supply chain categories

Level 1	Level 2
Development and project management	Project management
	Environmental surveys
	Site investigations
	Engineering
Turbine supply	Nacelle and hub
	Blade
	Tower
Balance of plant	Foundation
	Array cable
	Export cable
	Offshore substation
	Onshore substation and electrical equipment
Installation and commissioning	Turbine
	Foundation
	Offshore cable
	Onshore cable
	Offshore substation
	Onshore substation
Operations and maintenance	Wind farm operation
	Turbine maintenance and service
	Balance of plant O&M
	Vessels

Appendix C Stakeholder engagement

Work package	Name of company
Development & project management	Fugro, Aban offshore
Turbine supply	Vestas, Suzlon, Cubuilt, NIWE
Balance of plant	Sterlite, Polycab, L&T
Installation and commissioning	L&T
Operations and maintenance	Suzlon, Vestas

Appendix D Case study: GERMI

GERMI's Role in Developing R&D Facilities for OSW Projects

The Gujarat Energy Research & Management Institute (GERMI), a Government of Gujarat Centre of Excellence under GSPC and a DSIR-recognized Scientific & Industrial Research Organisation, operates across renewable energy, electrical systems, hydrogen technologies, environmental sciences, and petroleum research. GERMI is currently developing a state-of-the-art facility integrating Battery, Electrical, and Hydrogen testing equipment, along with NABL-accredited Environmental and Petroleum Research laboratories.

GERMI can play a similar anchor role in establishing advanced testing infrastructure for Offshore Wind (OSW) components in Gujarat by leveraging its multidisciplinary capabilities, which are summarized below.

Battery research and testing laboratory

A facility for evaluating the performance, safety, durability, and environmental assessment of battery cells, modules, and packs.

Major equipment at the facility includes a computer-controlled cell tester, drop & impact tester, crush test system, Nail penetration tester, external short-circuit testers (1,000 Amp and 25,000 Amp), battery pack tester, environmental & thermal cycling chambers with dataloggers, thermal abuse chamber with scrubber, vibration tester and X-ray machine for internal battery analysis. Testing capabilities include capacity, cycle life, state-of-health and state of change analysis, dynamic stress tests, circuit testing, thermal runaway testing, charging and discharging tests, mechanical integrity, impact and penetration testing, and environmental testing.

Electrical research and testing laboratory

A high-voltage testing and diagnostic facility for cables, insulators, transformers, switchgear, protection devices, and smart meters.

Major equipment in the facility include universal tensile testing machines (200 kN & 50 kN), porosity tester, optical emission spectrometer (OES), current impulse & reference voltage setup for 11 kV surge arresters, 33 kV / 5000 kVA transformer testing system, medium voltage covered-conductor test systems, personal protective equipment (PPE) testing, partial discharge test system, 160 kV HV temperature rise systems, breaker time analyser & contact resistance tester. Testing capabilities include high voltage testing, thermogravimetric analysis, insulation resistance, transformer routine tests, cable aging, breakdown, tracking/erosion, fuse endurance, breaker timing, metering accuracy tests for smart meters.

Hydrogen testing laboratory

Comprehensive evaluation of electrolyzers, fuel cells, storage systems, dispensers, and hydrogen piping/valves. Capabilities span performance, efficiency, durability, pressure cycling, leak detection, embrittlement assessment, system integration, and safety validation.

Environmental laboratory

Offers ISO/IEC 17025:2017-compliant testing of water, wastewater, soil, sediments, MSW, and biomethane potential, supporting environmental compliance and sustainability assessments. The lab is accredited by the National Accreditation Board for Testing and Calibration in laboratories (NABL).

Appendix E Economic impact assessment methodology

Conventional modelling of economic impacts for most industrial sectors relies on government statistics, for example, those based on the Ministry of Statistics and Programme Implementation's Central Statistical Office (CSO) and use input-output tables and other production and employment ratios. OSW is ideally suited to a more robust approach that considers the current and future capability of local value chains because:

- Projects tend to be large and have distinct procurement processes from one another, and
- Projects tend to use comparable technologies and share value chains.

This approach enables a realistic analysis of the local and national content of projects even where there are gaps in the data. In conventional analysis, multipliers are used that are based on statistics of expenditure flows in different sectors. Once the analysis has established what contracts have been awarded to companies in the territory under consideration, the contractors are associated with one of the more sectors used in the NIC. Input-output tables created, for example, by the CSO are used to develop multipliers. These multipliers are used to calculate how demand in each of the NIC sectors leads to direct, indirect, and induced impacts. The multipliers used in the conventional analysis in effect ignore the value chain in detail, assuming that sector statistics are valid. The BVGA method is based on the principles of Methodology for measuring UK content for UK offshore wind farms that seeks to understand the value chain in the lower tiers and produces a figure that is equivalent to direct and indirect GVA.

Calculating a local and national content figure, and understanding profit margins, costs of employment and salaries enable direct and indirect FTEs to be calculated. Induced impacts are calculated using conventional multipliers. The same methodology is followed for local content. The remaining expenditure is analogous to the direct and indirect gross value added (GVA) created. GVA is the aggregate of labour costs and operational profits. We can therefore model full-time equivalent (FTE) employment from GVA, provided we understand some key variables. In the economic impact methodology, employment impacts are calculated using the following equation:

$$FTE_a = \frac{(GVA - M)}{Y_a + W_a}$$

Where:

FTE_a = Annual FTE employment

GVA = Gross value added

M = Total operating margin

Y_a = Average annual wage, and

W_a = Non-wage average annual cost of employment.



About Ocean Energy Pathway

Ocean Energy Pathway accelerates global offshore wind growth through programmes which support the energy transition, enhance marine ecosystems and empower local communities. We provide expert, independent support to governments and key decision makers to fast-track offshore wind worldwide. Through collaboration with leaders in policy, industry, and conservation, we help shape sustainable solutions for the long-term growth of offshore wind. Ocean Energy Pathway owns the offshore wind POWER Library, in collaboration with Climate Policy Radar, to help policymakers easily find curated reports and policies related to offshore wind. Headquartered in the UK, we work in Australia, Brazil, Colombia, India, Japan, Mexico, the Philippines, South Korea, and Vietnam with ongoing projects in several other countries.

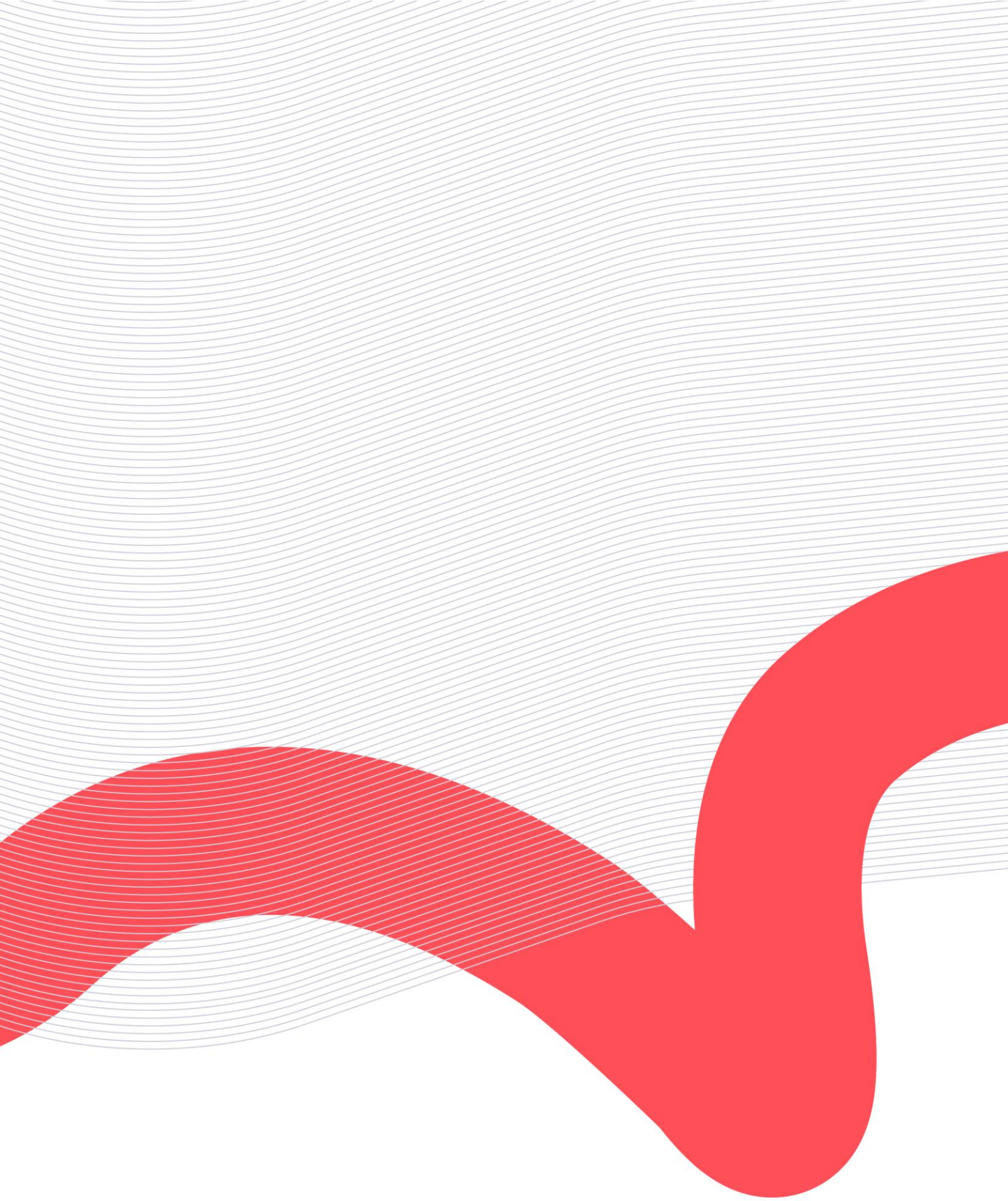


About BVG Associates

BVG Associates is an independent renewable energy consultancy focussing on wind, wave and tidal, and energy systems. Our clients choose us when they want to do new things, think in new ways and solve tough problems. Our expertise covers the business, economics and technology of renewable energy generation systems. Our knowledge, hands-on experience and industry understanding enables us to deliver you excellence in guiding your business and technologies to meet market needs.



MEC+ is a specialist research and consulting firm focused on the marine, energy and cleantech sectors, with a strong track record in offshore wind, supply chain strategy and renewable energy market development. Since its founding in 2011, MEC+ has supported leading global energy companies, government agencies and investors with actionable insights that bridge business, technology and policy.



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