



Accelerating the deployment of offshore wind in India

International insights and recommendations

January 2024



About BVG Associates

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- We have a global client base, including customers of all sizes in Europe, North America, South America, Asia and Australia.
- Our highly experienced team has an average of over 10 years' experience in renewable energy.
- Most of our work is advising private clients investing in manufacturing, technology and renewable energy projects.
- We've also published many landmark reports on the future of the industry, cost of energy and supply chain.



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Executive summary

India has high aspirations to achieve net-zero by 2070 and become a prominent player in offshore wind (OSW) energy. Although India has announced its ambition to develop OSW and has engaged in multiple OSW research projects and initiatives, deployment has not yet materialized. This report identifies the gaps in policy, frameworks, and delivery models that are inhibiting OSW acceleration in India.

Drawing insights from established and emerging OSW markets including Australia, Japan, the Netherlands, the United Kingdom, and the United States of America (New York State) this report offers a set of practical recommendations and strategic direction to the Government of India and other stakeholders to pave the way for the successful execution of future OSW projects in India.

The report was developed by BVG Associates (BVGA), a global leader in OSW industry building, with support from local Indian consultancy MEC+.

Indian offshore wind market overview

India has set an OSW leasing target of 37 GW by 2030, indicating a strong commitment to a renewable energy transition. India has taken several positive steps towards building an OSW sector in India, setting the stage for further development and growth. Initiatives like the FOWIND project and FOWPI (see Appendix B) have conducted extensive research and feasibility studies to understand the potential, challenges, and opportunities for OSW.^{i, ii} The Government of India has published a body of reports and established strategies to support the OSW sector, attracting investor interest and started to formulate frameworks for delivering a pipeline of projects.

International collaboration, including with the European Union and the World Bank Group, has brought in expertise, knowledge sharing, and best practice from established OSW markets. Specific personnel have been designated within institutions to work on policy, frameworks, financing considerations, and project delivery. Nodal agencies within central government have initiated aspects of the frameworks required to develop the OSW sector, indicating movement toward actual project implementation. Comprehensive preparatory activities such as marine spatial planning (MSP), resource assessment, and port infrastructure development have also begun, laying the groundwork for future projects.

Whilst these activities have set a positive direction over the past 8 years, on comparison with established OSW markets it is apparent that significant gaps exist in the policies, frameworks, and implementation capabilities required to deliver a thriving and attractive OSW sector in India. These markets have established their OSW markets through a gradual process, and there's potential for India to adopt or adapt some of these practices to suit its own conditions. It's important to recognise that these markets have evolved over years of trial, error, and refinement. While not all strategies or practices might directly translate, there are key learnings and successful models that India can leverage to expedite its OSW development.

Central government bodies and key supply chain players have begun to engage in project development, there remains an apparent absence of widespread alignment and involvement at the state and local levels. Frameworks related to OSW development are incomplete or ambiguous, including those required for sea bed leasing, permitting, offtake and revenue, and grid connection. A lack of comprehensive requirements for environmental and social impact assessment (ESIA) and community engagement creates uncertainty and complexity for developers. The power procurement process is complex and there are gaps and discrepancies in the regulations that govern it. The lack of alignment within the supply chain, inadequate capacity building support, and the absence of specific regulatory bodies for managing OSW operations pose significant hurdles.

ⁱ FOWIND is a 4 year project to develop a roadmap for OSW development in India, with a focus on the states of Gujarat and Tamil Nadu run by a consortium led by the Global Wind Energy Council (GWEC).

ⁱⁱ First OSW Project of India (FOWPI) is a project funded by European Union (EU) and it aims to support Ministry of New and Renewable Energy (MNRE) and National Institute of Wind Energy (NIWE) in strengthening the country's OSW energy sector and provide technical assistance in preliminary implementation of first OSW farm project of India in Gujarat.



The need for clarification on OSW frameworks concerning seabed leasing, ESIA, and grid connection is imperative, especially considering their pivotal roles in infrastructure development and needs immediate attention.

A lack of evident coordination among governmental agencies at various levels and stakeholders, coupled with limited engagement with local communities and interest groups, impedes progress. Insufficient awareness about OSW among local communities, industry associations, civil society organizations, and district-level authorities remains a pressing issue. Despite attempts to align OSW regulations with existing renewable energy frameworks, tailored engagement and integration with international practices are needed to bridge persistent gaps.

Given India's vast size, it holds immense potential to become a significant player in the global (and especially the South Asia) OSW market. Achieving an annual installed capacity of 3 to 5 GW would enable India to establish at least 2 or 3 factories for each major component, meeting much local demand as well as enabling export, based on India's long-term experience of onshore wind and its competitive supply capability.

Learning from global offshore wind markets

The report presents examples and learning from five countries - Australia, Japan, Netherlands, United Kingdom, and the US (New York State), a combination of emerging and established OSW markets across the world.

- Policy and frameworks: The Netherlands and UK have well-established and stable policies and frameworks
 that incentivize investment and provide regulatory clarity. India can benefit from adopting similar frameworks
 to attract project and supply chain investors.
- Grid integration and planning: The Netherlands has demonstrated effective grid integration strategies for OSW energy. India can learn from this to enhance its grid infrastructure and planning to accommodate OSW power efficiently.
- Environmental and social considerations: UK, Netherland, Australia, and New York State have set examples
 for integrating environmental considerations into OSW development. India can learn from these examples to
 ensure sustainable practices are implemented and to address concerns of local communities, environmental
 and social stakeholders.
- Infrastructure development: The Dutch focus on port infrastructure development has been crucial for the effective development of its OSW projects. The UK has also rolled out significant plans to invest in port and grid infrastructure development. Similarly, India could learn from this international experience to prioritise and invest in port facilities to support OSW projects effectively. Australia's emphasis on onshore infrastructure and grid connectivity highlights the importance of a robust grid system for successful OSW integration.
- Supply chain development: The Netherlands and UK OSW sectors have incentivised local supply chain
 development and invested in training programmes to develop a skilled workforce strategically focussed on
 certain areas of supply for the OSW sector. India can learn the importance of nurturing a robust domestic
 supply chain by incentivizing local manufacturing, encouraging partnerships, and developing skilled labour to
 support project needs. Socioeconomic studies in the established markets have helped in long-term planning,
 understanding the potential impact of OSW projects on communities, and developing strategies to maximise
 positive outcomes while mitigating any adverse effects.
- Revenue models: Revenue models for OSW, such as the UK's contracts for difference (CfD), offer attractive
 rates and long-term revenue certainty. India can explore similar mechanisms to attract investment and
 reduce risks for developers.
- Collaboration and stakeholder engagement: Established markets emphasise collaboration between government, industry, and research institutions to deliver a new infrastructure industry over decades. Stakeholder engagement practices in the Netherlands, UK, and New York involve local communities, environmental groups, and industry stakeholders, setting a precedent for India to adopt inclusive



engagement strategies. India can learn from examples of positive partnerships that foster innovation, share expertise, and ensure sustainable growth.

Key recommendations

While this report brings in learnings from other OSW markets, action will need to be taken by the Government of India to maximise the benefits that OSW can bring. There is much to do to get the Indian OSW firmly on track and we have provided over sixty recommendations for a wide range of stakeholders. To help focus efforts, we provide here key recommendations that the Government of India needs to prioritise.

Of these, it is suggested that recommendation 5 to establish a long-term official task force to prioritise and oversee progress is most important.

Targets

- 1. Ministry of New and Renewable Energy (MNRE) publishes medium- and long-term visions for OSW to 2070 as part of a decarbonised energy mix for India, considering targets for other renewable energy technologies, explaining the case for OSW in terms of cost benefits and long-term contribution to the energy mix, and its role in India's net zero targets. This vision should include maximising the energy system value of OSW and the steps that Government and industry should take to drive cost reduction over time.
- 2. MNRE, in partnership with Central Electricity Authority (CEA), Gujarat Urja Vikas Nigam Limited (GUVNL) for Gujarat, and Tamil Nadu Generation and Distribution Corporation (TANGEDCO) for Tamil Nadu, aligns MNRE OSW bidding targets with national and state-level OSW targets, to create urgency and a clear policy thrust for OSW.
- 3. MNRE establishes clear and binding medium-term OSW milestone capacity targets to 2047 with consistent capacity addition targets to provide industry clarity.
- 4. MNRE, in partnership with CEA, demonstrates the advantages of OSW in providing round-the-clock power to industrial centres in coastal areas. Simulations include OSW and hydrogen or other storage solutions and consider daily and seasonal supply and demand.

Collaboration and stakeholders

- 5. MNRE establishes a long-term official Government of India-industry task force along the lines of UK's Offshore Wind Industry Council (OWIC) involving local and international project developers and key suppliers, to work together to align interests, address gaps, and formulate solutions.ⁱⁱⁱ
- 6. MNRE ensures best, strategic impact of international donor support through dialogue and collaboration. India is fortunate to have a range of governments and agencies willing to support in establishing a vibrant OSW market. Coordinating and integrating this support will be key.

Marine spatial planning

- 7. National Institute of Wind Energy (NIWE), in partnership with Department of Science and Technology (DST), Indian National Center for Ocean Information Services (INCOIS), Ministry of Environment and Forests (MoEF), Ministry of Earth Sciences (MoES), National Institute of Oceanography (NIO) and National Institute of Ocean Technology (NIOT), undertakes similar OSW MSP processes for other states with OSW potential, to inform future OSW development opportunities beyond the early projects anticipated for Gujarat and Tamil Nadu, establishing a national OSW spatial plan.
- 8. NIWE to provide a common public data repository for data published by developers and other stakeholders, including from MSP activities.

Leasing

9. NIWE clarifies the discrepancies between issued guidance with regard to preliminary qualification criteria.

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iii https://www.owic.org.uk/



- 10. MNRE, in partnership with NIWE, updates guidelines to ensure a minimum gap of 10 km between sites for Model C.
- 11. MNRE allows transfer of ownership in OSW projects to help share risks and resources.

Environmental and social impact assessment

- 12. MNRE reviews the Environmental Social Impact Assessment (ESIA) regulations and process for OSW against international standards, Good International Industry Practice (GIIP) and lender requirements and makes necessary updates and clarifications. To facilitate lending, international funding organisations need to ensure that projects meet their environmental and social standards.
- 13. MoEF provides guidance and establishes regulations applicable to developments located beyond 12 nautical miles from shore.
- 14. MNRE, in partnership with Ministry of Environment and Forest (MoEF), State Department of Environment & Forest, and State Coastal Zone Management Authority (SCZMA), ensures stakeholder engagement as part of the ESIA process, including engagement with communities, marine industries, and other sea users.

Permitting

15. MNRE, in partnership with Green Energy Transition Research Institute (GETRI), Guidance Tamil Nadu, Ministry of Home Affairs, Department of Space, Ministry of Defence, SCZMA, MoEF, and State Department of Environment & Forest, establishes specific agencies, formats, guidelines, timelines, and a comprehensive procedure for the permitting process.

Offtake and revenue models

- 16. MNRE fast-tracks Viability Gap Funding (VGF) for initial auctioned capacity.
- 17. MNRE, in partnership with GUVNL, TANGEDCO and the power ministries of other states, establishes a competitive system solely for OSW power purchase agreements (PPA), with a ceiling price to limit cost to consumers and potentially a floor price in early years to avoid the risk of unrealistic low bids. Consultation on ceiling and floor prices should be with relevant stakeholders in the run up to competitions to reflect evolving fossil fuel and OSW prices, especially recognizing current high fossil fuel and commodity prices. A mechanism should be included to address multiple bids being received at the floor price, which may include the consideration of non-price factors.

Export system and grid connection

- 18. Central Electricity Regulatory Commission (CERC) details procedures, timelines, and transparent compensation mechanisms for delays to grid connection to new OSW projects.
- 19. CERC, in partnership with State Electricity Regulatory Commission (SERC) publishes simulations to show that there will be no curtailment of OSW projects operational from 2035 onwards.

Health and safety

- 20. MNRE in partnership with NIWE establishes stringent regulations and standards specifically tailored to OSW health and safety from development and survey work through to construction, operations, and decommissioning. It also collaborates closely with industry players to develop and update safety protocols, harnessing expertise from global training bodies and private enterprises.
- 21. NIWE, in partnership with Ministry of Skill Development and Entrepreneurship, invests in training programmes and capacity building initiatives for workers involved in OSW projects, including safety training, emergency procedures, specialized skill development and building a culture of safety.
- 22. NIWE establishes dedicated bodies or assign existing agencies to monitor and enforce compliance with health and safety standards through regular inspections, audits, and certifications.



Port infrastructure

23. Ministry of Ports and Shipping develops a long-term multi-phased plan for developing an offshore renewable energy hub within the port facilities of Hazira, Pipavav, Tuticorin, and Vizhinjam. This should sit alongside securing permits for future expansion to keep pace with the growing demand for services within the OSW sector, and a strategy of attracting major anchor tenants around which wider supply-chain businesses and infrastructure can grow.

Transmission network

- 24. MNRE and CEA, with support of CTU, publishes a 2070 vision for a nationwide transmission network development plan for a decarbonized energy system, with short-, medium- and long-term milestones and consideration of finance. This incorporates OSW development zones defined through MSP into the transmission network development plan.
- 25. Grid India undertakes power systems studies to understand the potential impacts of large volumes OSW on the future transmission network and ESIAs in line with GIIP and lender requirements to understand the environmental and social implications of transmission network upgrades, feeding these into MSP activities.



1. Introduction

Offshore wind (OSW) is increasingly recognised globally as a means of achieving net zero ambitions, as it provides a low-cost, high-volume solution where conditions are suitable. India is one of the fastest growing economies in the world and aims to achieve net zero by 2070.

The Government of India has shown a strong commitment to clean energy, setting ambitious target of 500 GW by 2030. India's renewable energy sector comprises various sources, including solar, wind, hydroelectric, and biomass. Among these, wind energy plays a crucial role in India's renewable energy landscape. India is a global leader in onshore wind power generation. The country has abundant wind resources, especially in states of Gujarat, Maharashtra, Karnataka, Rajasthan, and Tamil Nadu. India's substantial experience in wind energy spans more than three decades, marking its prowess in harnessing this technology for power generation. The country has an installed onshore wind energy capacity of nearly 41 GW making it the fourth-largest market worldwide in terms of installed wind energy capacity. While India's onshore wind sector has witnessed impressive growth, there are challenges such as land availability, grid integration issues, and intermittency concerns.

With extensive wind resources and a coastline of about 7,600 km, India is an important emerging OSW market. It has an ambitious OSW target of 37 GW leased by the end of 2030, putting OSW at the forefront of its energy transition plans. Based on preliminary assessments, the states of Gujarat and Tamil Nadu together have 70 GW of OSW potential. No capacity has been deployed in India to date although numerous studies and research activities have been conducted to develop the OSW sector, including:

- The Facilitating Offshore Wind Energy in India (FOWIND) project supported by the European Union (2013 to 2018),
- The First Offshore Wind Project in India (FOWPI) project in 2015 aimed to provide technical assistance in support of a planned early 200 MW OSW project, and
- The World Bank Group Offshore Wind Roadmap for India (2021-22) (unpublished).

Since the first *National Offshore Wind Energy Policy* was published in 2015, the Government of India has subsequently published various reports to support the sector and attract investor interest.⁴³ Although there are high aspirations and there has been some progress, gaps remain that have hindered OSW's acceleration in the country and there are a range of policies, frameworks, and delivery matters that need to be resolved to accelerate the industry.

This report aims to identify these gaps, understand how other countries have progressed their OSW programmes, and use the learnings to identify solutions for the Indian OSW sector. We bring learnings and examples from five countries – Australia, Japan, Netherlands, United Kingdom, and the United States of America (New York State), representing a combination of emerging and established OSW markets across the world.

This report provides recommendations relating to:

- Strategy and policy required to set the environment and direction for the OSW sector in India,
- Frameworks to enable efficient progress of projects through to operation, and
- Practical solutions to facilitate the delivery of future OSW projects.



1.1. About this report

This report is the output of work undertaken by BVG Associates (BVGA), a global leader in OSW industry building with support from Indian consultancy MEC+. The study was carried out from September 2023 to December 2023, with engagement and input from the Ministry of New and Renewable Energy (MNRE), and other relevant stakeholders.

The report is structured as follows:

- Section 2: A summary of key factors for a successful OSW industry drawing in The World Bank's Key Factors for Successful Development of Offshore Wind in Emerging Markets (the Key Factors report),² This document was co-authored by BVGA and defines the key strategy, policy, frameworks, and delivery considerations for successful OSW development.
- Section 3: A review of strategy and policy from global examples, the status of strategy and policy in India, and recommendations for India.
- Section 3.2: A review of frameworks from global examples, the status of frameworks in India, and recommendations for India.
- Section 5: A review of delivery models from global examples, the status of delivery models in India, and recommendations for India.

A glossary is provided in Appendix A, a non-exhaustive list of Indian OSW development studies is provided in Appendix B, comparison of the Indian OSW lease frameworks are provided in Appendix C, a non-exhaustive list of active key stakeholders across the example countries are provided in Appendix D.



2. Key factors for the successful development of offshore wind in emerging markets

This section summarises the key factors required to successfully develop an OSW industry in emerging markets. This is based on experience in a range of OSW markets, as captured in the World Bank Group (WBG)'s *Key Factors* report.

An overview of the key factors is presented in Figure 1, broken down into four categories:

- Strategy
- Policy
- Frameworks, and
- Delivery

We address these four categories in the sections that follow. Every OSW market will have different strategic drivers and considerations, so whilst generic key factors are important, learning always needs to be applied in the context of a specific country.

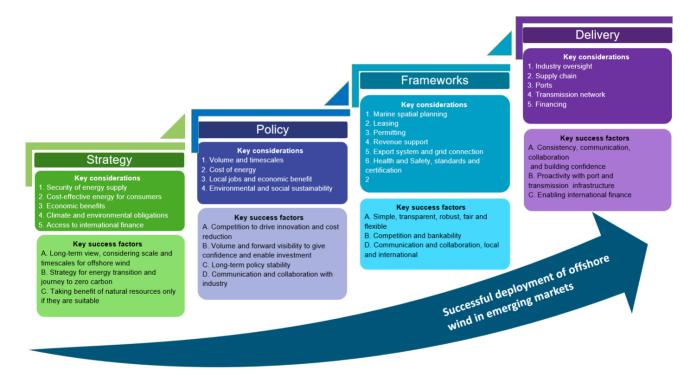


Figure 1 Strategy, policy, frameworks, and delivery: key considerations and success factors for offshore wind.²

2.1. Strategy

Strategy, in the context of OSW development, involves the long-term planning undertaken by political leaders, decision-makers, and energy planners who recognise OSW's potential contribution to the country's economic and societal wellbeing. This planning encompasses the incorporation of OSW into the future energy portfolio, aiming to achieve diverse goals such as energy security, economic vitality, and environmental sustainability. When contemplating OSW projects, it's crucial to embed them within the broader energy strategy of a country. This energy strategy is needed to ensure that the country has:

- Security of energy supply
- Cost-effective energy for consumers



- Economic benefits in the form of jobs and supply chain development
- A pathway to meet climate and environmental obligations, and
- Access to international finance

In the context of electrification and decarbonisation goals leading up to 2070, OSW projects should be considered integral components of a comprehensive, long-term energy strategy alongside other forms of energy production. This is assuming that the country has already established that OSW is a possible option. The primary sources of energy production are anticipated to be renewable, including wind, solar, and hydropower. When integrating OSW into India's long-term energy strategy, policymakers should contemplate overarching strategic questions at a macro-level to ensure a comprehensive and well-informed approach. These key questions include:

- Can OSW significantly enhance the country's energy security by diversifying its energy sources and reducing dependence on fossil fuels and imports?
- What role can OSW play in meeting the country's future energy demands, considering both the growth in electricity consumption and the shift to electrification in various sectors?
- Is there potential for surplus OSW energy generation to be exported to neighbouring markets, thereby enhancing energy trading opportunities and benefiting the national economy?
- Does the seasonal and diurnal output variation of OSW complement other forms of electricity generation, such as solar or hydropower, to ensure a balanced and reliable energy supply?
- Can OSW projects be developed in an economically viable manner, ultimately leading to cost-effective energy prices for consumers and industries?
- What economic advantages can OSW create, including job creation and supply chain development within the domestic market, thereby stimulating economic growth?
- To what extent can OSW contribute to achieving the country's climate and environmental obligations, including reducing greenhouse gas emissions and mitigating the impacts of climate change?
- How much foreign direct investment can OSW projects attract, fostering international collaboration and strengthening the country's energy infrastructure?

Addressing these strategic questions is paramount for policymakers in formulating a robust OSW strategy that aligns with national goals, maximises the benefits for the country, and ensures a sustainable, secure, and cost-effective energy future.

KEY SUCCESS FACTORS

Related to energy strategies for OSW, governments should:

- a) Establish a clear role for OSW in the country's future energy mix to help meet local electricity demand, and potentially the energy demands of other consumers and markets.
- b) Set a long-term energy strategy, considering reductions in the cost of OSW over time.
- c) Consider the emissions reduction potential and economic benefits of OSW, including job creation potential, and integrate it into the country's climate, industrial, and economic strategies.
- d) Attract foreign investment by signalling strategic intent and through bankable frameworks including longterm, stable revenue support and environmental and social safeguards.
- e) Use the energy strategy to inform the creation of strong policies and frameworks to deliver on strategic objectives for OSW deployment.



2.2. Policy

Policy refers to the fundamental political objectives, legislation, and accords that translate a strategic vision into tangible actions, typically executed by legislators and government officials. Once a high-level strategy has been set, policymakers must then craft specific OSW policies to translate the strategy into practical action. In shaping these policies, policymakers must address critical questions such as:

- What is the target capacity for OSW, and when should it be operational?
- What is a feasible yet cost-effective electricity price for initial projects?
- What are the long-term energy cost reduction objectives, and what strategies can be employed to achieve these price reductions?
- How can we strike a balance between prioritizing job creation, economic benefits, and reducing energy costs?
- What measures can be taken to optimise economic benefits while ensuring that electricity remains affordable for consumers?
- What initiatives are required to establish a skilled local workforce that promotes gender diversity and inclusion?
- What government actions are necessary to safeguard or even enhance the local environment in the context of OSW development?

KEY SUCCESS FACTORS

Related to energy policies for OSW, governments should:

- a) Provide long-term policy stability and project pipeline visibility to help build industry confidence and ability to invest.
- b) Recognise that larger volumes of OSW help drive down the cost of energy and grow local supply chain.
- c) Create policies based on realistic timescales, considering that it takes time to build an industry.
- d) Consider using demonstration projects as a way of kick-starting sector growth.
- e) Create confidence in the market through clear policies and targets, enabling long-term investment in cost reduction.
- f) Encourage a competitive environment through auctions and through investments in the local supply chain.
- g) Enable project developers to minimise project risk and attract low-cost finance by developing clear, robust frameworks that enable bankable project delivery.
- h) Focus on the largest realistic opportunities for the local supply chain.
- i) Balance pressure for local content with providing market volume, visibility, and competitiveness.
- j) Consider local supply in the context of a competitive regional and global market.
- k) Develop policies aimed at creating confidence to invest.
- I) Enable positive coexistence of OSW with other users.
- m) Engage with stakeholders to understand concerns and explore local benefits of OSW.
- n) Align Set policies to make a positive local impact on the local ocean environment.



2.3. Frameworks

Frameworks are the mechanisms through which the policies are enacted; these are usually implemented by government agencies and utilities. A government's vision and priorities, communicated through its strategy and policies, need to be enabled through a series of frameworks and are discussed below.

Effective frameworks play a pivotal role in minimising risks for project developers, suppliers, and investors while attracting experienced parties to the OSW market. Each offshore project navigates through various stages within these frameworks, involving leasing, permits, grid connection, and revenue support, before reaching the crucial investment decision for construction. The key attributes of good frameworks are:

- Transparency: Providing clear and understandable processes and priorities, facilitating communication, and ensuring accountability throughout the entire process.
- Timeliness: Allowing the right projects to progress within a defined timeframe, enabling the industry to maintain momentum and achieve project milestones efficiently.
- Fairness: Ensuring decisions are made based on principles of good governance and social justice, with transparent reasons, ensuring no stakeholders feel unfairly treated.
- Robustness: Establishing industry confidence that due process will be followed, leading to outcomes that are reliable and unlikely to face challenges or disputes.
- Consistency: Maintaining stability by avoiding frequent changes in frameworks and ensuring logical coordination between different stages and interfaces within the processes.
- Proportionality: Delivering requirements efficiently, without unnecessary complexity, ensuring a streamlined and effective approach without excessive complications.

A well-structured framework not only fosters a conducive environment for OSW projects but also encourages the active and confident participation of all stakeholders involved in the industry.

2.3.1 Marine spatial planning

Marine spatial planning (MSP) is the process of deciding where to strategically locate OSW projects taking a comprehensive view of marine resources and carefully considering environmental and social factors to avoid high-risk areas where unacceptable impacts cannot be avoided or mitigated. This holistic approach ensures that the chosen sites maximise the benefits of OSW while minimising potential negative impacts on the environment and local communities.

MSP processes, when implemented in a balanced and practical manner, can play a substantial role in the strategic deployment OSW projects.

KEY SUCCESS FACTORS

Related to marine spatial planning for OSW, governments should:

- a) Use proportionate and pragmatic MSP processes to define the geographical limits of leasing for OSW.
- b) Follow good practice, including consideration of guidance produced by the Intergovernmental Oceanographic Commission and the WBG.
- c) Ensure that strategic spatial planning for OSW is informed by economic analyses of potential OSW sites, as well as environmental and social considerations.



2.3.2 Leasing

Leasing encompasses the process of granting specific rights to a project developer, beginning with the authorisation to conduct surveys and assessments of a potential OSW site. Upon meeting requirements and regulatory standards, the developer is subsequently authorised to proceed with the development, construction, and operation of a wind farm on the designated site. This leasing process ensures a systematic and regulated approach to OSW development.

The award of leases can take a range of different formats and are summarised in Table 1.

Table 1 Comparison of different formats for lease awards.

	Bilateral	Competitive (just leasing)	Competitive (combined with revenue support)
Description	Ad-hoc agreement between individual developers and leasing authority	Competition to award leases early in the project development lifecycle, with any revenue support competition run separately, after permitting	Competition to award leases late in the project development lifecycle, along with any revenue support
Activities	Developer: Early- stage project development to determine site. Leasing body: Responds to requests and assesses, in isolation, other potential future requests. Both: Negotiate terms. After award: The Developer progresses through all stages of project development — design, permitting, purchasing, and construction.	Leasing body: Decides areas to be leased, preferably using MSP principles (likely to be broad areas, rather than specific project boundaries due to uncertainty at this stage) and manages tender, providing rules and terms of lease. Developers: Respond to tenders by assessing areas and bidding following competition rules. After award: Winners negotiate details of the lease with the terms provided, then progress through all stages of project development – design, permitting, purchasing, and construction.	Leasing body: Carries out early-stage project development work (design and permitting) to progress the project far enough to define the project site and enable project developers to place informed bids with a low risk of surprises during the final stage of project design and permitting. Manages tender, providing rules and terms of lease. Developers: Respond to tenders by assessing sites and bidding following competition rules. After award: Winners negotiate details of the lease with the terms provided, then progress remaining stages of project development – final design, final permitting, purchasing, and construction.
Pros / Cons	Pros: Can work well to help accelerate early projects in an emerging market. Cons: Not a viable long-term route in a market with multiple developers competing for the same locations.	Pros: Less effort and cost for the government than option 3. Gives developers the most freedom in the design of their projects – they should know best about how to develop the lowest levelized cost of energy (LCOE) projects. Developers own projects for longer – more freedom to speed up / slow down the development of any project in their portfolio. Cons: The government does not prescribe exactly where projects will go.	Pros: Government is in full control of where projects will go, and when they will be constructed. The single competitive process to manage. Governments de-risk projects further for project developers by considering permitting in detail (including cumulative effects of multiple projects) before leasing. Cons: The government must manage early development work, up to leasing specific



		Extra process (and risk for developers) for revenue support once developers understand the LCOE of the project better. More risk to developers relating to permitting.	projects. This requires more effort and cost for the government than option 2. Little room for project developers to make project design decisions or prioritise between projects. Excludes smaller, more entrepreneurial developers
Examples	Colombia, Korea, Philippines, Vietnam (early project(s) only)	Taiwan, UK, USA	Denmark, Germany, Netherlands

KEY SUCCESS FACTORS

Related to leasing for OSW, governments should:

- a) Set out a transparent, robust, and repeatable leasing process.
- b) Ensure leasing is managed by a well-resourced, trusted organisation for timely, bankable outcomes.
- c) Continue to monitor leasing to ensure processes are delivering suitable volumes of projects to meet future delivery targets and are following evolving international good practice.

2.3.3 Environmental social impact assessment

An environmental and social impact assessment (ESIA) is a comprehensive evaluation of the potential environmental and social effects of a new infrastructure project, along with an assessment of the magnitude of these consequences. In established markets, regulatory frameworks mandate the inclusion of an ESIA as a prerequisite for a developer's permit application.

Incorporating a legal or regulatory stipulation that mandates ESIA to be conducted in compliance with Good International Industry Practice (GIIP) can yield significant advantages for the deployment of OSW projects. Examples of such standards include the WBG's Environmental and Social Standards (ESS) and the International Finance Corporation's Performance Standards (IFC PS).³ These standards are internationally recognised and provide a framework for conducting ESIA in a manner that aligns with best practices and ensures that projects adhere to high environmental and social standards.

In countries where the local ESIA requirements do not meet international standards, developers seeking international financing for their projects often find themselves in the position of having to produce two assessments. The first assessment is tailored to meet the demands of the local authorities and fulfil their regulatory requirements. The second assessment, which is more comprehensive, is necessary to ensure that the project aligns with international standards and the expectations of international financiers. This dual assessment approach is intended to bridge the gap between local and international requirements, ensuring that the project satisfies both sets of standards. Examples of this practice include Taiwan and Vietnam.

2.3.4 Permitting

The permitting process provides project developers permission to construct and operate offshore projects whilst minimising environmental harm, social impacts, and conflicts with maritime stakeholders. Permitting encompasses the process of granting explicit permissions to a project developer, enabling them to undertake the construction and operation of a wind farm. These permissions are issued after a comprehensive ESIA, which rigorously evaluates the potential environmental and social consequences of the project. The permitting process ensures that the development aligns with regulatory and sustainability standards, while also mitigating any adverse impacts on the environment and local communities.

Effective permitting processes require oversight from a well-resourced and trusted organisation. Project developers often find a one-stop shop for permitting to be highly beneficial in streamlining the process. In



scenarios where multiple projects are simultaneously progressing through the permitting process, a one-stop shop facilitates the consideration of cumulative impacts, more productive communication, and efficient resource allocation.

Stakeholder engagement and public consultation play a crucial role in identifying and addressing concerns. Local communities can offer valuable insights and additional information that can mitigate risks associated with OSW project development. Notably, input from marginalised communities and indigenous peoples is of particular significance in obtaining the social licence to operate, even when the necessary permits have been granted. This inclusive approach ensures that the project aligns with social and environmental considerations and enjoys broader support from all affected stakeholders.

KEY SUCCESS FACTORS

Related to permitting for OSW, governments should:

- a) Establish a transparent, robust, and flexible permitting process.
- b) Ensure that the organisation administering permitting is trusted and well resourced.
- c) Define requirements for environmental and social impact assessments, following good international practice, including for robust baseline studies.
- d) Support broad stakeholder engagement and education about OSW.

2.3.5 Offtake and revenue support

Offtake and revenue support play a critical role in providing consistent revenue for OSW projects. This support helps mitigate risks associated with fluctuating power prices, thus providing a stable financial environment that enables investors to make final investment decisions for these projects with greater confidence.

There are several mechanisms through which governments support and incentivise OSW and other renewable energy production, summarised below:

- Feed-in Tariff (FIT): Under this system, the government pays a fixed price for the electricity produced, typically covering 75% or more of the project's anticipated lifespan. To encourage cost reductions, governments often gradually decrease the tariff for new projects. This approach has been previously successfully employed in countries like Germany. It relies on developers to reduce costs to a level that ensures a satisfactory internal rate of return (IRR) without necessarily reflecting the actual generation costs.
- Renewable Energy Certificate (REC): Governments issue certificates for renewable energy generation and mandate that electricity-generating companies or suppliers obtain certificates for a growing proportion of their total generation. This requirement is typically enforced through a Renewable Portfolio Standard (RPS) or a similar mechanism. Companies can meet this obligation by either generating renewable energy, purchasing certificates from other renewable generators, or paying an increasing buy-out charge to the government. RECs create a market price for certificates, driving uptake, but they do not necessarily foster direct competition in determining the price. This form of revenue support was used in the early growth phase of now established OSW markets, including Renewables Obligation which supported early OSW projects in the UK.
- Contract for Difference (CfD): Also known as a sliding feed-in premium, this approach involves the government awarding a contract that covers a significant portion of the project's expected lifespan. The contract provides a top-up to the revenue earned by the developer, based on the difference between the wholesale electricity price and a pre-agreed strike price.
 - o In a one-way CfD, when the wholesale electricity price is lower than the strike price, the contract provides a payment to the developer, effectively topping up their revenue. This payment equals the difference between the wholesale electricity price and the strike price. In some cases, there might be a maximum limit on this top-up to prevent excessive costs to consumers during periods of low wholesale prices. When a one-way CfD is based on a strike price of zero, it means that the plant essentially



operates as a merchant power plant, with its revenue entirely dependent on market prices without government support.

- o In a two-way CfD, developers reimburse the government if the wholesale electricity price exceeds the strike price. This system offers price certainty to the developer while minimising the government's exposure. In some cases, the cost to the government can be negative, effectively leading to project developers paying the government to ensure a stable revenue per megawatt-hour (MWh). This approach ensures a predictable revenue stream and encourages investment in renewable energy projects which have high upfront capital costs.
- Fiscal support: Incentives for renewable energy, including OSW, can also take the form of fiscal incentives, typically involving taxes. These incentives can be broadly categorised into generic ones that are applicable across various industries and those specifically tailored to support renewables. For example:
 - Accelerated Depreciation: Some countries, like France and the Netherlands, have provided incentives for the wind industry through accelerated depreciation on capital investments. This allows companies to deduct the cost of their investments more quickly than traditional depreciation methods.
 - Capital Gains Tax Exemptions: Many European countries have offered exemptions from capital gains tax on the sale of shares in project companies involved in renewable energy projects. This encourages investment and ownership changes in the industry.
 - Production Tax Credits (PTCs): In the USA, PTCs have been instrumental in driving onshore wind energy. These tax credits involve a rebate that is proportionate to the electricity generated by a specific company. It provides a financial incentive for generating renewable energy.⁵
 - Investment Tax Credits (ITCs): The USA has also implemented ITCs, which offer a tax rebate based on the level of investment made in a renewable energy project. This encourages capital investment in the renewable energy sector.⁶

KEY SUCCESS FACTORS

Related to revenue support for OSW, governments should:

- a) Structure revenue support processes to be robust, transparent, and fair.
- b) Ensure a bankable revenue support mechanism is in place.
- c) Enable price competition at the revenue support stage to drive cost reduction.

2.3.6 Export system and grid connection

The export system comprises the infrastructure that links OSW farms to the onshore transmission network, enabling power transfer. This includes substations, export cables, and other assets. Grid connection processes represents the approach for securing transmission capacity so OSW energy can access the broader electricity grid. Through grid connection agreements and processes, developers obtain the export capability to integrate their projects with the terrestrial grid.

The export system and grid connection process play a pivotal role in ensuring the timely integration of each OSW project with the electrical transmission network. This connection is a critical component of the project's success, allowing the generated electricity to be efficiently transmitted and distributed to consumers. It is essential for ensuring the project's viability and contributing to a reliable and sustainable energy supply.



KEY SUCCESS FACTORS

Related to export system and grid connection for OSW, governments should:

- a) Provide clarity for developers through a clear, bankable, framework to secure grid connections.
- b) State the parties responsible for the delivery and operation of the export system, and clearly define the technical and commercial interfaces between assets.
- c) Include mechanisms to compensate curtailment of generation output to give developers sufficient clarity of revenue.
- d) Keep grid codes applicable to OSW, with the aim of harmonisation with international standards to avoid additional costs.

2.3.7 Health and safety

The offshore industry must prioritise and maintain effective health and safety practices and foster a culture that safeguards the well-being of individuals and the environment. These practices are essential for preventing accidents, minimising risks, and ensuring that offshore operations are conducted responsibly and sustainably.

The WBG provides a series of general and sector-specific Environmental, Health, and Safety (EHS) Guidelines. ⁷Promoting best practices from global training bodies, such as the Global Wind Organisation (GWO), G+ OSW Health and Safety Association, and similar industry entities, is highly encouraged. ^{8,9} These organisations offer a wealth of technical expertise and data that emerging OSW markets can leverage. They have played a crucial role in the development of globally recognised safety and technical standards, along with best practice guidelines, specifically tailored to OSW operations.

KEY SUCCESS FACTORS

Related to health and safety for OSW, governments should:

- a) Combine international best practice with local considerations.
- b) Involve all stakeholders to ensure legislation is fit for purpose and responsibilities are clear.
- c) Drive health and safety-focused behaviours through leadership and culture, that are fully embedded in the industry.

2.3.8 Standards and certifications

Designing, manufacturing, installing, and operating wind farm components that adhere to robust technical standards is instrumental in mitigating project risk. These standards ensure that the various elements of the wind farm are developed and maintained to meet established safety, quality, and performance criteria.

Standards such as the International Electrotechnical Commission (IEC) 61400 suite, are tailored to the wind industry and encapsulate best practices that have been honed over many years. ¹⁰ Established suppliers routinely adhere to these standards, which have become industry benchmarks for quality, safety, and performance. Encouraging new entrants in the market to adopt these standards is imperative to ensure uniformity and maintain high-quality products and services. It not only promotes a level playing field but also maximises the market's potential for growth and success.

In addition to adhering to wind industry standards, wind farm components are engineered to meet a range of internationally recognised standards, including Deutsches Institut für Normung (DIN), Euronorm (EN), International Organisation for Standardisation (ISO), and others related to design and manufacturing. 11,12,13,14 Embracing these established standards, rather than introducing new national standards, can help mitigate additional costs and delays in industry growth. Governments are encouraged to facilitate harmonisation between relevant international and national standards, where applicable, to streamline the global development and implementation of wind energy projects.



An excellent example of such harmonisation efforts was demonstrated by the British Standards Institute (BSI) in 2014, where they harmonised standards for offshore renewables. ¹⁵ This kind of coordination not only enhances efficiency but also reduces complexity and costs for wind energy projects by aligning them with recognised global standards.

KEY SUCCESS FACTORS

Related to standards and certification for OSW, governments should:

- a) Support the development of standards to ensure local applicability, through engagement with the international standards organisations.
- b) Avoid national standards which introduce additional costs and extended delivery times for components.
- c) Allow industry and investors to determine what Type Certification and Project Certification is required to manage risk.

2.4. Delivery

Delivery refers to the enabling environment required to deliver on-the-ground results; these are implemented by governments in partnership with industry, civil society, and other stakeholders.

2.4.1 Port infrastructure

Ports play a fundamental role in facilitating the construction, operation, and maintenance of OSW farms. These facilities are crucial hubs for the efficient transportation of personnel, equipment, and components to and from the offshore sites. They serve as pivotal points for staging, assembling, and deploying the various elements needed for OSW projects, ensuring that the operations run smoothly and effectively.

The government plays a crucial role in ensuring that the port infrastructure aligns with its OSW strategy. It should evaluate and communicate the suitability of existing port facilities for use in the construction and operation of OSW projects on time.

When it comes to port development, various ownership and operational models can be considered, including public service ports fully owned and operated by the government, private service ports operated by private businesses, and hybrid models that involve a mix of public and private ownership. iv

KEY SUCCESS FACTORS

Related to ports for OSW, governments should:

- a) Ensure existing port facilities are assessed to determine any required upgrades or new ports for OSW.
- b) Establish effective ownership and funding models to enable necessary investment.
- c) Determine whether to grant freeports status to relevant locations.

2.4.2 Transmission network

A robust approach to transmission network planning and upgrades is essential to instill confidence within the industry that OSW projects can be reliably connected to a sufficiently strong transmission network. This proactive approach ensures the seamless integration of renewable energy sources into the grid.

Efficient integration of OSW into the onshore transmission network requires careful consideration of the anticipated pipeline of future OSW projects. As variable energy supply from OSW increases, the roles of interconnectors, energy storage, and demand and supply management become progressively more important for maintaining grid stability and reliability.

Accelerating deployment of offshore wind in India

Freeports are specialised economic zones where customs regulations, tax duties, and administrative requirements are eased for goods within or passing through the port area.



KEY SUCCESS FACTORS

Related to transmission network for OSW, governments should:

- a) Consider the anticipated pipeline of future OSW when planning transmission network upgrades, to ensure timely connection of OSW farms.
- b) Coordinate with stakeholders to reduce uncertainty related to transmission network upgrade timing and capacity.

2.4.3 Financing mechanisms

The OSW industry is characterised by its high capital intensity, necessitating substantial involvement from the banking sector and the capital markets to fund projects and facilitate its growth. Given the substantial capital demands and the intricacies of OSW financing, projects inherently bear significant development, construction, and operational risks. Even in well-established markets, the financing of increasingly larger projects presents its own set of challenges. It is essential to acknowledge and manage these risks to ensure the successful development and operation of OSW projects.

Experienced International Banks, Development Finance Institutions (DFIs), International Financial Institutes (IFIs) like the European Investment Bank, and Export Credit Agencies (ECAs), play a vital role in mobilising substantial amounts of long-term financing required for OSW projects. These financial institutions are instrumental in supporting specific supply chain contracts and facilitating the large-scale investment needed for the development and operation of OSW ventures.

KEY SUCCESS FACTORS

Related to financing for OSW, governments should:

- a) Carefully consider how their policies and frameworks affect financing for OSW projects.
- b) Engage with credit enhancement providers to prepare for the financing of OSW.
- c) Consider the financing implications of offtake tariff currency, indexation, and related protections.
- d) Create a regime and environment which gives investors access to insurance from the international insurance and reinsurance markets.

2.4.4 Supply chain

OSW projects require a level of local supply chain development to be successfully delivered which in turn can offer significant local economic benefits. This approach not only promotes economic growth within the project vicinity but also enhances the overall success and sustainability of OSW initiatives. Markets often lack sufficient scale to independently sustain competitive local supply chains. Governments should balance national strategic interests with the need for developers to source globally cost-competitive components. Collaboration on local content incentives across neighbouring markets can boost the scale of regional manufacturing and services clusters.

Governments can expand local OSW jobs by proactively planning for workforce needs and supporting training programmes. Grants to equip these institutions and manufacturing facilities facilitate the development of an employable talent pool. With appropriately timed training synchronised to industry growth, a capable local workforce can be cultivated to supply skilled labour as demand ramps up. Being a relatively new sector, OSW can also establish best practices in measuring and promoting ethnic diversity, gender balance, and equality within its workforce.

Encouraging the development of industrial clusters is essential for promoting collaboration and investment within the OSW industry. This can be achieved through supportive policies, funding for business networks, and various initiatives that foster industry cooperation. Ports play a pivotal role in this by providing a central location around which clusters of related OSW businesses can flourish, ultimately improving logistical efficiency.



KEY SUCCESS FACTORS

Related to supply chain development for OSW, governments should:

- a) Create the environment and confidence to invest in a local supply chain.
- b) Listening to industry to help focus attention on the most important areas.
- c) Consider supply chain growth as part of the wider regional and international OSW industry, focusing on local strengths, and opportunities for export as well as local supply.
- d) Deliver skills and supply growth through collaboration with industry.



3. Strategy and policy

A successful strategy, policy, and regulatory environment should set achievable, long-term objectives while encompassing a comprehensive range of initiatives that address energy planning, supply chain expansion, stakeholder involvement, and ongoing cost reduction. Given the vast scale and intricacy of the OSW industry, policies need to harmonise the diverse and often conflicting interests of various stakeholders, including:

- Governments, focusing on decarbonisation, economic growth, and job creation
- Industry, prioritizing profitability, and risk management
- Civil society, emphasising environmental and social impacts and societal benefits, and
- Electricity consumers, seeking competitively priced electricity.

A comprehensive OSW strategy and policy environment should encompass the following key elements:

- Volume and timescales: The policy should outline clear targets and timescales of OSW in the context of
 energy and decarbonisations strategies, providing investors with the confidence and certainty they need to
 plan their investments effectively.
- Cost of energy: The policy should articulate a roadmap for achieving low-cost energy production from OSW.
 This involves strategies to reduce the overall cost of energy for consumers, ensuring that OSW remains economically competitive.
- Local jobs and economic benefits: To support the growth of the OSW industry, the policy should emphasise
 the creation of local jobs and economic opportunities. This can involve incentivizing the development of a
 robust local supply chain and creating conditions for job growth and skills development in the sector.
- Environmental and social sustainability: The policy should address the environmental and social impacts of OSW projects. This includes measures to minimise negative effects on habitats, other sea users, and local communities.

This section presents learnings on the OSW strategies and policies, from Australia, Japan, Netherlands, the United Kingdom, and the US (New York state), representing a combination of emerging and established OSW markets across the world. It also provides a summary of existing OSW policies and strategies in India and offers a set of recommendations for the Government of India to consider as the next steps in developing the OSW industry. The analysis and findings of this section are based on research and stakeholder engagement.

3.1. Targets

3.1.1 Learning from global markets

Australia

In 2022 the Australian Government passed the Climate Change Bill into law, setting an emissions reduction target of 43% of 2005 levels by 2030 and achievement of net zero by 2050. As of 2022, Australia's renewable energy sector accounted for 36% of total electricity generation, with the Government targeting 82% of electricity generation from renewables by 2030. ¹⁶



The two key pieces of regulation relating to OSW in Australia are:

- The Offshore Electricity Infrastructure Act 2021, which was passed in December 2021. ¹⁷ It provides a
 framework enabling the construction, installation, commissioning, operation, maintenance, and
 decommissioning of offshore infrastructure.
- The Offshore Electricity Infrastructure (Regulatory Levies) Regulations 2022, which entered into force in November 2022.



These documents facilitate the development of marine electrical infrastructure activities, including the Australian OSW industry. ¹⁸ The 2022 Regulation set out arrangements including an offshore electricity infrastructure licensing scheme, spatial data provisions, arrangements for pre-existing infrastructure, and application of fees and levies.

The Australian Government is committed to increasing levels of renewable generation; however, these efforts have to date been largely focussed on onshore wind and solar. OSW in Australia is still a nascent industry, with no firm capacity targets yet set at a Commonwealth level. Currently, the states of New South Wales (NSW), Queensland, Southern Australia, Victoria, and Western Australia have been identified as suitable for OSW development. The state targets for OSW are:

- In 2020, New South Wales set a target of 12 GW of new renewable capacity by 2030 but does not set a
 specific target for OSW. ¹⁹ Registration of Interest (ROI) processes conducted to inform the development
 of NSW's Renewable Energy Zones (REZs) in 2022 identified significant commercial interest in OSW
 projects, including a total of 24.5 GW in the Hunter-Central Coast region and 12.9 GW in the Illawarra
 region.
- Queensland has stated a target of 22 GW of new renewable energy capacity by 2035 but has not set a specific reference for OSW.
- Under its 2022 OSW Implementation Statement, Victoria set OSW targets of 2 GW by 2032, 4 GW by 2035, and 9 GW by 2040.²⁰
- South Australia and West Australia have not set firm OSW development targets.

Japan

In 2020, the Government of Japan committed to achieving net zero greenhouse gas (GHG) emissions by 2050 in the *Green Growth Strategy to Achieve Carbon Neutrality in 2050*. ²¹ In 2021, the Government committed to reducing GHG emissions by 46% compared to 2013 levels by 2030 in the *Plan for Global Warming Countermeasures*. ²²

In 2021, the Government committed to generating up to 38% of its electricity from renewable sources by 2030 in the *Sixth Strategic Energy Plan*. ²³

In 2020, the Government committed to licencing 10 GW of OSW by 2030 and 30 GW to 45 GW by 2040 (including floating OSW) in the *Vision for Offshore Wind Power Industry*. ²⁴ The same vision linked the upper end of these volumes to the industry making strong progress in reducing the levelized cost of energy (LCOE) of OSW to JP¥8 /kWh to ¥9 /kWh (INR4.4 /kWh to INR4.9 /kWh) by 2035 and increasing local content to 60% by 2040. ^v

Japan's current policies only legislate for OSW projects within territorial waters (within 12 nautical miles of the coast) and not out to the extent of its Exclusive Economic Zone (EEZ). Most of Japan's OSW potential sits in areas outside territorial waters, with water depth suitable for floating OSW deployment. This means all OSW projects to date are being developed in territorial waters where the wind resource is lower, project sizes are limited and there are more environmental and social constraints compared to further from shore.

Japan is planning to introduce new legislation to allow OSW projects within the EEZ. The Agency of Energy asked the Cabinet Office to define the legal requirements for this legislation in 2022 and a summary report was published in January 2023. The legislation to occupy the EEZ is currently being developed by the Cabinet Office and is likely to be introduced in 2024.

^v Conversion to Indian Rupee based on conversion rate in November 2023.



Netherlands

The Netherlands 2019 Climate Act sets legally binding targets for greenhouse gas emissions reductions in the Netherlands. The Dutch Government seeks to reduce emissions from a 1990 baseline by at least 49% in 2030 and by 95% in 2050. The Climate Act commits to reducing carbon emissions to net zero by 2050. The act sets targets for 16% of all energy used in the Netherlands to come from renewable sources by 2023 on the way to achieving an electricity sector based 100% on renewable energy by 2050.



OSW energy is expected to play a significant part in this. The Offshore Wind Energy Act was adopted in June 2015 and entered into force in July 2015. It provides an integral framework for the large-scale realization of OSW energy. In 2022, the Netherlands Government raised its existing 11 GW 2030/2031 target for OSW to 22 GW by the end of the decade. ²⁶ In 2022, the Government also announced its OSW vision post 2030. This includes:

- Using a large part of the OSW energy for hydrogen production in the future by developing 'energy hubs' in areas further out to sea.
- Launching the North Sea Energy System Development Programme (Ontwikkelprogramme Energiesysteem Noordzee) to support the growth of the industry.
- Outline the plan for future projects in the Offshore Wind Energy Roadmap (Routekaart Windenergie op zee), and
- Using the 'one-stop-shop' principle for permitting OSW wind farms and the offshore grid.

United Kingdom

The energy policies, net zero and renewable energy targets for each country in the UK are listed below.



Country	Responsible body	Net zero	Renewable energy
England	UK Government	As part of <i>The Climate Change Act 2008</i> legislature, the Department for Business, Energy, and Industrial Strategy (BEIS now DESNEZ) amended the greenhouse emissions target from 80%, compared to 1990 levels, to net zero by 2050. ^{27,vi}	DESNZ is targeting full decarbonisation of power systems in the UK by 2035. ²⁸
Northern Ireland	Northern Ireland Executive	Northern Ireland follows the same target as England. ²⁹	Northern Ireland is targeting 80% of electricity consumption to be generated from renewable sources by 2030. ²⁹
Wales	Welsh Parliament	Wales follows the same target as England. ³⁰	Wales follows the same target as England. ³¹

vi As of February 2023, BEIS was replaced by the Department for Business and Trade (DBT), the Department for Energy Security and Net Zero (DESNZ) and the Department for Science, Innovation and Technology (DSIT).

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Scotland Scottish Government

The Scottish Government has outlined plans to reach net zero by 2045 in the *Climate Change (Scotland) Act 2019.* 32

The Scottish Government has set a target of generating 50% of Scotland's overall energy consumption by 2030, and a target of 11 GW of OSW to be installed by 2030. 33,34

The UK Government agreed to the *Offshore Wind Sector Deal* with industry in 2019.³⁵ The document set a target of 30 GW of OSW by 2030. This target has subsequently been increased to 40 GW and later 50 GW.³⁶ This includes 5 GW of floating OSW capacity. England has 13 GW of operational fixed OSW projects, Wales has 0.8 GW, Scotland has 1.8 GW, and over 50 MW of floating projects. There are no OSW farms in Northern Ireland.

The Offshore Sector Deal also aligned the UK Government and industry on plans around future auctions, local content, workforce composition, exports, and supply chain investment. As part of the Offshore Sector Deal, the UK Government funds collaborative R&D work to increase UK competitiveness and reduce costs, including innovation activity to include a focus on increasing the UK competitiveness of goods and services.

US (New York State)

In its Clean Energy Standard (CES) and Climate Leadership and Community
Protection Act (Climate Act), New York State is committed to reducing GHG
emissions to 40% and 85% below 1990 levels by 2030 and 2050 respectively,
providing 70% of its electricity from renewable sources by 2030 and aims to reach
carbon neutrality by 2040.³⁷ As a part of this overall strategy, the government aims
to have 2.4 GW of OSW operational by 2030 and 9 GW of OSW operational by 2035, the largest declared
target of any US State.

The New York State Energy Research and Development Authority (NYSERDA) is a public-benefit corporation that leads the coordination of OSW opportunities in New York State. NYSERDA developed key strategies and policies for OSW in New York State and published its Offshore Wind Master plan in 2017.³⁸ In 2023 it published a 10-Point Action Plan for renewable energy development, which includes a commitment to update the Offshore Wind Master Plan.³⁹

3.1.2 Current status of offshore wind in India

In 2021, the Government of India set an ambitious goal for climate change mitigation and clean energy transition during the COP26 summit⁴⁰: These have been imbibed into India's Nationally Determined Contribution (NDC).⁴¹

- 500 GW of clean energy capacity generating by the end of 2030
- 50% of all electricity requirements from renewable energy by 2030^{vii}
- The reduction in total projected carbon emissions by 1 billion tonnes by 2030
- The reduction of the carbon intensity of the economy by 45% by 2030 compared to 2005 levels, and
- Achieving the target of net zero by 2070.

In 2023, the Central Electricity Authority (CEA), released a report *Optimal mix generation by 2030.* ⁴² The report sets a national target of achieving a total installed onshore wind power capacity of 100 GW by 2030. Notably, the report indicates that the installation of OSW power capacity is anticipated to commence after 2030. In

vii As per COP26 targets – 50% of all energy requirement is to be met by renewable energy by 2030. NDC submitted by India in August 2022 states 50% energy target is to be met by non-fossil based energy.



2023, the CEA also unveiled the *National Electricity Plan*, which outlines a goal of incorporating 56 GW of new wind power into the energy infrastructure by 2032, including 1.5 GW of OSW. Figure 2 shows a timeline of OSW activities to date in India.

National publications

The Government of India introduced the *National Offshore Wind Energy Policy* in 2015.⁴³ This policy identified MNRE as the 'nodal ministry' for development of OSW in India. NIWE is the nodal agency for exploration and exploitation of offshore energy within the EEZ. The policy had several objectives including encouraging organised planning of maritime renewable energy assets within the EEZ, establishing OSW farms within the EEZ, and fostering research and development in the OSW energy sector. The policy did not specify any targets for OSW installations in India. Between 2015 to 2018, no noticeable progress was seen.

In 2018, the MNRE unveiled ambitious OSW expansion targets of 5 GW installed by the end of 2022 and 30 GW installed by the end of 2030.⁴⁴ It issued an Expression of Interest (EoI) for a 1 GW OSW project in Gujarat.⁴⁵ Industry's response to this EoI was muted, and due to a lack of readiness, the proposed competition was postponed.

To facilitate future OSW projects, NIWE issued *Guidelines for Offshore Wind Power Assessment Studies and Surveys* in 2018, offering guidance for private developers and surveyors interested in OSW energy projects. ⁴⁶ In July 2022, MNRE released the *Strategy Paper for Establishment of Offshore Wind Energy Projects*, establishing offshore wind tender in India. ⁴⁷ In 2023, MNRE published the final revised version of the *Strategy Paper for Establishment of Offshore Wind Energy Projects*, which presents three models for OSW development in the country and an ambition of tendering 37 GW of leases by 2030. ⁴⁸ In 2023, the Ministry of External Affairs (MEA) issued *Offshore Wind Energy Lease Rules*. ⁴⁹

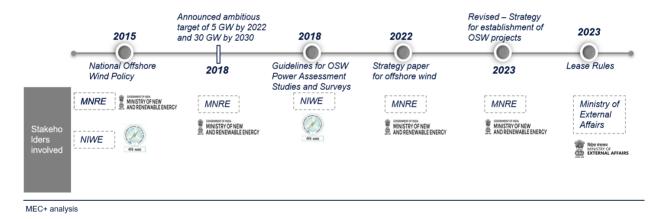


Figure 2 Timeline of national offshore wind activities in India and the stakeholders involved. 43,44,45,46,47,48,49 **State publications**

At the state level, there is a lack of OSW specific policies, however renewable policies do exist. In June 2023, Gujarat unveiled the *Gujarat Renewable Energy Policy 2023* with an ambitious goal of achieving 100 GW of renewable energy capacity in the state by 2030. No specific target was set for OSW installations.⁵⁰

The Energy Department of the Government of Tamil Nadu has also released a policy note for FY 2023 to 2024. ⁵¹ Additionally, Tamil Nadu released draft Renewable Purchase Obligation (RPO) targets till 2030 which will require an additional 2.7 GW of wind installations to meet the RPO targets by 2027. Again, these documents do not establish specific OSW targets.

Technical assistance studies

In addition to the frameworks and guidelines established by the Government of India and states, a series of technical assistance studies were conducted between 2011 and 2022 to increase readiness for the development of OSW projects. These studies encompassed a range of themes, including pre-feasibility and



feasibility technical assessments, calculations of the cost of energy (LCOE), and consideration of social, economic, and environmental factors, as well as site conditions.

- In the period from 2011 to 2015, the Government of India, in conjunction with various private entities, established frameworks and guidelines aimed at assessing the potential for OSW development in states including Gujarat and Tamil Nadu. Extensive studies were conducted during this time, including those initiated by Facilitating Offshore Wind in India (FOWIND) and the First Offshore Wind Project of India (FOWPI), focusing on the feasibility of OSW in selected regions.
- Building on this foundation, from 2016 to 2018, further in-depth feasibility studies and comprehensive assessments were conducted by FOWIND and FOWPI. These studies explored the technical potential for OSW development, presenting insights into upcoming years, and included lidar-based wind speed measurement studies.
- In 2022, focused studies were conducted to assess the commercial viability of specific sites. Studies covered
 maritime spatial planning in the states of Gujarat and Tamil Nadu along with the calculation of the LCOE for
 OSW in India. These site-specific studies considered various aspects including environmental and social
 impacts, marine traffic conditions, and ports.

A detailed list of relevant studies is provided in Appendix B.

3.1.3 Discussion and recommendations

Discussion

The Government of India has set renewable energy ambitions at a national level that are driven by its target of being net zero by 2070. The national renewable energy targets announced by the CEA state a limited ambition of 1.5 GW of OSW operating by the end of 2032. MNRE announced in 2023 to undertake OSW bidding rounds amounting to 37 GW of leases to be awarded by 2030. At a Gujarat and Tamil Nadu state level, where early OSW activity is most likely to be focussed, there are ambitious renewable energy targets, but no specific OSW targets have been announced.

The net result of the stated strategies provides an overall positive signal regarding India's net zero and renewable energy ambitions, but a mixed signal with regard to OSW. The OSW bidding round target is not aligned with either national or state level OSW capacity installation targets.

The successful build-out of OSW capacity in more established markets such as the UK and Netherlands demonstrates that ambitious and unambiguous targets send a positive signal to developers and investors, providing them with the confidence required to invest in projects and portfolios. A clear target also allows other Ministries and agencies of the Government of India to align themselves with the target and implement well aligned policies and frameworks, and to resource teams sufficiently to deliver the anticipated volumes.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that OSW can bring.

- Ministry of New and Renewable Energy (MNRE) publishes medium- and long-term visions for OSW to 2070
 as part of a decarbonised energy mix for India, considering targets for other renewable energy technologies,
 explaining the case for OSW in terms of cost benefits and long-term contribution to the energy mix, and its
 role in India's net zero targets. This vision should include maximising the energy system value of OSW and
 the steps that Government and industry should take to drive cost reduction over time.
- MNRE, in partnership with Central Electricity Authority (CEA), Gujarat Urja Vikas Nigam Limited (GUVNL) for Gujarat, and Tamil Nadu Generation and Distribution Corporation (TANGEDCO) for Tamil Nadu, aligns

viii Lidar in OSW is used for wind resource measurement and assessment, turbine placement optimisation, and ongoing monitoring, enabling efficient and productive wind farm operation while minimising environmental impact.



MNRE OSW bidding targets with national and state-level OSW targets, to create urgency and a clear policy thrust for OSW.

- MNRE establishes clear and binding medium-term OSW milestone capacity targets to 2047 with consistent capacity addition targets to provide industry clarity.
- MNRE, in partnership with CEA, demonstrates the advantages of OSW in providing round-the-clock power to industrial centres in coastal areas. Simulations include OSW and hydrogen or other storage solutions and consider daily and seasonal supply and demand.

3.2. Collaboration and stakeholders

3.2.1 Learning from global markets

Industry, government, and wider stakeholder communication and collaboration is instrumental in developing a functional and thriving OSW sector.

Collaboration between industry and government allows for the formulation of effective policies that support OSW development. It ensures that frameworks and delivery mechanisms align with government and industry needs alike, fostering a conducive environment for investment and growth. Joint efforts between industry players and government bodies create stable, effective frameworks and signal commitment, reducing risks for investors and facilitating the financing of large-scale OSW projects. Partnerships between industry, supply chain, and academia enable the sharing of expertise, and prioritisation of research and development regarding innovative enabling technologies. This further facilitates capacity building within both industry, academic, and government sectors, enabling better decision-making and improved project execution.

By working together, industry and government can nurture and strengthen the supply chain. This helps local businesses grow, creates jobs, and enhances the competitiveness of the sector by fostering innovation and efficiency. Collaborative efforts between government, stakeholders, and industry ensure that environmental and social concerns are addressed and encourages projects that mitigate environmental impacts and ensure community engagement, fostering a sustainable industry.

In the UK, the Offshore Wind Industry Council (OWIC) is a joint forum comprising senior industry leaders and government representatives. Established in 2013, it serves as a collaborative platform to drive the development and growth of the OSW sector. OWIC works closely with the Government to shape policies and initiatives that support offshore wind development. It enables discussion of policies, frameworks and delivery mechanisms. It is responsible for the implementation of industry aspects of the Offshore Wind Sector Deal and has dedicated workstreams to oversee different aspects. Similarly, the Scottish Offshore Wind Energy Council (SOWEC) is a partnership between the Scottish public sector and OSW industry.

A list of key active stakeholders for the example is provided in Appendix D.

3.2.2 Current status of offshore wind in India

Government stakeholder organisations will play a crucial role in the development of OSW projects in India, including authorities that must be consulted with such as the Ministry of Military and Defence, airport authorities, marine management agencies, and local government. ⁵² It is essential to involve these stakeholders early in the development of OSW projects to ensure that they are fully equipped with the required knowledge, capabilities, and resources.

In India, key stakeholders have been identified across various stages of OSW development including central, local, intergovernmental, and R&D bodies. The first document that identified a list of stakeholders to be involved was the *National Offshore Wind Energy Policy* which listed 10 ministries that would give Stage I and Stage II clearances for the set-up of OSW projects. ⁴³ Further to this, the FOWIND report, *From zero GW to five GW*, identified 14 central, 10 local, and four R&D bodies with specific roles and responsibilities for each of the stakeholders. The RfS document further reiterated the involvement of the 10 ministries listed in the *National*



Offshore Wind Energy Policy for the attainment of clearances. A comprehensive list of these stakeholders across the three documents is given in Figure 3.

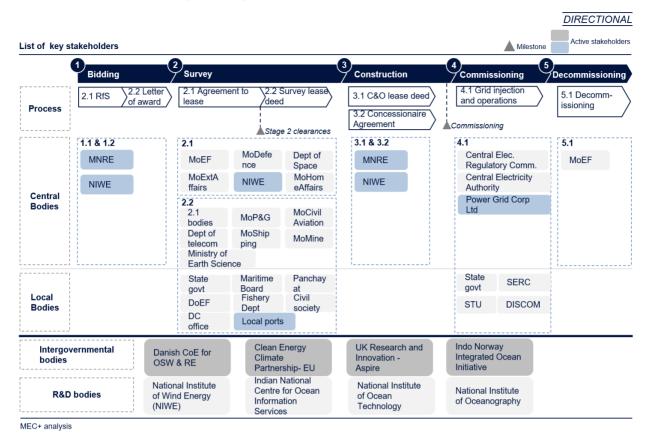


Figure 3 List of stakeholders involved at various levels.

Of these identified stakeholders, those who are actively involved in the development of OSW projects are central bodies such as MNRE, NIWE, and PGCIL. Certain local ports such as Pipavav in Gujarat and VOC Tuticorin in Tamil Nadu are also assessing the feasibility of their ports to support OSW development. Further, intergovernmental bodies and enablers such as the Centre of Excellence for Offshore Wind and Renewable Energy, Clean Energy Climate Partnership-EU, UK Research and Innovation-Aspire, and Indo Norway Integrated Ocean Initiative are involved in conducting studies and working with policymakers for OSW development in India. The roles and responsibilities of these active stakeholders are given below:

- Central Bodies:
 - MNRE is the nodal Ministry for OSW development in India and is responsible for overall monitoring, coordination with ministries, and issuing of guidelines, directives, tariffs, and regulations. It released the National Offshore Wind Energy Policy in 2015 and has also released a draft RfS for Model B.
 - NIWE, authorised by MNRE, acts as the nodal agency responsible for all works related to spatial planning, resource assessments, leasing, contracting, bidding, and coordination of clearances. It issues the letter of consent to the selected bidder during the survey stage and enters into a concession agreement with the project developer during the construction phase. It has conducted various studies including lidar studies to identify potential zones for OSW in India and collaborated with organisations to conduct spatial planning studies. It is also responsible for undertaking promotional activities such as organizing workshops and symposiums to bring awareness to the local wind turbine manufacturers and components manufacturers including potential investors.
 - PGCIL is responsible for the facilitation of the onshore grid for the connection of OSW farms. In efforts to strengthen the transmission capacity, 500 GW of non-fossil-based power capacity is planned for by 2030 of which 10 GW of capacity (5 GW each in Gujarat and Tamil Nadu) has been allocated for OSW.
- Intergovernmental bodies ^{53,54}:



- Centre of Excellence for Offshore Wind and Renewable Energy, a joint initiative between the MNRE and the Danish Ministry of Climate, Energy and Utilities, is working with NIWE and partner organisations including The World Bank to conduct maritime spatial planning for Gujarat and Tamil Nadu, and to assess port infrastructure for OSW activities.
- Clean Energy Climate Partnership- EU has conducted a study Gap Assessment of Training and Skill Building in the Offshore Wind Energy Sector in India to understand the local training and skill development programmes required for building OSW energy in India.⁵⁵
- UK Research and Innovation-Aspire programme is a collaboration of the UK Government, the Ministry of Power (MoP), and MNRE to promote the delivery of renewable energy projects including OSW. Various initiatives such as a knowledge exchange delegation were conducted to familiarise Indian stakeholders with the development of the OSW sector in the UK.
- Indo-Norway Integrated Ocean Initiative aims to conduct MSP studies for Lakshadweep and Puducherry under the Memorandum of Understanding signed between India and Norway in 2019. These are not specific to OSW.

Local bodies:

- Local ports such as Pipavav (Gujarat) and VOC Tuticorin (Tamil Nadu) are actively involved in assessing
 the feasibility of the ports for OSW activities. These ports have given presentations during the roundtable
 conference held under the EU-India Clean Energy and Climate Partnership, discussing their readiness
 and investment requirements for OSW activities.
- o In terms of capacity building, the FOWIND report *From zero GW to five GW* has identified institutions that would be involved in R&D to build technical awareness and capabilities for OSW. While these bodies are currently not active in performing research specific to OSW, they have the required expertise from parallel sectors and can build capability to perform R&D activities for OSW:
 - Indian National Centre for Ocean Information Services (INCOIS): autonomous body under the
 Ministry of Earth Science that would provide information to ensure appropriate marine zone planning.
 - National Institute of Ocean Technology (NIOT): autonomous body under the Ministry of Earth Science to develop technology to solve various engineering problems associated with resources in the Exclusive Economic Zone (EEZ).
 - National Institute of Oceanography (NIO): laboratory of the Council of Scientific and Industrial Research (CSIR) to undertake widespread geotechnical and geophysical surveys for the Indian seabed in the EEZ.

3.2.3 Discussion and recommendations

Discussion

The successful execution of OSW projects involves collaboration among multiple stakeholders across various levels – central, state, district, industry, and interest groups. Established markets show significant collaboration between industry, governments, and wider stakeholders to develop robust and effective frameworks. In the UK, OWIC, includes project developers and supply chain firms from the international OSW industry. A pivotal achievement of OWIC collaboration was the Offshore Wind Sector Deal, a landmark agreement between government and industry. This deal covered crucial industry policy and framework issues such as future auction plans, local content goals, gender workforce targets, export aims, and supply chain investments. Similarly in Japan, the Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation is jointly organized by the Japanese Government (including METI and MLIT) and core industry members. Their focus involves discussing challenges in expanding OSW power generation in the mid to long term.

While engagement with nodal agencies, supply chain players, and industry experts has been active in India, a significant challenge lies in the lack of awareness and limited engagement at the state and local levels,



including gram panchayats, districts, local communities, industry associations, and civil society organizations. This creates a siloed understanding of OSW among specific individuals within institutions. To address this, an all-encompassing stakeholder forum is vital to broaden awareness, align interests, and ensure ongoing engagement.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE establishes a long-term official Government of India-industry task force along the lines of UK's Offshore Wind Industry Council (OWIC) involving local and international project developers and key suppliers, to work together to align interests, address gaps, and formulate solutions. ix
- MNRE establishes memoranda of agreement between relevant government departments, to define interdepartmental cooperation on OSW, covering strategy and policy collaboration, frameworks like MSP, leasing, permitting, power purchase, transmission, health and safety, and other key areas of delivery including supply chain, ports, and finance.
- MNRE ensures best, strategic impact of international donor support through dialogue and collaboration.
 India is fortunate to have a range of governments and agencies willing to support in establishing a vibrant OSW market. Coordinating and integrating this support will be key.

ix https://www.owic.org.uk/



4. Frameworks

To transform policies into operating projects, a comprehensive set of frameworks is essential. These frameworks define the processes necessary for projects to be developed and constructed. They need to be overseen by agencies with well-defined mandates, sufficient resources, and clear roles. The success experienced in established OSW markets can be attributed to robust frameworks in MSP, leasing, permitting, offtake and revenue agreements, export systems, grid connections, health and safety practices, and standards and certifications. Achieving success in these areas relies on several crucial factors, including:

- Stakeholder engagement: Agencies should actively involve relevant stakeholders and align existing frameworks to international best practices while addressing the specific requirements of OSW projects.
- Coordination: Agencies need to work closely together, ensuring a seamless and client-centric experience.
- Transparency and timeliness: Each process should be transparent, proportional, timely, and flexible, with clear risk allocation and well-defined milestones.
- Minimising risks: Frameworks should create bankable offtake agreements and establish transparent grid access and curtailment rules to minimise risks.
- Health and safety: Make health and safety an absolute priority by instilling a safety-first work culture.

This section presents learnings on OSW frameworks from Australia, Japan, the Netherlands, the United Kingdom, and the US (New York state), representing a combination of emerging and established OSW markets across the world. It also summarises the MSP process in India and offers a set of recommendations for the Government of India to consider as the next steps in developing the OSW industry. The analysis and findings of this section are based on research and stakeholder engagement.

4.1. Marine spatial planning

4.1.1 Learning from global markets

Australia

Australia does not currently have a single national level MSP framework. MSP is primarily conducted at a state level with some input from the Commonwealth Government. New South Wales, Northern Territory, Queensland, South Australia, Victoria, and Western Australia have MSPs in place. Victoria's MSP framework makes mention of OSW, however, the others do not and no state outlines specific targets for OSW capacity in the context of its MSP. Tasmania does not have a Marine Plan in place. Data to support MSP in Australia is published on the Australian Marine Spatial Information System (AMSIS), including data on OSW development areas. ⁵⁶



The MSP framework of Victoria is described here as it is currently the most developed state-level framework relating to OSW. Victoria's MSP framework covers a range of uses of the marine environment, considering existing marine uses such as fishing, marine transport, and tourism, and emerging uses such as OSW. It does not state a specific capacity for OSW development.

Victoria's MSP framework is outlined in the Marine and Coastal Policy 2020. The policy guides respect for the rights of Traditional Owners (Australia's native Aboriginal communities), protection of ecosystems, natural features, and heritage sites, as well as the management of coastal hazards, emergency response, coastal settlements, marine and coastal industries, tourism, and coastal buildings.⁵⁷

The Department of Energy, Environment and Climate Action (DEECA) is the body responsible for leading the implementation of Victoria's MSP framework. Victoria's MSP framework is an important first step in establishing a cohesive set of policies regarding marine activities in Australia. Implementation of a national level MSP framework has been difficult due to the fragmented jurisdictional landscape in Australia. Responsibility is divided between federal and state governments, with this division often creating overlaps



and inconsistencies in policy leading to situations where the effectiveness of MSP has been limited due to jurisdictional constraints.⁵⁸

Japan

The MSP process for OSW in Japan relies upon the Ministry of Economy, Trade, and Industry (METI) and the Ministry of Land, Infrastructure, Transport and Tourism (MLIT). The Ministries first nominate areas as Preparatory Stage Areas, before designating them as Promising Areas and later Promotion Areas. This follows the process established in the Act on Promoting the Utilisation of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities (Marine Renewable Energy Act or MREA) in 2018. ⁵⁹ In 2019, METI and MLIT issued Guidelines for the Designation of Promotion Areas, defined below ⁶⁰:



- In theory, the process begins with the prefectural government informing METI
 and MLIT of its intention to develop an OSW project in its regional territorial waters. In practice, a
 developer approaches the prefectural government with a potential site that they have begun to develop.
 Typically, a developer will carry out a desk-based GIS study, grid, and port assessments, and early
 engagement with stakeholders before the site is proposed to the prefectural government. Once METI and
 MLIT are informed of a potential project, it can be designated a Preparatory Stage Area.
- To be designated a Promising Area, the Preparatory Stage Area must meet a set of criteria which includes, but is not limited to:
 - Have suitable natural conditions to operate a marine renewable power generation business with considerable energy output
 - Not hinder the use, preservation, and management of waterways and ports
 - o Have suitable use of ports for the construction and operation of the project, and
 - Have secured a grid connection right to connect to the onshore transmission network.
- Once an area is designated as a Promising Area, METI and MLIT will gather information for the prefectural
 governments, consult with experts, facilitate stakeholder engagement, conduct initial site surveys, and
 publish the area for public comment. This process culminates with the designation of the final Promotion
 Area which will then be leased through the auction system.

This approach to MSP has the following key issues:

- The policy only covers sites inside the territorial waters where the wind resource is lower, project sizes are limited and there are more environmental and social constraints compared to further from shore. The Government is aware of the need to carry out multi-sector MSP. Legislation to occupy the EEZ is currently being developed by the Cabinet Office and is likely to be introduced in 2024.
- Multiple developers can be developing overlapping sites which increases the burden on fishing
 cooperatives and local stakeholders who are asked to engage with developers seeking to build consensus
 for their projects to progress through the promotion system.
- The developer assumes a large amount of risk at the early stage of development when carrying out early stakeholder engagement, site surveys, grid connection applications, and port assessments even before the site is designated a Preparatory Stage Area. The site could potentially not move forward through the promotion system, could be slow to move through the promotion system (for example due to resistance from fishing cooperatives), or could be won by another developer at the eventual auction.

In 2021, the *Guidelines for the Designation of Promotion Areas* were amended to enable METI and MLIT to take action to conduct surveys at an early stage of the promotion system. Three areas have been identified that will take part in a central survey system in 2024, managed by the Japan Organisation for Metals and Energy Security (JOGMEC). This will include surveys of wind conditions and seabed conditions.



Netherlands

The Dutch Ministry of Infrastructure and Water Management coordinates MSP activities in the Netherlands. National law requires the Ministry to reconsider MSP at least every 6 years when drafting National Water Plans. The latest iteration covers the period 2022 to 2027 and includes MSP activities carried out to increase 2030 OSW deployment targets by 10 GW. MSP activities in the Netherlands consider and engage with all relevant sea users from maritime, energy, military, aggregates, recreation, fishing, mariculture, and nature conservation sectors. Completed plans are approved by Parliament and are legally binding. Supplementary plan-level environmental impact assessments are carried out as part of MSP activities, which typically take around 2 years to complete.

United Kingdom

The Marine Policy Statement (MPS) was jointly prepared by the UK Administration and published in 2011.⁶¹ It provides the framework for the preparation of marine plans and high-level marine objectives. The preparation of marine plans is delegated to the respective governments within the UK, consisting of an inshore region (up to 12 nm) and an offshore region (12 to 200 nm).

In addition, The Crown Estate (TCE) set up the Offshore Wind Evidence & Change programme in 2020, funded with an initial £50 million investment. ⁶² The programme is delivered in partnership with DESNZ, the Department for Environment, Food & Rural Affairs (DEFRA), and a consortium of other OSW stakeholders, including the devolved nations. It aims to better understand and overcome the cumulative environmental impacts of OSW and its impacts on users of the sea and coastal communities.



England

The Marine Management Organisation (MMO) released plans for 11 regions around England with a long term (20 year) view of activities. The first plans were released in 2014 and the final plans in 2021. TCE uses technical and constraint data from the MMO and stakeholder engagements to identify OSW lease areas through the following process:

- Technical resource modelling is undertaken to define the most favourable areas for OSW development based on wind resource, water depth, Metocean conditions, and seabed geology.
- Exclusion modelling removes areas where development would not be possible because of environmental reasons, existing infrastructure, health and safety reasons, or existing sea bed rights.
- Restriction modelling identifies where development might be constrained, but not precluded, by variables such as environmental designations, fishing, and visual impacts.
- The results of the previous stages identify lease areas that are subject to a two-stage refinement process that involves consultations with statutory and non-statutory stakeholders.

Northern Ireland

The Department for Agriculture, Environment and Rural Affairs (DAERA) published a draft Marine Plan in 2018 and aims to release a final version by the end of 2023.⁶³ TCE uses technical and constraint data from the DAERA and stakeholder engagements to identify OSW lease areas. This follows the same process as in England.

Scotland

Marine Scotland released Scotland's National Marine Plan (2015), which provides a single framework for managing Scotland's seas out to 200 nm. Scotland's National Marine Plan is supplemented by 11 Regional



Marine Plans prepared by Marine Planning Partnerships. These provide detailed guidance for inshore waters (out to 12 nm). Marine Scotland uses technical and constraint data from Scotland's National Marine Plan and stakeholder engagement to identify lease areas in the Sectoral Marine Plan for Offshore Wind Energy. ⁶⁴ It uses the following process to identify lease areas:

- Iterative opportunity and constraint analysis are carried out to identify potential lease areas.
- A Sustainability Appraisal consisting of a Strategic Environmental Assessment (SEA), Habitats Regulations Appraisal (HRA), and ESIA is carried out to assess the impacts of the potential lease areas.
- Stakeholder consultation is undertaken to ensure the views of statutory and non-statutory stakeholders inform lease area identification.

The results of the previous stages identify lease areas that Crown Estate Scotland (CES) then offers to prospective through the ScotWind sea bed leasing process.

Wales

The Welsh Government released the Welsh National Marine Plan in 2019, and a progress report was published in 2021. TCE uses technical and constraints data from the Welsh Ministers and stakeholder engagement to identify lease areas. This follows the same process as in England.

US (New York State)

Under the Energy Policy Act of 2005, the Bureau of Ocean Energy Management (BOEM) is responsible for allocating areas for future OSW development in federal waters of the Outer Continental Shelf (OCS), including lease seabed areas for OSW development. ⁶⁵ The OCS is defined as the seabed area between the seaward extent of the State's jurisdiction and the seaward extent of the Federal jurisdiction. In New York State this is between 3 nm and 200 nm. ⁶⁶ No projects have been proposed in areas of seabed under New York State's jurisdiction so far.

The Renewable Energy and Alternate Uses of Existing Facilities on the OCS ruling outlines the programme through which lease areas are defined and leases are granted. ⁶⁷ Whilst not resulting in a full MSP, the process of determining lease areas is as follows:

- The process starts with BOEM issuing a Request for Interest (RFI) which opens a comment period for potential developers to express interest in a site. This allows BOEM to determine whether there is interest in the site and if there is enough interest to require a competitive auction.
- When BOEM wishes to initiate a competitive auction process, the first step is to issue a Call for
 Information and Nominations. Like the RFI, this opens a period for public comment on the potential sites.
 These comments will be used to further define areas based on the areas of interest expressed by
 developers and areas of conflict or concern expressed by other stakeholders.
- Based on stakeholder feedback, BOEM will identify priority Wind Energy Areas (WEAs).
- A Proposed Sale Notice (PSN) will be issued, in which BOEM seeks to balance economic, social, and
 environmental factors that have been raised in previous stages. The PSN will be used in consultations with
 relevant state governments, localities, and Tribes.
- A Final Sale Notice is issued including details of the leasing process.



4.1.2 Current status of offshore wind in India

India does not have national or state-level marine spatial plan in place. It has however published guidance for acquiring and producing geospatial data which applies to OSW. ⁶⁸ These guidelines are issued by the Department of Science and Technology and underscore the importance of geospatial data. Marine spatial plans, supported by the Norwegian Government, are being progressed for the city of Puducherry on the east coast and the island archipelago of Lakshadweep in the Indian Ocean, although these are not areas where early OSW development is likely. ⁶⁹

For OSW, the Government of India released the *National Offshore Wind Energy Policy* in 2015, designating MNRE as the central ministry responsible for the development and utilisation of maritime space within the EEZ. NIWE serves as the main agency for conducting resource assessments, surveys, and studies within the EEZ, delineating designated areas.

In 2018, FOWIND and FOWPI conducted research concerning pre-feasibility and feasibility assessments in Gujarat and Tamil Nadu. 70, 71 The studies identified 16 potential zones for OSW development shown in Figure 4.

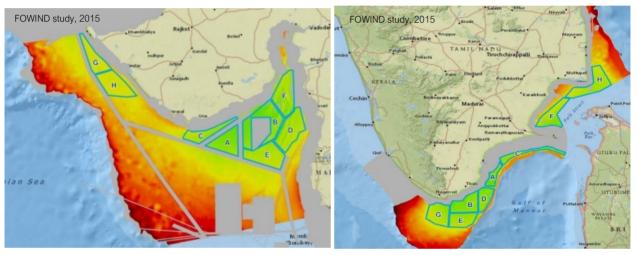


Figure 4 Maps showing potential offshore wind zones in Gujarat and Tamil Nadu, from 2018 studies by DNV GL.

The latest marine spatial plan for OSW in the states of Gujarat and Tamil Nadu has been developed by the Danish Energy Agency and the Centre of Excellence for Offshore Wind and Renewable Energy. ^{72, 73} This work identifies the most suitable locations for OSW farm development, accounting for environmental, social, and technical considerations. As part of this work, an examination of the LCOE was conducted, and the prospective areas were narrowed down. In Gujarat, the potential zones were decreased from 8 to 5 and in Tamil Nadu, they were reduced from 8 to 7, as shown in Figure 5. This reduction was influenced by factors such as marine traffic, fisheries, and oil and gas platforms.



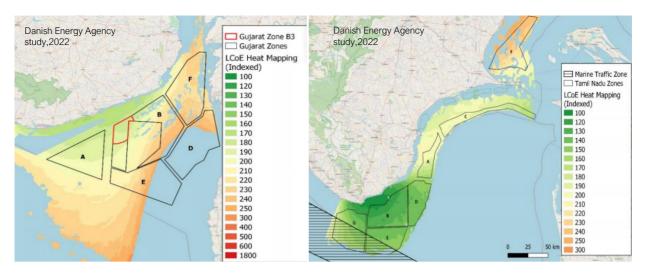


Figure 5 Maps showing potential offshore wind zones in Gujarat and Tamil Nadu, from 2022 studies by the Centre of Excellence for Offshore Wind and Renewable Energy.^x

4.1.3 Discussion and recommendations

Discussion

Established OSW markets show the importance of stakeholder engagement, technical analyses, and environmental considerations in delivering marine spatial plan. For example, both Netherlands and the UK prioritise central coordination, stakeholder involvement and environmental considerations. All international OSW markets define ongoing stakeholder engagement as a critical action in the MSP process.

India does not have a national marine spatial plan in place for OSW. Marine spatial plans have been undertaken to a identify OSW zones in Gujarat and Tamil Nadu, providing guidance for the identification of OSW lease areas.

The OSW marine spatial plan completed for Gujarat and Tamil Nada was largely a desk-based technical exercise. Good International Industry Practice (GIIP) in the MSP process requires establishing best practices from successful international experiences, focusing on EIA, stakeholder engagement and data collection. It is critical to undertake extensive stakeholder engagement to inform a marine spatial plan. This should include engagements with coastal communities, other marine users, and maritime industries, and to undertake additional data collection regarding key sensitivities where required.

The concentration of India's best wind resource off the coasts of Gujarat and Tamil Nadu will focus early OSW development in these states. Future work should focus on other coastal states with good resources.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that OSW can bring.

 National Institute of Wind Energy (NIWE), in partnership with Department of Science and Technology (DST), Indian National Center for Ocean Information Services (INCOIS), Ministry of Environment and Forests (MoEF), Ministry of Earth Sciences (MoES), National Institute of Oceanography (NIO) and National Institute of Ocean Technology (NIOT), undertakes similar OSW MSP processes for other states with OSW potential, to inform future OSW development opportunities beyond the early projects anticipated for Gujarat and Tamil Nadu, establishing a national OSW spatial plan.

Accelerating deployment of offshore wind in India

^x The Centre of Excellence for Offshore Wind and Renewable Energy is a joint initiative between the Indian Ministry of New and Renewable Energy and the Danish Energy Agency.



- NIWE, in partnership with Indian National Centre for Ocean Information Services (INCOIS), Department of Science and Technology (DST), National Institute of Oceanography (NIO) and National Institute of Ocean Technology (NIOT), updates the Gujarat and Tamil Nadu marine spatial plans, implementing the identified next steps of stakeholder consultation and additional data collection, as recommended in the published reports.
- Gujarat Maritime Board, in partnership with Hazira and Tamil Nadu Maritime Board in partnership with Port of Tuticorin, promotes transparency in the MSP process and engage stakeholders, including local communities, environmental groups, and industries, in decision-making. Seek feedback and input from diverse stakeholders to enhance the effectiveness and acceptance of Good International Industry Practice (GIIP) across the process.
- NIWE to provide a common public data repository for data published by developers and other stakeholders, including from MSP activities.

4.2. Leasing

4.2.1 Learning from global markets

Australia

The first Australian OSW leasing process commended in late 2023, with a feasibility licence application round for the Gippsland area in Victoria. This initial round closed in April 2023. The Gippsland areas under consideration are highlighted in Figure 6. Further leasing rounds are now underway or in planning, including for New South Wales, Southern Australia, and Western Australia.



The Australia OSW leasing process is administered by the Commonwealth Government (the federal Government in Australia) and follows a three-phase process.

Phase 1 involves area identification and declaration. The Ministry for Climate Change and Energy publish a notice on the Department of Climate Change, Energy, the Environment and Water (DCCEEW) website. Government agencies are engaged to analyse environmental, shipping, aviation, and defence risks that may result from the development of the proposed area. A public consultation is held involving various stakeholders including local communities, Traditional Owners, environmental groups, OSW developers, and other marine industries that may be affected by OSW development. The Australian energy minister will then decide if all, some, or none of the proposed area is fit for development. This phase lasts approximately 6 months to 9 months.

Phase 2 is a feasibility licence auction. After an area has been declared and deemed fit for development, the minister will invite developers to apply for a feasibility licence under a competitive process. The minister assesses the application against the merit criteria outlined in the Offshore Electricity Infrastructure Act 2021, which includes:

- The technical and financial ability of the applicant to carry out an offshore infrastructure project
- The project's viability
- The suitability of the applicant to hold the licence, and
- That the project serves the national interest in terms of factors such as socioeconomic benefit and job creation.

If granted, the feasibility licence is valid for 7 years. Licence holders then begin studies on the area to obtain environmental and other required approvals. Management plans must be approved by the Offshore Infrastructure Regulator before the applicant can apply for a commercial licence. The feasibility licence allows applicants to undertake surveys and install equipment required to establish project feasibility, such as



floating lidars. It does not allow the construction of a wind farm. The feasibility licence phase lasts up to 7 years.

Phase 3 involves the acquisition of a commercial licence. Upon completion of Phase 2, the energy minister will then assess if the applicant is suitable for a commercial licence. If a commercial licence is granted, applications can then begin the development of the proposed area. The commercial licence is valid for up to 40 years.⁷⁴

The leasing process is nationally led, but state and territory governments collaborate with the national government to ensure that the leasing process aligns with regional interests and adheres to state-level regulations and requirements.

Levies are imposed on holders of feasibility, commercial transmission, and infrastructure licences. 75

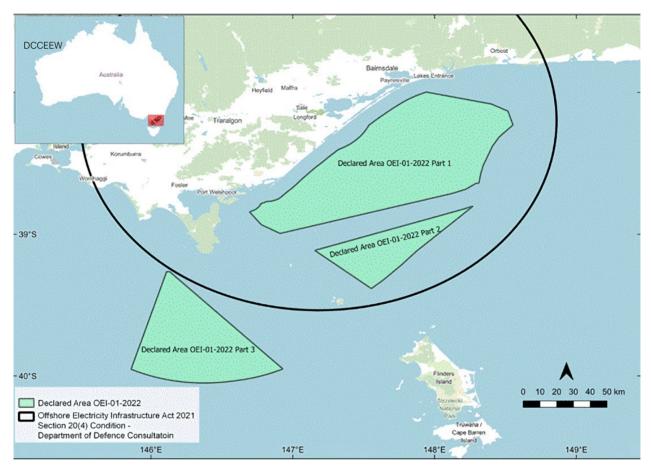


Figure 6 Gippsland, Australia area proposed for renewable energy development.⁷⁶

Japan

The leasing mechanism for OSW in Japan is regulated by the Marine Renewable Energy Act (MREA) and METI and MLIT are responsible for running the auctions and tender evaluation criteria.

In 2021, Japan held its Round 1 auction which awarded the lease and revenue support for three sites accounting for around 1.7 GW of fixed-foundation capacity. The auction offered a 30 year Occupancy Permit, a feed-in tariff (FIT) contract, and a grid connection agreement. It was assessed across price (50% weighting) and non-price criteria (50% weighting). All sites auctioned in Round 1 were won by Mitsubishi Corporation. Following the announcement of the winners, concerns were expressed by losing developers and other industry stakeholders that the auction scoring system had disproportionately weighted the impact of a low



bid and that there was a risk of a monopoly emerging. This led to a delay in the Round 2 auction whilst changes were made to the auction framework.

The Round 2 auction, which offers four sites and 1.8 GW of capacity, was launched in December 2022 with results to be announced by March 2024. The Round 2 auction offers a 30 year Occupancy Permit, an FIP contract, and grid connection agreements. Bids will be assessed across price (50% weighting) and non-price criteria (50% weighting). In Round 2 no coalition is allowed to bid for more than 1 GW of capacity and a bid floor price has been set. Figure 7 highlights areas selected in Round 1 and areas under consideration in Round 2.

With the FIP contract, electricity will be sold at the market price with an additional premium payment on top. It is designed to bridge the gap between the FIT system and market prices.

Bidders must submit an Occupancy Plan as outlined in the MREA and that plan must meet certain technical criteria before a bidder can participate in the auction.

Non-price criteria include:

- Timeliness and implementation aspects of the project plan
- Ability to provide a stable source of power
- Ability to coordinate the heads of relevant administrative agencies
- Coordination and coexistence with other sea users, and
- Regional and national economic impact.

The Round 3 auction is being planned for two further Promotion Areas and nine Promising Areas.⁷⁷ The current auction model has the following key issues:

- Once a site is designated as a Promotion Area, METI currently collects basic site survey data. This data is largely considered to be insufficient for developers to make a well-informed auction bid. For example, for the Round 2 sites currently being auctioned, METI has only provided 6 months of wind data and one geotechnical core penetration test sample for each site. This system favours the incumbent developer who will have conducted these surveys as the site moves through the system. It also drives other developers to undertake their site surveys which can lead to the same surveys being carried out on the same site multiple times, often by the same contractor.
- The process requires the developer the commit to an FIP rate during the auction. For most bidders there is often a high level of uncertainty around the site conditions at this stage. It also takes around 7 years from site award to grid connection, over which time supply chain costs can change significantly. These elements introduce significant price risk into projects.
- Industry stakeholders have expressed concern regarding the transparency of the evaluation of the nonprice related criteria.





Figure 7 Map of Japan's lease areas, showing both ongoing and completed auction rounds.

Netherlands

Under the Dutch OSW model, the Dutch state is responsible for allocating OSW development areas via a process coordinated by the Netherlands Enterprise Agency (RVO). Proposed and selected development areas are highlighted in Figure 8. For each area, the RVO carries out surveying and permitting work before allowing pre-qualified developers to bid for consented sites. Pre-qualification criteria are typically related to financial criteria.



Developers are expected to build and operate OSW projects in each site, but, the national transmission system operator (TSO) TenneT is responsible for the planning and development of offshore grid connections, reducing the development costs and risks that developers face.

The Dutch Government has set out a clear pipeline of annual auctions for sites totalling 17 GW before 2027, which serves to stagger the delivery of new OSW projects and limit supply chain bottlenecks. To secure control of the sites, developers submit a single sealed bid, which is scored by a panel of expert judges. Scoring criteria for each site are variable but have recently focused on subjective criteria used to measure the deliverability, potential for energy system integration, ecological benefits, innovation, and sustainability of each bid. Auction rounds are generally well subscribed. This process has worked well, and state auctions have been subsidy free since 2019.



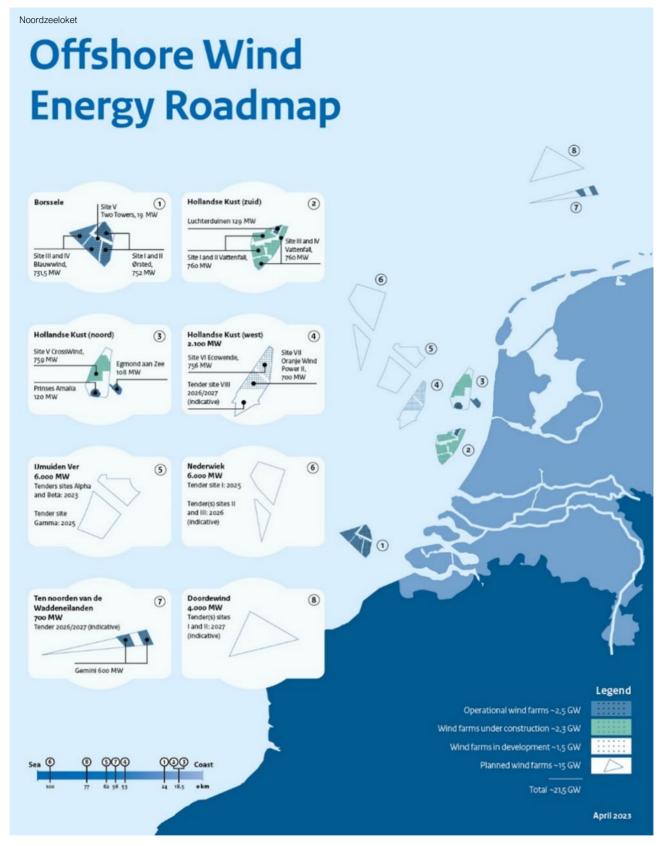


Figure 8 Netherlands offshore wind energy roadmap, highlighting current wind farms and areas still to be tendered. 78



United Kingdom

The (TCE) and Marine Scotland uses technical and constraint data from the MMO and stakeholder engagements to identify lease areas through various modelling assessments and consultations with statutory and non-statutory stakeholders. The developer must identify and propose project areas within the lease areas defined by TCE or CES and bid for a site lease.

The UK operates a two-competition system in which sea bed leases and revenue support are awarded separately. TCE and CES offer Agreements for Lease and Option Agreements through competitive auctions known as leasing rounds. The Agreements set out the terms on which TCE or CES will grant a lease if the developer succeeds in obtaining all the necessary consents. The lease gives the developer sea bed rights for 60 years.



England

TCE is responsible for managing the sea bed leasing process. TCE has held 4 leasing rounds for OSW projects (>100 MW) in England and Wales, and a single leasing round in Scotland before the devolution of CES. For the most recent leasing round, Round 4 (highlighted in Figure 9), the leasing process had four stages⁷⁹:

- A pre-qualification questionnaire to assess the developer's capabilities on a pass or fail assessment basis. The pre-qualification process lasted 3 months.
- The Invitation to Tender Stage 1 to assess the financial and technical robustness of the proposed project on a pass or fail basis.
- The Invitation to Tender Stage 2, a multi-cycle bidding process that used option fees to determine preferred bidders. The option fee (in £/MW/year) is a fee paid annually after the award of the Agreement of Lease until the developer reaches a final investment decision (FID), up to a maximum of 10 years. The highest-bid site was selected in each bidding cycle until the capacity cap was reached.
- A plan-level HRA carried out by TCE to assess the possible cumulative impacts of the proposed projects on marine protected habitats. This lasted 14 months. The Agreement for Lease is awarded following the HRA.

Once the Agreement for the Lease has been signed, the developer must meet certain milestones set by TCE. Failure to meet a milestone by the deadline will give TCE the right to terminate the Agreement for Lease. The developer has:

- 18 months to provide evidence of initial site development
- 5 years to submit a consent application to the national planning body, and
- 10 years to obtain all necessary consents and exercise its option to enter the lease with TCE.

In November 2021, TCE published plans to launch a floating offshore wind (FOW) leasing round in the Celtic Sea for early commercial scale (around 300 to 350 MW) and fully commercial scale (up to 1 GW) projects. This will be the first leasing round exclusively for FOW projects in the UK. The leasing round is likely to follow a similar process to that used for Leasing Round 4. One key difference is that TE will undertake a Plan-Level HRA as part of the spatial design stage, before award. ⁸⁰ In November 2021, TCE began industry engagement to inform the spatial and tender design of the leasing round. It plans to release an Information Memorandum before the end of 2023, ahead of the formal start of the leasing round. The awards for Agreement for Leases in FOW projects have been delayed and are unlikely to occur in 2023.



Northern Ireland

TCE is responsible for managing the sea bed leasing process In Northern Ireland, which follows the same process as in England. The Department for the Economy (DfE) and TCE have developed a statement of intent to express their commitment to establishing OSW leasing for Northern Ireland.⁸¹

Scotland

CES manages the development rights to the Scottish area of the UK EEZ and is responsible for managing the sea bed leasing process for OSW. CES offers Option Agreements through competitive auctions known as leasing rounds. The Option Agreement sets out the terms on which CES will grant a lease if the developer succeeds in obtaining all the necessary consents.

CES has held one leasing round to date, known as ScotWind which offered Option Agreements for fixed and floating OSW sites.

There was no pre-qualification stage, with the eligibility of developers being judged during the evaluation of applications. Applicants were required to submit a Supply Chain Development Statement (SCDS), outlining how they plan to develop the local supply chain. This was not used in the assessment of applications, but each developer must meet 25% of the SCDS commitments it made for the lease to be granted.

Applications were evaluated on the following:

- Project concept and density
- Project delivery plan
- Capability and experience
- Development budget
- Financial resources, and
- Commitment to the project.

The ScotWind process lasted just under 2 years, from the launch of the leasing round to the signing of Option Agreements. On signing Option Agreements developers must meet certain milestones set by CES. Failure to meet milestone dates gives CES the right to reduce the option period. The developer has:

- 3 years to provide evidence of submitting an ESIA scoping report
- 6 years to submit a consent application to Marine Scotland, and
- 10 years to obtain all necessary consents and exercise its option to enter the lease with Crown Estate
 Scotland (Crown Estate Scotland has the right to terminate the Option Agreement if this milestone is not
 met).

In addition to the ScotWind Leasing round, CES launched the Innovation and Targeted Oil and Gas (INTOG) Leasing round for FOW projects. The leasing round followed a similar process to that used for ScotWind Leasing with variations to the evaluation weighting of the criteria.

Wales

TCE is the responsible organisation for managing the sea bed leasing process in Wales which is incorporated into the same process used in England.



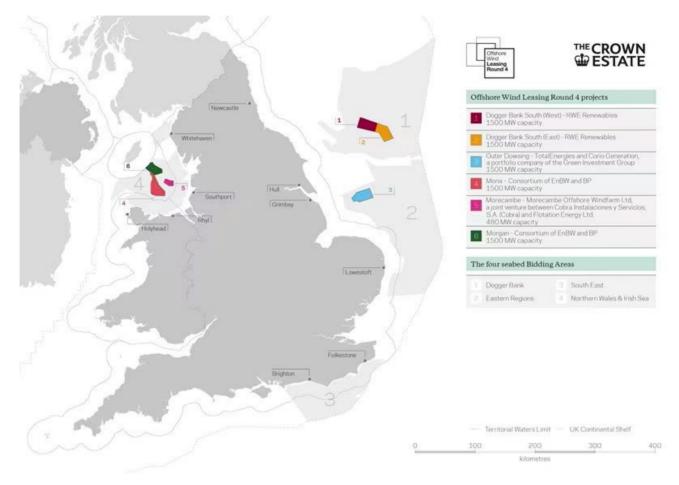


Figure 9 Map of lease areas and projects selected during UK Leasing Round 4.82

US (New York State)

OSW leasing in New York State is administered by BOEM at a federal level, as is the case for all States of the US. To initiate an auction BOEM issues a Final Sale Notice which details the requirements and details of the auction including prequalification criteria for bidders related to their legal position and their technical and financial ability to hold a commercial wind lease.



The auction is a cash ascending bidding auction. This auction mechanism takes place over multiple rounds where the bids on the lease area increase until there is no more than one bidder for each lease area. BOEM has also used a mechanism of bidding credits in its auctions. Bidders can access bidding credits for the auction if they make monetary commitments to different types of programmes that support the development of the OSW industry and/or workforce in the United States.

Three auctions rounds have been held in New York State to date. In the most recent 2022 auction BOEM auctioned six lease areas in the New York Bight representing at least 5.6 GW of OSW capacity. The auction took place over 64 rounds and fetched US\$4.38 billion overall. New York's OSW leasing areas are highlighted in Figure 10.



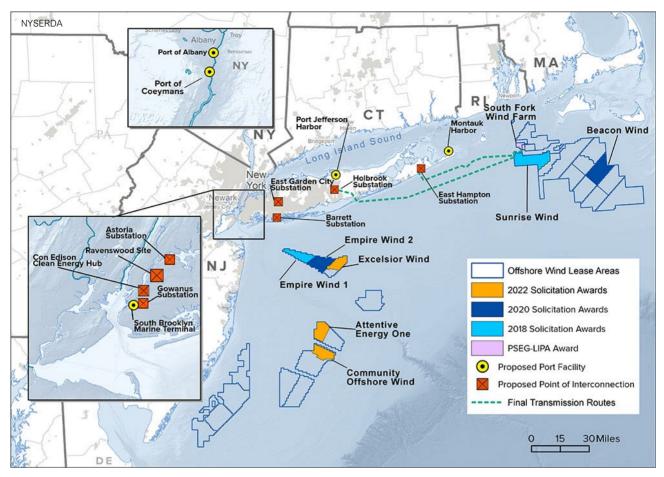


Figure 10 New York offshore wind lease areas.83

4.2.2 Current status of offshore wind in India

In July 2022, MNRE released a strategy paper for establishing an offshore wind tender in India. In 2023, the revised *Strategy Paper for Establishment of Offshore Wind Energy Projects* for the establishment of OSW projects offers three models for OSW development bidding in the country.⁴⁸

Appendix C provides a detailed comparison of the three models, summarised below.

- Model A (for 1 GW in Gujarat / Tamil Nadu): Power Purchase Agreement (PPA) award tender to be supported with Viability Gap Funding (VGF).xi Developers will bid the required VGF for a PPA with the Solar Energy Corporation of India (SECI), to win concessions to construct the projects at two sites of 0.5 GW each in Gujarat and Tamil Nadu, respectively. Due to completed surveys and studies in the Gujarat zone, it is expected that the first allocation will be in Gujarat in FY 2024, followed by allocation in Tamil Nadu in FY 2025. Both the sites have a total potential of 1 GW, 0.5 GW of which is to be allocated through model A tenders. 4 years have been allocated for construction and commissioning from the date of receiving concessions and agreements being signed, extendable by a year.
- Model B (for 14 GW): Exclusive site lease tender without VGF support, before developer surveys. Developers will bid for a site lease based on a seabed lease fee with a minimum floor price of INR 1 lakh/sq. km/year.xii It is planned that in FY 2024, 4 GW will be awarded from Tamil Nadu (potential 3.7 GW to 5 GW). In FY 2025, it is planned that 3 GW will be awarded from Tamil Nadu (potential 4 GW to 6.6 GW). The survey period is

xi The VGF Scheme is administered by the Department of Economic Affairs within the Ministry of Finance and provides financial support in the form of grants, one time or deferred, to economically desirable but commercially unviable infrastructure projects undertaken through Public-Private Partnerships with a view to making them commercially viable.

xii 1 lakh is equivalent of one hundred thousand.



specified as 2 years and construction is to be completed within 3 years of receiving the final set of approvals and concession agreement signing. No provision for time extension has been made.

Under model B, MNRE has issued a draft *Request for Selection (RfS)* for leasing 4 GW of seabed for OSW energy in Tamil Nadu within zone B in November 2022. 84 The bid evaluation is divided into 3 stages. Following the three stages, a final score is calculated, and the highest scoring bidder is declared winner. The three stages are:

- 1. Preliminary technical eligibility criteria: The preliminary technical eligibility criteria is a qualitative pass or fail test which includes aspects such as experience in installation of OSW energy, having policies pertaining to environment, health & safety, quality assurance among others.
- 2. Techno-commercial evaluation (70% weightage): The techno-commercial evaluation is a quantitative test with marks awarded for experience in commissioning OSW energy projects, conducting surveys along with some financial parameters like annual turnover, fund raising experience, net worth and others.
- 3. Financial bid evaluation (30% weightage): During financial bid, evaluation will be carried out based on the Quoted Lease Rental quoted by bidders for each block. The highest evaluated financial Bid shall be given the maximum financial score of 100 and the score for other bidders will be calculated based on a formula. The draft *RfS* outlines the structured five-stage process for Model B, as shown in Figure 11.xiii Within this five-step process for Model B, three specific lease agreements need to be executed and signed including the Agreement to Lease (ATL), survey lease deed, and Construction & Operation (C&O) lease deed. The specific details of these lease agreements are provided below:
- Letter of Award (LOA) to Agreement to Lease (ATL):
 - The initial step necessitates obtaining a LOA
 - To obtain ATL, a key step involves making a security deposit payment to the MNRE within 90 days of receiving the LOA, and
 - The challenge arises in the procedure for submitting this security deposit, as the document specifies that it should adhere to a prescribed format, yet no specific format is provided.
- ATL to survey lease deed:
 - o To be eligible for the survey lease deed, certain prerequisites include acquiring stage 1 clearances
 - The process of obtaining the survey lease deed entails obtaining the necessary permits from government bodies such as the Ministry of Environment and Forests (MoEF), the Ministry of Defense (MoD), the Ministry of External Affairs (MoEA), and the Ministry of Home Affairs (MoHA), and securing a letter of consent from NIWE, and
 - All the steps, from signing the ATL to finalizing the survey lease deed, must be completed within a 6 months' time frame.
- Survey lease deed to Construction & Operation (C&O) lease deed/Concessionaire agreement:
 - Before obtaining the C&O deed, it is necessary to fulfil certain conditions, including conducting surveys and submitting a DPR that outlines the actual area, capacity, a milestone-based completion plan, and the expected construction costs. However, no clear information on the timeline is provided for stage 2 clearances
 - As part of this procedure, the establishment of a special purpose company as the 'concessionaire' is required
- After C&O lease deed

There is mismatch between the timeline mentioned in the draft *RfS* document and the Strategy Paper. The draft *RfS* document states 5 years for survey and 4 years for construction whereas the Strategy Paper states 5 years in total before concessionaire agreement is given.



 This process involves the execution of a C&O deed with the MNRE for a 35-year term, along with the signing of a concessionaire agreement with NIWE.

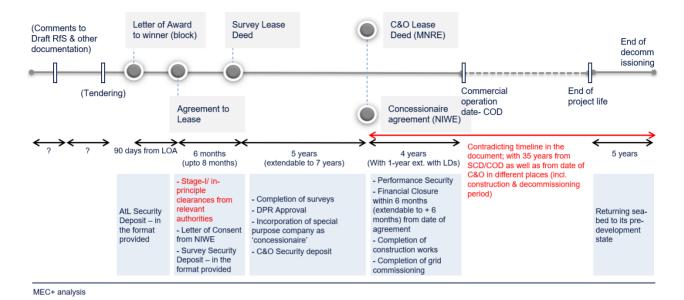


Figure 11 Stages and timeline of offshore wind development in India for Model B. 84,48

• Model C (22 GW): Similar to Model B but without exclusivity during the surveying period. Prospective developers may identify any site excluding the sites considered under Models A and B and apply to NIWE to conduct surveys as per the *Guidelines for Offshore Wind Power Assessment Studies and Surveys*. 85 The Government will award survey consent on a first-come-first-serve basis to developers, ensuring a minimum gap of 1 km between sites. Model C tenders are to start from FY 2026 for any site in India's EEZ. The duration of the survey licence is 3 years. The project needs to be commissioned within 4 years from the date of receiving a final set of approvals and/or concession agreement signing.

A draft tender document has been released for Model B and a similar is anticipated for Model A shortly.⁸⁴ In 2023, MEA notified the *Offshore Wind Energy Lease Rules.*⁴⁹ The document provides the definition of lessee & lessor, permits required, rights and responsibilities of OSW leaseholders, fees and deposits, and transfer & cancellation process for all models. Key points include:

- Grant of lease: The Central Government is authorized to lease out offshore areas within EEZ for Offshore
 Wind Energy Projects and Offshore Wind Transmission Projects
- Lease Duration
 - o 5 years for resource measurement and related studies/surveys activities (3 years extendable by 2 years)
 - 35 years for construction, operation, and decommissioning which can be extended further on a case-bycase basis subject to the functional viability and safety of the project
- Security deposit
 - Rs. 1 lakh/MW for installation and commissioning of offshore wind energy projects
 - Rs. 50,000/MW for a separate offshore wind transmission project

The security deposit will be returned after production of a certificate of decommissioning.

- Annual lease fee: Applicant shall pay an annual lease fee of Rs. 1 lakh/sq. km
- Transfer and cancellation
 - The lease rules allow the transfer and assignment of lease subject to the written consent of the Central Government



- Cancellation of the lease is possible in case the lessee violates the terms and conditions of the lease or fails to fulfil or contravenes any of the terms
- Delivery of Data: Upon termination of the lease or the relinquishment of any area covered by it, the lessee shall furnish confidentially complete records of all the survey or investigation data such as meteorological, bathymetric, ocean current, sonar data, physical oceanographic data, surface geological maps tec.
 Information shall be shared with the Integrated Headquarters (Navy), Ministry of Defence.

In general, the framework for securing a lease has been structured with transparency, incorporating various criteria within the preliminary qualification criteria, technical, and financial bid categories. Again, some uncertainties exist for developers, such as the need for a more detailed preliminary qualification criteria definition, the Stage 2 procedure (timeline and stakeholders involved), and the lack of a specified format for the security deposit at the ATL. xiv

4.2.3 Discussion and recommendations

Discussion

Established OSW markets show that the leasing processes should be transparent, robust, and repeatable, and should encourage timely project development. The stated ambition and timetable to auction 37 GW of capacity by 2030 is a positive market signal for India. The country has developed a three-model approach to provide OSW developers with various pathways to securing an OSW project lease. This multi-option approach presents a level of choice that increases complexity and uncertainty from a developer and investor perspective.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that OSW can bring.

- NIWE clarifies the discrepancies between issued guidance with regard to preliminary qualification criteria.
- MNRE, in partnership with NIWE, updates guidelines to ensure a minimum gap of 10 km between sites for Model C.
- MNRE allows transfer of ownership in OSW projects to help share risks and resources.

4.3. Environmental and social impact assessment

4.3.1 Learning from global markets

Australia

Before an area is declared available for OSW development, the Australian Government assesses the environmental and social impact of potential wind farm developments in the proposed areas, including engagement with relevant government agencies and public consultation. Once an area is declared suitable for development and a feasibility licence has been awarded, responsibility is placed on developers to conduct an ESIA as part of the project approval process. This assessment will investigate whether the proposed development will result in significant impacts on Australian Metters of National Environmental significance and meters.



significant impacts on Australian Matters of National Environmental significance and must follow the process outlined in the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). 86 The responsible department at Commonwealth Government level is DCCEEW, and the responsible minister is the Minister for the Environment and Water.

Environmental assessments are conducted in two stages:

Accelerating deployment of offshore wind in India

xiv Details on Stage 2 clearances is discussed under Section – 5.4 Permitting



- Referral, to decide if the proposed action requires approval under the EPBC Act, and
- A decision to approve, outlining how the minister will consider the action and how a decision will be made.

If an environmental assessment is required, it will be accomplished through one of the following methods:

- An accredited assessment
- Assessment of referral information (based solely on the information provided in the referral form)
- Assessment of preliminary documentation (based on the referral form and any other relevant material identified by the minister)
- An EIS or public environment report (PER), or
- An assessment via public inquiry.

The process is transparent, with the process, necessary actions and responsible persons comprehensively described in the EPBC Act.

See Key environmental factors for offshore windfarm environmental impact assessment under the EPBC Act 1999 for the detailed environmental impact procedure for Australian OSW development.

Japan

In Japan, OSW farms are subject to the Environmental Impact Assessment Act and developers must produce an environmental impact statement (EIS) which will be assessed by the national government.⁸⁷ Developers follow the process below when developing their EIS:

- Primary Environmental Impact consideration
- Determination of the assessment method (scoping)
- Draft EIS, and
- Final EIS.

The environmental impact assessments (EIA) involves conducting surveys, forecasting, and evaluations of the possible changes in the environment caused by the implementation of the project.

Steps two and three both involve input from local citizens, stakeholders, and the local governments and step three involves additional input from the national government and the environment minister. The final assessment is conducted by METI, with input from the environment minister.

This method for environmental impact assessment has the following key issues:

- The process can be lengthy, typically taking 4 years to 5 years.
- As the process takes a long time, developers typically start the process before they have leased a site, increasing risk for the developers.
- As many developers will be going through this process for sites in the same area this places a burden on local governments, communities, and stakeholders who need to be consulted throughout the process.

To address the latter point, Yamagata Prefecture asked developers planning projects in the Yuza-machi Promotion area to consolidate their environmental impact assessment processes to reduce the burden. A consortium was established by a group of developers and has been going through the process on behalf of all the projects of the consortium.

A new technical guide for environmental impact assessments for OSW projects has been drafted by the Minister of the Environment and is currently open to public consultation. 88 This new guidance is to address the lack of specific guidance related to the types of environmental impact that OSW farms will have and to rationalise the process to reduce the burden on local stakeholders.





Netherlands

Dutch legislation mandates the performance of EIA and comprehensive public consultations as prerequisites for the approval of new OSW zones and projects. This is mandated under Directive 2011/92/EU of the EU law. Oversight and execution of these EIAs are primarily entrusted to the Ministry of Infrastructure and Water Management (for Strategic EIA of zoning plans) and the RVO (at an individual project level).

The TSO TenneT is responsible for conducting EIAs necessary for the construction of new transmission infrastructure, ensuring that environmental and social factors are carefully considered.

Upon the completion of these assessments, the findings are made accessible for public consultation. The Netherlands has established a clear and well-defined framework for executing these studies, which are typically conducted by a robust domestic supply chain of expert consultancies and completed to high standards. The timing of these assessments is predominantly dictated by the need to conduct comprehensive desktop and site studies to facilitate the assessment process. EIA requirements are not a source of delay for OSW development in the Netherlands.

United Kingdom

All OSW projects in the UK require an ESIA as part of the developers' permitting application, as outlined in *The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017*. 89 The developer is responsible for carrying out site surveys and an ESIA. Surveys can include environmental surveys, archaeological surveys, geophysical studies, geotechnical studies, meteorological surveys, oceanographic studies, and unexploded ordnance (UXO) surveys.

The developer is required to make assessments of potential impacts, formally consult with stakeholders, and develop approaches to manage and mitigate issues. The surveys required are determined during a pre-application scoping meeting.

To encourage open dialogue, the UK has taken steps to improve stakeholder communication. The Fishing Liaison with Offshore Wind and Wet Renewables (FLOWW) group was established to encourage open dialogue between the fishing industry and the wind energy sector.⁹⁰

US (New York State)

Under the National Environmental Policy Act (NEPA) of 1969, BOEM is responsible for creating an Environmental Assessment (EA) and the EIS. The EA is created whilst BOEM is determining the potential lease site and is used to support the engagement with the public and to determine whether a project in the area would require an EIS.



The EIS document is created after a site has been leased to a developer and is used to support BOEM's decision to approve or reject the project's Construction and Operations Plan (COP).

The process for creating the EIS is as follows:

- Scoping: First BOEM must determine what the contents of the EIS should be. Many groups are called
 upon to input into this process including local citizens, public interest groups, Native communities,
 government agencies, industry stakeholders, scientists, and other technical experts. BOEM uses this
 engagement to determine relevant issues to be addressed in the EIS as well as alternatives to the
 proposal to be considered, mitigation measures, and analytical tools to be used.
- Analytical scenarios: Based on the outcomes of the scoping phase, different scenarios for analysis are determined. These scenarios can represent variations to the proposed project specifications or mitigation



measures that could be introduced. In June 2022, BOEM standardised the criteria for identifying the alternative scenarios so that scenarios are technically and economically feasible and are consistent with existing state and federal laws, policies, and goals.⁹¹

- Impact analysis: The analysis of the environmental impacts is carried out because of the project proposal and the alternative scenarios.
- Draft EIS and public review: Once a Draft EIS has been created it is made available for public comment.
- Final EIS: A final EIS document is published, addressing any comments received during the previous phase.⁹²

4.3.2 Current status of offshore wind in India

India has addressed requirements for EIA in various OSW documents such as the *National Offshore Wind Energy Policy*, *Guidelines for Offshore Wind Power Assessment Studies, and Surveys*, and the draft *RfS tender*. ^{43, 46} India recognises the importance of having an ESIA in place for OSW development. ^{xy} In line with the *National Offshore Wind Energy Policy*, NIWE must secure preliminary clearances before announcing OSW energy blocks for bidding. Project developers are required to obtain clearances and no-objection certificates from Government ministries to conduct surveys, studies, and project development. The Ministry of Environment, Forest, and Climate Change is responsible for granting EIA and Coastal Regulation Zone clearances for up to 12 nautical miles from shore. Surveying companies must adhere to relevant provisions and notifications under the *Environment Protection Act*, *of 1986*, and the *Forest Conservation Act*, *of 1980*. ^{93, 94} No regulations exist beyond 12 nautical miles from shore.

A Rapid EIA published by the National Institute of Oceanography and NIWE has been released for Gujarat, while one for Tamil Nadu is pending. ^{95, xvi} This highlights that India has established formats to recognise environmental impacts and the relevant regulatory bodies to be contacted. Within these documents however there is a notable absence of guidance regarding stakeholder consultation with expert groups, local communities, and with local and state governments.

Based on the draft *RfS*, for Model B, the bid evaluation is divided into three stages: preliminary technical eligibility criteria, techno-commercial evaluation, and financial bid evaluation. Currently EIA is part of the preliminary technical eligibility criteria which requires the bidder to submit a copy of their environmental plan specific to offshore infrastructure as per international practices to move onto the techno-commercial and financial evaluation stages. **XVIII* To create a mitigation plan, a bidder must meet a pre-qualification criterion, which is a pass or fail assessment. There is no clear guidance for developing a time-bound mitigation plan.

The OSW energy sector can refer to relevant frameworks that are in place for parallel industries such as oil & gas and the onshore wind sector:

- Oil & gas: The EIA is a three-step process including scoping, public consultation, and appraisal which takes place in a time bound manner of 180 days to complete environmental clearance. The following legislation are is applicable: Wildlife (Protection) Act of 1972, Water (Prevention and Control of Pollution) Act of 1974, Forest (Conservation) Act of 1980, Environment (Protection) Act of 1986, Environmental Impact Assessment Notification of 2006, Shale Oil and Gas Policy of 2013 and Hazardous and Other Waste (Management and Trans-boundary Movement) Rules of 2016. 93, 96, 97, 93, 94, 98, 99, 100
- Onshore wind: While EIA is not mandatory by law for onshore wind projects, certain regulations applicable
 for the sector are the Water (Prevention and Control) Act of, 1974, Guidelines for the diversion of forestland
 for non-forest purposes under the Forest (Conservation) Act of 1980, Air (Prevention and Control) Act of

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xv As per National Offshore Wind Energy Policy, Draft RfS document.

xvi A Rapid EIA is a speedier appraisal process to complete EIA within a short period of time as the assessment is based on one season data to see the likely environmental impacts of any proposed development activity.

xvii As per pre-qualification criterion stated in *Draft RfS* document.



1981, Scheduled Tribes and Other Forest Dwellers (Recognition of Forest Rights) Act of 2006, and Hazardous Wastes (Management, Handling, and Transboundary Movement) Rules of 2008. 101,102

Other studies such as the *Maritime Spatial Planning for offshore wind farms in Tamil Nadu* have also indicated the application of Coastal Regulation Zone clearance for OSW projects.⁷³ The document states that it would be advantageous to apply environmental standards consistent with international standards (International Finance Corporation performance standards on social and environmental sustainability and World Bank environmental, health, and safety guidelines) aligned with the Equator Principles for OSW development in India.^{103,104}

4.3.3 Discussion and recommendations

Discussion

India has established regulations and processes for undertaking an ESIA for oil and gas and onshore wind, but no specific guidance or process that has been adapted for OSW. The existing guidance and processes do not conform to the international ESIA standards that OSW developers require to meet to fulfil their own environmental and social governance standards, or to attract funding from international lenders, especially with regard to stakeholder consultation.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE reviews the Environmental Social Impact Assessment (ESIA) regulations and process for OSW
 against international standards, Good International Industry Practice (GIIP) and lender requirements and
 makes necessary updates and clarifications. To facilitate lending, international funding organisations need to
 ensure that projects meet their environmental and social standards.
- MNRE, in partnership with Ministry of Environment and Forests (MoEF), State Department of Environment & Forest, and State Coastal Zone Management Authority (SCZMA), ensures stakeholder engagement as part of the ESIA process, including engagement with communities, marine industries, and other sea users.
- MoEF provides guidance and establishes regulations applicable to developments located beyond 12 nautical miles from shore.

4.4. Permitting

4.4.1 Learning from global markets

Australia

Successful acquisition of the feasibility and commercial licences described in Section 4.2.1 permits OSW farm construction. The Offshore Infrastructure Registrar is responsible for leading the assessment of licence applications, with the Minister for Climate Change and Energy ultimately responsible for granting licences.

Additional permitting requirements vary between states. Taking Victoria as an example, developers need to obtain construction permits and land rights for onshore activities, namely cable routing to a predetermined onshore substation or connection point. Offshore construction of the wind farm and export cable system will be permitted by acquisition of feasibility and commercial licences and a transmission and infrastructure licence respectively. To provide additional confidence to developers, Victorian Government is seeking to amend land legislation to allow developers to obtain tenure more easily over Crown land and facilitate construction of electrical infrastructure.²⁰

In Victoria, municipal district councils are the bodies responsible for assessing planning and issuing construction permits in areas that fall under their jurisdiction (for example onshore export cable routing). For



land that does not fall under the jurisdiction of a municipal district, such as offshore land, the Minister of Planning carries out the function of the local council. 105

Japan

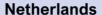
The relevant permits required for the construction of an OSW farm in Japan need to be secured from multiple administrative organisations at the national and prefectural levels. These requirements vary according to the local prefecture. The developer is responsible for securing the permits and there is no centralised agency to coordinate the process.

Key issues with the permitting system in Japan include:

- · The lack of a centralised system for managing the permitting system, and
- Many of the permits required were not designed for OSW projects which adds a barrier for developers meeting the requirements and can contribute to delays.

A full list of the permits required can be found in the New Energy and Industrial Technology Development Organisation's *Installation guidebook for offshore power generation*. ¹⁰⁶

The Cabinet Office is in the process of rationalising the permitting procedure. 107



Once zones have been designated as sites for future OSW development, the Offshore Wind Energy Act requires that the Minister of Economic Affairs takes a positive site decision on future development before projects can be realised. ¹⁰⁸ To arrive at a positive site decision the Minister must consider various factors, including the efficient use of the sea, and social and environmental concerns. The site decision must also specify terms and conditions related to the rights of third parties and describe measures to mitigate development effects.



To ensure the minister has enough information to make a site decision, the RVO oversees the permitting process. The RVO commissions various studies, including archaeological, UXO, geological, seabed, wind, and metocean assessments, and conducts stakeholder and community engagement to gather input from relevant parties to inform the assessment. During permitting, the RVO establishes a broad design envelope, such as turbine dimensions and project footprint. It shares the findings from site assessments carried out to inform developers so that they can optimise the design of projects they present at auctions. TenneT, the transmission operator, is responsible for permitting offshore high voltage and onshore transmission.

The Netherlands has seen low rates of project attrition and legal challenges during the consenting process. The centrally run process has helped ensure a continuous development pipeline and contributes to lower developer risk as site assessment, permitting, and grid development costs are not borne by developers.

United Kingdom

England, Northern Ireland, and Wales

The Planning Inspectorate (PINS) is an executive agency, under the Department for Levelling Up, Housing and Communities. It is responsible for managing the permitting process for OSW farms with an installed capacity greater than 100 MW, known as National Infrastructure Projects in England, Northern Ireland, and Wales. It makes recommendations to the relevant Secretary of State, who has 3 months to consider the application and make the final Development Consent Order (DCO). MMO is also





responsible for issuing licences for some activities, for example dredging or installing moored buoys.

PINS acts as a one-stop shop for permitting for OSW. The results of the ESIA and stakeholder engagement are submitted to PINS as part of the DCO application. The DCO includes the marine licence and other onshore and offshore consents. ¹⁰⁹ The marine licence grants the developer permission to carry out marine activities including construction and the DCO grants the developer permission to construct and operate an electricity generation station. The level of information required from each survey for the ESIA and HRA process is agreed upon between the developers and key stakeholders as part of the evidence plan process during the pre-application phase of the DCO.

The process from signing the Agreement for Lease to receiving a DCO takes between 4 years and 5 years, with 2 years to 3 years of pre-application work and around 2 years to approve applications. The UK Government aims to reduce the approval time to 1 year.

The permitting requirements are the same for fixed-bottom OSW and FOW projects. The permits required, however, vary based on project capacity.

Scotland

Marine Scotland is responsible for managing the permitting process for the offshore assets of the wind farm. The primary permits are a Section 36 consent and a marine licence. 110

The developer is responsible for carrying out site surveys, an ESIA, and undertaking an HRA. This process can take between 2 years to 3 years and the results of the ESIA are submitted to Marine Scotland as part of the Section 36 consent and the marine licence application.

The developer is also required to formally consult with stakeholders as part of the application evaluation process. The process from signing an Option Agreement to receiving a Section 36 consent and a marine licence takes between 3 years and 4 years, with 1 year to 2 years to approve applications.

The permitting requirements are the same for fixed-bottom OSW and FOW projects.

US (New York State)

There are a range of permits and approvals required for OSW development in New York State at both state and federal levels, BOEM is responsible for the coordination of the permitting activities. A full list is available on NYSERDA's website. 111 It typically takes 5 years after the lease has been issued before they are all approved. 112



Key to the permitting process is the creation and approval of the COP. This document specifies the project design, the plans for construction, operation, and decommissioning, presents all required survey results, and outlines the Safety Management System (SMS).

NYSERDA's solicitation for Offshore Renewable Energy Credits (ORECs), the mechanism through which developers secure offtake in New York State, requires that developers detail a plan for securing the necessary permits. Proposals are evaluated based on the degree of certainty the plan offers and any proposals that have already secured permits will be evaluated favourably.

4.4.2 Current status of offshore wind in India

According to the *National Offshore Wind Energy Policy 2015*, the development of OSW projects in India must go through a two-step permitting process, consisting of Stage 1 and Stage 2 clearances.⁴³ Stage 1 encompasses preliminary approvals, while Stage 2 entails obtaining the final set of approvals. To secure these approvals, multiple agencies and stakeholders are involved at each stage, as outlined in Table 2.



Table 2 List of stakeholders involved in Stage 1, and Stage 2 clearances in all three models.

Ministry	Stage 1 clearance	Stage 2 clearance	
Ministry of Environment & Forests	Yes. In-principle Clearance	Yes. EIA and CRZ clearance	
Ministry of Defense	Yes. In-principle Clearance	Yes. Clearance related to defence & security aspects, related to the Army, Navy, Air Force, Defence Research and Development Organisation (DRDO), and other institutions under MoD	
Ministry of External Affairs	Yes. In-principle Clearance	Yes. Clearance for the development of OSW energy projects within the maritime zones of India	
Ministry of Home Affairs	Yes, In-principle Clearance	Yes. Clearance regarding the deployment of foreign nationals in OSW energy blocks	
Ministry of Civil Aviation	No clearance is needed at this stage	Yes. Clearance for construction near aviation radars or aerodromes. No clearance or No Objection Certificate (NOC) required for all other locations	
Ministry of Petroleum & Natural Gas	No clearance is needed at this stage	Yes. Clearance for OSW power installations is proposed in Oil and gas Blocks. NOC for construction outside the offshore Oil & Gas Blocks	
Ministry of Shipping	No clearance is needed at this stage	Yes. Clearance for projects near Major Ports. NOC to operate away from shipping lanes	
Department of Space	Yes. In-principle Clearance	Yes. Clearance from a security angle about Dept. of Space installation and for minimum safety distance to be maintained from the Dept. of Space installations	
Department of Telecommunication	No clearance is needed at this stage	Yes. NOC to operate outside subsea communication cable zones	
Ministry of Mines	No clearance is needed at this stage	Yes. NOC to operate outside mining zones	

The three different models for OSW development in India follow distinct permitting frameworks:

- In Model A, the initial stage 1 clearances will be obtained by the Government of India, and the developer will be accountable for securing the stage 2 clearances. More comprehensive information and the specific procedure for this are expected to be provided in the forthcoming tender document for this model.
- Under Model B, the developer is responsible for obtaining both Stage 1 and Stage 2 clearances, with the NIWE serving as the central agency overseeing the process. MNRE has provided a comprehensive outline of the permitting procedure by releasing the draft RfS tender document for a 4 GW OSW project in Tamil Nadu. As per the draft RfS, once the ATL is signed, developers will have a period of 6 months (extendable to 8 months) to obtain all the stage 1 clearances, along with the letter of consent from NIWE. Again, there is a discrepancy regarding the stakeholders involved. As per Letter of Consent under Guidelines for Offshore Wind Power Assessment Studies and Surveys, the relevant Ministries include the Ministry of Defence, Home Affairs, External Affairs, Department of Space, and the Government of India. In contrast, as per the Letter of Consent outlined in the draft RfS for OSW in 2022, only approval from the Ministry of Defence and Home Affairs is required for the permitting procedure.

After obtaining Stage 1 clearance and signing a letter of consent with NIWE, the developer proceeds to the survey lease deed stage. At this point, the developer is required to submit a Detailed Project Report (DPR) and initiate the application for Stage 2 clearances. Again, the document does not specify the timeline for applying for Stage 2 clearance or the associated timeframes for clearance approval. It's worth noting that, based on discussions with MNRE, once the developer has applied for Stage 2 clearance, they won't be



required to pay lease fees during this period. There exist elements of ambiguity for developers regarding the procedure, timeline, document formats, and other details, and it's important to address these concerns. (See Figure 12).

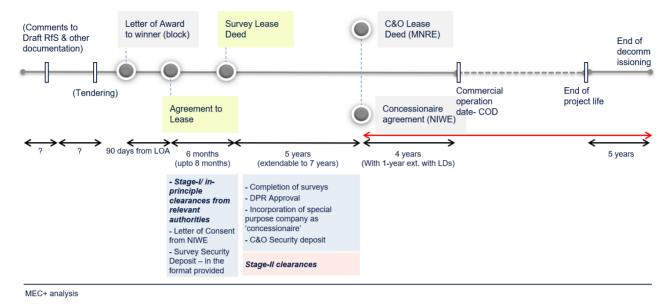


Figure 12 Procedure for permitting under Model B. 84,48

 In Model C, the permitting process closely resembles that of Model B; however, MNRE has not yet provided specific guidelines or details.

4.4.3 Discussion and recommendations

Discussion

The permitting process for offshore wind projects in India involves a multi-stage clearance procedure that necessitates engagement with various ministries and government bodies. The first stage of the permitting process in India is well-defined and falls within the government's purview, particularly for model A. The second stage of clearance introduces a notable level of uncertainty for developers, as regardless of the model, they bear the responsibility of obtaining stage 2 clearances.

Differences in stakeholder involvement between various documents issued by MNRE contribute to a lack of clarity. Developers struggle to navigate the differing criteria, hindering effective planning and execution. Insufficient details regarding application formats, documentation requirements, and associated timelines for the permitting process create uncertainty for developers, impacting project planning and execution. The discrepancies between the outlined procedures for different models (A, B, C) further complicate the understanding and adherence to the permitting process. These inconsistencies can lead to challenges in compliance and execution.

Addressing these concerns is crucial, as the permitting process is a vital procedure that consumes resources and a significant capital outlay. Having a well-defined, transparent process can streamline operations and foster a more conducive environment for investment.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

MNRE, in partnership with Green Energy Transition Research Institute (GETRI), Guidance Tamil Nadu,
 Ministry of Home Affairs, Department of Space, Ministry of Defence, SCZMA, MoEF, and State Department



of Environment & Forest, establishes specific agencies, formats, guidelines, timelines, and a comprehensive procedure for the permitting process.

4.5. Offtake and revenue models

4.5.1 Learning from global markets

as weaknesses in a CfD auction system. 114

Australia

To date, no OSW farm in Australia has progressed past the feasibility licence phase, so no projects have yet secured an offtake contract.

As for the more mature onshore wind industry in Australia, offtake and revenue

models will be mandated at a State rather than Commonwealth level. The most common models are CfDs and power purchase agreements (PPAs). For example, the Victorian Government incentivised renewable investment through its competitive Victorian Energy Target (VRET) auctions, which utilised CfDs to provide investment certainty to developers. Alternatively, New South Wales offers a competitive tender process for PPAs under its Long-Term Energy Service Agreement (LTESA) scheme, which it has proposed as an alternative to what it views

Victoria has announced that is planning to implement a competitive OSW auction in 2025, providing CfDs to ensure that a first tranche of at least 2 GW of OSW capacity is constructed, allowing the state to meet its 2032 target. The finer details of the auction process are expected to be announced in 2024, although it has been announced that winning bids will be chosen based on factors, including price, demonstrated track record, quality of community engagement and benefits sharing, project preparedness, workforce and industry development, and value for money.

On a national level, the Australian Government encourages the purchase of renewably generated electricity through the Large-scale Renewable Energy Target (LRET) scheme. Under the LRET scheme, LRET-accredited power stations can create and sell certificates called Large-scale Generation Certificates (LGCs) for electricity that has been generated from renewable sources. These certificates can then be sold to various entities, most often electricity retailers that are legally obligated to purchase LGCs from the market under the Renewable Energy (Electricity) Act 2000, or companies or individuals wanting to prove claims of emissions reduction or use of renewable electricity. 115

Japan

In Japan, OSW auctions allow developers to secure site leasing and offtake contracts under a single process.

Japan's Round 1 auction offered a FIT contract and Round 2 offered a FIP contract. This shift is designed to bridge the gap between the initial FIT system and eventual direct participation in the wholesale market.

The FIP contract provides a monthly premium payment from the Organisation for the Cross-region Coordination of Transmission Operators (OCCTO) in addition to the revenue made from selling the electricity directly to the wholesale market, with market price fluctuation.

market price fluctuation.

An issue with this model is that it requires the developer to commit to an FIP during the auction. For most bidders, there is, however, often a high level of uncertainty around the site conditions at this stage. It also takes around 7 years from site award to grid connection, over which time supply chain costs can change significantly. These elements introduce significant price risk into projects.





Netherlands

Under the Offshore Wind Energy Act, OSW projects in the Netherlands have been allocated through subsidy tenders, comparative assessments, and pay-to-build auctions.

Since 2017, subsidies have been eliminated for OSW projects, and winners are determined via comparative assessment using non-price criteria. ¹¹⁶ These competitive tenders involve sealed bids assessed by anonymous experts, considering evolving criteria that emphasise deliverability, ecological merit, innovation, and energy system integration. Again, the framework allows the government to use different models if they want to.



The comparative assessment process is managed by the RVO. Developers participating in this process are required to submit plans for revenue and offtake. Due to the substantial scale of these projects, developers have adopted a hybrid approach to mitigate risks associated with merchant offtake of power, including signing corporate power purchase agreements (CPPAs) with large telecom, technology, and industrial companies, along with utility PPAs with local energy firms. This approach is expected to continue in the future.

United Kingdom

DESNZ is the responsible organisation for managing the offtake agreement award process in the UK. The Low Carbon Contracts Company (LCCC) is a government-owned company that enters a CfD contract with OSW developers. The UK Government runs annual Allocation Rounds (Ars) to award 15 years two-way CfD contract.

Through the two-way CfD mechanism, the LCCC pays the developer the difference between the wholesale electricity price and the bid price if the wholesale price is lower than the bid price. The developer pays the LCCC the difference between the wholesale electricity price and the bid price if the wholesale price is higher than the bid price.



To be eligible to participate in Ars, developers must have a supply chain plan (SCP) that has been approved by the Secretary of State, an Agreement for Lease, necessary planning consents, and a grid connection agreement. For each AR, DESNZ sets:

- A budget that is divided into different technology pots (Fixed and floating are in separate pots)
- An administrative strike price (the maximum price a developer can bid per MWh for each technology)
- A capacity cap (for the whole round, for technology pots, or each technology), and
- Delivery years, target commissioning windows, and longstop dates for each technology.

Ars use a single sealed-bid auction format. The developers that bid the lowest price per MWh are awarded CfDs until the budget or capacity cap is reached. The auction system for the CfD pays as clear (not pay as bid). This means the price awarded to all successful developers in each technology pot is set by the price bid by the last project allocated a contract.

The process from the launch of the AR to the signing of CfDs takes around 1 year. Preparation of the SCP will need to take place before the launch of the AR.

Developers must include a target commissioning window start date within their application for a CfD which falls in or before the delivery year set by DESNZ. If a project is not operational by the end of the target commissioning window, the CfD term is reduced each day until the longstop date. If a project is not operational by the longstop date, the LCCC has the right to terminate the CfD Agreement.

Ars 1, 2, and 3 were launched in 2014, 2017, and 2019 respectively. AR4 was launched in September 2021 and around 7 GW of fixed OSW projects and only 32 MW of FOW were awarded CfD contracts. 117 AR5 was



launched in March 2023 and no new OSW projects were awarded CfD contracts. ¹¹⁸ Developers refrained from bidding at the maximum price set, citing it as too low due to inflationary pressures that have escalated the costs associated with building OSW farms. The UK Government is contemplating long-term reforms to the system. In November 2023, DESNZ announced an increase to the maximum strike price for offshore wind projects competing in AR6 by 66% and a CfD Sustainable Industry Reward (SIR) from AR7 onwards. ^{119,120} AR6 will feature a separate funding pot for offshore wind and is expected to launch in March 2024. SIR could provide greater revenue support to projects that demonstrate an increase in the economic, environmental, and social sustainability of their offshore wind project. Proposals for SIR are to be submitted to DESNZ along with the estimated cost of delivering those criteria 6 months ahead of an AR. It will follow a two-stage process:

- Stage 1 involves submission of proposals followed by a dispute resolution process and the proposal will be assessed and scored.
- Stage 2 involves submitting the price or cost of delivering their proposal and a final score will be determined based on price and quality.

Criteria and overall budget for the SIR for AR7 to AR9 will be published by Q3 2024

Projects have been partially funded with a CPPA, but the UK OSW industry is reliant on CfDs as a more reliable and bankable mechanism.

US (New York State)

In New York State the New York State Energy Research and Development Authority (NYSERDA) issues competitive solicitations for OSW energy and contracts with OSW developers to purchase Offshore Wind Renewable Energy Certificates (ORECs). Projects in lease areas off the coast of other states are eligible for the process as lease areas are in federal waters.



NYSERDA launched its inaugural solicitation for OSW in November 2018 followed by the second in 2020. NYSERDA opened the most recent solicitation in July 2022 and announced the winners in October 2023

The 2022 solicitation proposals had to meet eligibility criteria, most of which related to project specifications such as minimum project size or appropriate commercial operation date.

Eligible proposals were then evaluated based on:

- Project viability (10%),
- New York Economic Benefit (20%), and
- Offer prices (70%)

The winners of the 2022 solicitation represent over 4 GW of OSW energy. In conjunction with the announcement of the winners, NYSERDA published its 10 Point Action Plan to Expand a Thriving Large-Scale Renewable Industry which includes a commitment to announce a new solicitation soon. 121

In August 2023, the winning developers of 2018 and 2020 solicitations petitioned the New York Public Service Commission to increase the value of the offtake contracts. This was due to cost increases they were facing related to unforeseeable rises in inflation and supply chain costs and constraints. ¹²² This petition was denied in October 2023 on the basis that the requested adjustments would have been outside of the competitive process and not in the best interests of ratepayers. ¹²³

The 2022 solicitation had a provision for developers to propose how their bid price will be indexed.

4.5.2 Current status of offshore wind in India

In June 2003, the Electricity Act which is a primary law regulating the electricity and power sector in India came into action. It was launched to consolidate laws relating to generation, transmission, distribution, and market mechanisms. The act defines three models of power offtake structure in India:



- Power through Distribution Companies (DISCOMs),
- Open Access, and
- Power through bilateral sales or power exchanges.

As per the *Strategy Paper for Establishment of Offshore Wind Energy Projects* published in 2023, the offtake structure is planned differently under each model, as shown in Figure 13.⁴⁸

	Model A	Model B	Model C
Sale through DISCOMs	~	After 2 years	~
Open Access	×	✓	~
Bilateral sales or through power exchange	×	~	~

MEC+ analysis

Figure 13 Offtake structure under different models.

In Model A, the allocation of PPA follows a competitive bidding process, where the PPA is granted to the bidder who offers the lowest VGF bid in exchange for a fixed tariff from the DISCOMs. This process involves an e-Reverse auction, conducted by SECI, with MNRE serving as the implementing agency responsible for initiating the procurement bids for OSW power capacity. It is important to note that this model exclusively permits power sales to DISCOMs. Further details are awaited in the upcoming *RfS*. Incentives such as Renewable Energy Certificates (REC) with multipliers and carbon credits may be introduced for OSW projects, similar to those in place for other renewable energy projects.

Under Model B, NIWE will conduct a single-stage two envelope bidding process to award the lease. Once the lease is awarded, developers are expected to scout for potential offtakers and secure private PPAs. As per the draft *RfS*, these PPAs must be finalised before the concessionaire agreement is signed (up to 6 years from securing the LOA), and copies of these agreements must be submitted to NIWE or MNRE within 60 days of the project's commissioning. **XVIIII,XXIX** The Strategy Paper for Establishment of Offshore Wind Energy Projects in India suggests power sales could be possible through bilateral and power exchange sales and the government could initiate bids for power procurement through DISCOMs based on tariffs after 2 years based on the response received by the developer under Model B. Similar to model A, incentives such as REC with multipliers and carbon credits may be introduced in the future.

In Model C, seabed allocation is without exclusivity and the Government of India will come up with bid for project development and exclusive allocation of seabed starting FY 2026. The bidding may include any of the following methods:

- Bidding based on lease/allocation fee or revenue sharing for sale in open access or power exchange
- Competitive bidding based on quoted power tariff for power sales to DISCOMs/government, or
- Any other transparent bidding mechanism.

Incentives envisioned for the development of OSW projects in India as per the draft tender are discussed below:

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Time period: 6 months after ATL + 5 year for survey = 5.5 years to 6 years to secure PPA

xix As per RfS draft tender: Clause 20.5.



- REC with a multiplier: India already has incentives through REC, and the regulations were updated in 2022 to incorporate multipliers for the development of nascent technologies. Separate amendments to REC regulations will be circulated for incorporation of REC multiplier for OW projects by CERC and MNRE, which is under the drafting stage. 124
- Carbon market: The carbon market in India is currently under development and is envisioned to transit to a
 carbon credit & offset trading mechanism by 2026. The Government of India has notified the eligibility of
 credits generated from OSW projects to be traded in these markets, as stated in the "Policy Paper on Indian
 Carbon Market, 2022". 125

4.5.3 Discussion and recommendations

Discussion

Recent cost escalation within the OSW sector due to inflation, high interest rates, commodity price rises, and supply chain constraints have sparked concerns regarding the impact on offtake contracts and revenue models. In the US, this has led to the cancellation of projects, including Orsted's Ocean Wind I and II sites. In the latest allocation round of the UK's CfD auction mechanism (AR5), no OSW wind projects were bid due to industry concerns that the auction strike prices on offer did not reflect market reality. In response the UK Government quickly announced that strike prices will increase for the next allocation round (AR6), a move which has been welcomed by industry. In considering revenue models for OSW the Government of India should consider the latest trends in OSW costs in order to set realistic revenue values.

There is a lack of certainty in India regarding the ability for developers to obtain offtake contracts in the form of CfDs or equivalent or to obtain long-term merchant PPAs. OSW developers require long-term price certainty to commit development resources and justify early project expenditure. As things stand, there is not sufficient confidence that stable, long-term, and bankable offtake arrangements will become available.

Whilst early projects that are likely to be developed under Model 1 will be able to bid under the VGF mechanism, there is no guidance as to what revenue values this arrangement will realise. For projects being developed under model 2 or model 3, developers again face the risk of not knowing what their long-term project revenues will be, and of not being able to source a suitable PPA from the private market where appetite may not exist for the volume of electricity generated from a large OSW project.

In all cases, this lack of certainty over revenue values and ability to secure an offtake arrangement introduce significant uncertainty and will dissuade international developers from committing to the Indian OSW market.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE fast-tracks Viability Gap Funding (VGF) for initial auctioned capacity.
- MNRE introduces national level Feed in Tariff or Feed in Premium or Renewable Power Obligation (RPO) to provide market certainty and incentivise investments.
- MNRE, in partnership with GUVNL, TANGEDCO and the power ministries of other states, establishes a
 competitive system solely for OSW power purchase agreements (PPA), with a ceiling price to limit cost to
 consumers and potentially a floor price in early years to avoid the risk of unrealistic low bids. Consultation on
 ceiling and floor prices should be with relevant stakeholders in the run up to competitions to reflect evolving
 fossil fuel and OSW prices, especially recognizing current high fossil fuel and commodity prices. A
 mechanism should be included to address multiple bids being received at the floor price, which may include
 the consideration of non-price factors.
- MNRE, in partnership with SECI, develops a standard-form PPA for adoption across OSW projects to accelerate market development that provides stable income per unit of electricity generated. Consider



indexation for commodity price changes between bidding and completion, inflation, and foreign exchange rate variations.

4.6. Export system and grid connection

4.6.1 Learning from global markets

Australia

Developers must secure a grid connection agreement with the relevant local Network Service Provider (NSP) before construction can commence. To construct and operate transmission infrastructure, a transmission and infrastructure licence must be secured. A transmission and infrastructure licence grants land rights for the offshore portion of the cable system, however land rights for the onshore portion must be acquired, and the developer is responsible for the planning, finance, and construction of the export system up to the connection point.



The grid connection process is led on a state rather than a national level. Taking Victoria as an example, developers must connect to common points, which are yet to be identified by VicGrid, the network operator in Victoria. This is done to avoid uncoordinated developer-led connections. Victoria is also planning the development of Renewable Energy Zones (REZs), which are areas that have been identified as having good renewable generation potential and strong grid infrastructure. This programme is led by DEECA as the body responsible for coordinating the planning and development of Victorian REZs. 126

Japan

Before a project can be designated a Promotion Area, a grid connection must be secured so when a developer begins to develop a site it will usually seek to secure a grid connection agreement with the local TSO.

Once an auction winner is selected, all grid connection-related agreements are transferred to the successful developer, even if the agreement was secured by another party. The developer is compensated for the costs incurred securing the grid connection agreement if they fail to secure development rights in the auction. The developer is responsible for planning, financing, and constructing the export system to the point of the onshore grid connection.



The key issue with this system is that if the auction winner is transferred to a grid connection agreement secured by another developer, the grid connection agreement is often sub-optimal for the project designed by the winning developer.

In 2021, the *Guidelines for the Designation of Promotion Areas* were amended to enable METI and MLIT to request the OCCTO ensure the TSO provides provisional grid capacity for Promotion Areas if a grid connection agreement has not been made with a developer. Again, in practice, there has been a lack of clarity regarding what projects this will apply to.

Netherlands

Once the Dutch Government designates areas for future OSW development, a long-term rollout sequence for projects is developed in collaboration with the national transmission system operator, TenneT. TenneT is responsible for planning, installing, and maintaining the offshore and onshore grid network. It must also ensure that new infrastructure is ready according to a predetermined timetable, allowing developers to access it as soon as they begin generating power.





Given the extended lead time associated with planning and installing transmission assets, work typically commences 8 years to 10 years before operations. This long-term approach has, in the past, enabled TenneT to achieve economies of scale by standardizing offshore substation designs for consecutive projects and issuing single tenders for multiple transmission assets.

TenneT is obligated to provide the Dutch Authority for Consumers and Markets (ACM) with a new investment plan every 2 years, detailing performance targets and planned expenditures. In the event of a delay or unavailability of the offshore grid, TenneT is legally bound to compensate the wind farm owner for income losses resulting from postponed or missed electricity sales, as well as any associated damages.

United Kingdom

England, Scotland, and Wales

Grid connection offers are made by the National Grid Electricity System Operator (ESO). The developer applies and pays an application fee to obtain a grid connection. ¹²⁷ National Grid ESO is required to make an offer within 3 months and the developer has a further 3 months to agree to the contract. There are two delivery model options laid out by Ofgem. ¹²⁸

- The developer designs and builds the grid connection and the OFTO operates it, and
- The developer is responsible for the design and pre-construction of the grid connection and the OFTO constructs and operates it.

Under these delivery models, the Office of Gas and Electricity Markets (Ofgem) runs competitive tender rounds for offshore transmission assets, owned by the developer, to be sold and licences granted to an offshore transmission owner (OFTO). The OFTO receives a regulated revenue stream which is guaranteed for 25 years. The relevant legislation is the *Energy Act 2004*, the *Electricity Act 1989*, and *The Electricity (Competitive Tenders for Offshore Transmission Licences) Regulations 2015*. ^{129,130,131}

The UK Government is currently reviewing the OFTO regime, to determine its suitability for the delivery of future projects. This is driven by the increasing size of projects and the complexity of their offshore transmission assets, as well as a push to move towards shared offshore transmission assets to deliver future capacity. 132

Northern Ireland

The grid connection process for OSW in Northern Ireland has not been well proven and there is no clear guidance regarding the process for OSW. It is expected that the developer will apply for a grid connection via the System Operator for Northern Ireland (SONI), following a similar process to England, Scotland, and Wales. SONI is the ESO for Northern Ireland, which facilitates the connection of generation and demand customers to the transmission system.

US (New York State)

In New York, the developer is responsible for building the export system. In the 2022 OREC solicitation there was an eligibility requirement that projects have HVDC export systems and be Meshed Ready, meaning that they can receive power from multiple projects linked up via an interconnector. This is to allow for an optimised meshed system to be implemented if directed to do so by the Public Service Commission.



To secure a grid connection a developer must enter into an Interconnection Agreement with New York Independent System Operator (NYISO). First, the developer files an Interconnector Request, and then a



scoping meeting is held between the developer and NYISO. NYISO conducts three studies on behalf of and at the cost of the developer:

- Feasibility study,
- System impact study, and
- Facilities study. This study aims to assess the collective impact of a group of projects and understand the cost estimates for required upgrades. 133

This average length of time between the Interconnection Request being made and the execution of the Interconnection Agreement was 3.5 years for NYISO requests between 2018 and 2022. 134

4.6.2 Current status of offshore wind in India

In India, grid operation is divided into three levels by ownership:

- The Central Transmission Utility (CTU):
 - Covers transmission line voltages from 400 kV to 765 kV
 - Is responsible for facilitating inter-state and inter-regional power transmission, coordinating, and planning with the State Transmission Utility (STU)
 - The Power Grid Corporation of India Limited (PGCIL) implements the responsibilities of the CTU and is responsible for inter-state transmission and development of the national grid
- The State Transmission Utility (STU):
 - o Covers transmission line voltages ranging from 66 kV to 400 kV
 - Is responsible for intra-state transmission, providing the use of a transmission system for open access (for example The Gujarat Energy Transmission Corporation Limited)
- Distribution companies:
 - Cover transmission line voltages from 230 v to 66 kV
 - Are responsible for the distribution of power to consumers at low voltage levels. States can have multiple DISCOMs for distribution purposes.

For an OSW project in India, the sites need to be connected to the CTU or Interstate Transmission System (ISTS).

In the initial draft OSW strategy paper, the responsibility for the grid fell on the developer. Again, based on the feedback received from the stakeholders, the recent 2023 *Strategy Paper for Establishment of Offshore Wind Energy Projects* states that the developer is accountable for evacuating power to the offshore metering or interconnection point across all three development models. The developer must establish the OSW project, including the inter-array cables connecting the project to the offshore substation at the designated voltage level. The construction of the offshore substation and the transmission infrastructure will be undertaken by CTU, as illustrated in Figure 14.



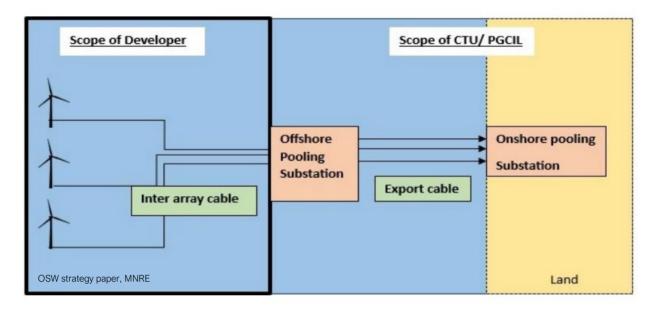


Figure 14 Construction of the offshore sub-station and the transmission infrastructure. 48

Model B has received detailed clarification, with the issuance of the *draft RfS* for the 4 GW OSW project in Tamil Nadu. The Government of India has outlined the entire procedure and timeline for this project. Again, there are specific areas that lack clarity. For instance, the application process for bay allocation for an OSW substation by the developer, as well as the criteria for bay allocation, remains unclear. Additionally, there is no explicit information in either the *Strategy Paper for Establishment of Offshore Wind Energy Projects* or the *draft RfS* regarding the procedure for compensating the developer if the project is ready, but grid connectivity is delayed. To address these concerns, it is crucial to provide developers with explicit guidance on procedures, timelines, compensation mechanisms, and the allocation process for OSW projects in India.

Renewable energy has the Must Run^{xx} status in India, and OSW is expected to be included as well. Additionally, RE serves as a last resort to be considered for curtailment as per Indian Electricity Grid Code regulations, 2023. ¹³⁵ Again, in cases where curtailment occurs for RE due to grid stability issues, the government has implemented compensation mechanisms at both the central and state levels to address this situation.

At the Central level, the Forum of Regulations released guidelines for the management of RE curtailment for wind and solar generation in 2022, which state 100% compensation for solar and 50% compensation for wind energy. xxi,136 Further, as part of the standard PPA for long-term procurement through SECI, a plan is in place to provide complete, 100% compensation for curtailed energy. 137

OSW plant in India will be connected to the Interstate or Central grid, as the responsibility for the OSW pooling substations falls under the remit of the Central Transmission Utility. There is no curtailment within the Interstate Transmission System (ISTS) and a provision for 100% compensation safeguards developers from curtailment risks.

4.6.3 Discussion and recommendations

Discussion

From the examples cited above, it is seen that governments in established markets play an important role in ensuring a timely and cost-effective offshore export system to connect into the national transmission network. They have well laid out plan and clear understanding of the responsibilities to facilitate OSW grid connection.

xx As per Indian Electricity Grid Code Regulations 2023, renewable is given the status of must run and will be the last resort for curtailment after all other sources of energy.

xxi Central level contracts include contracts through SECI – relevant for OSW.



Established markets also review policies and frameworks related to grid connections in the OSW sector to ensure they are aligned with technological advancements and project pipeline.

The Indian OSW export system has gaps in providing explicit guidelines and clear regulatory oversight. Ambiguity exists regarding the responsibilities of developers versus the central utility in grid connection. Clarity is needed on the procedure, timelines, and compensation in cases of delayed grid connectivity. Lack of explicit guidance on the application process and criteria for bay allocation for OSW substations by developers also poses a challenge.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- Central Electricity Regulatory Commission (CERC) details procedures, timelines, and transparent compensation mechanisms for delays to grid connection to new OSW projects.
- CERC, in partnership with State Electricity Regulatory Commission (SERC) publishes simulations to show that there will be no curtailment of OSW operational from 2035 onwards.
- Ministry of Power, in partnership with PGCIL, develops a transparent and well-defined process for bay allocation for OSW substations. Establish criteria and application procedures, ensuring fairness and transparency in the allocation process.
- State Maritime Boards, District Collectorate offices, state level fisheries departments, SCZMA, Gram
 Panchayats and civil bodies, engages with local communities and stakeholders to address concerns, obtain
 buy-in, and ensure transparent communication regarding the necessity and benefits of grid connections for
 offshore wind projects.
- Ministry of Skill Development and Entrepreneurship, in partnership with Sector Skill Councils (SSCs), fosters partnerships between government entities, offshore wind developers, and transmission system operators. These collaborations can help in planning, funding, and executing grid connection projects.
- NIWE enables centralized survey activities through common agencies to optimise resources, standardise
 processes, and expedite project development while reducing environmental footprint and redundant
 expenses within the sector.



4.7. Health and safety

4.7.1 Learning from global markets

Australia

As part of the feasibility licence application process outlined in Section 4.2.1, applicants must submit a management plan outlining how various measures including health and safety will be addressed. The safety plan should highlight potential safety issues and a mitigation or elimination plan based on a risk management approach. This plan will be examined by the Offshore Infrastructure Regulator to ensure that sufficient health and safety measures are implemented before the plan is approved.



In Australia, wind farm developments are considered a workplace, and therefore must be compliant with relevant Occupational Health & Safety (OH&S) regulations. These are administered on a state level and differ between states. Current OH&S legislation regarding wind farms is focussed on onshore developments, however, offshore developments will follow similar requirements and procedures with some adjustments to ensure these legislations are suitable offshore.

Compliance with OH&S legislation and building codes is mandatory in every state of Australia. There is a duty of care imposed onto wind farm designers to reduce risks associated with their design As Low as Reasonably Practicable (ALARP). To demonstrate this, designers must identify hazards associated with a design, assess the risk associated with each hazard, and reduce this risk ALARP. Records of this process must be kept displaying that the duty has been discharged. If a particular hazard is addressed in an Australian Standard, compliance with that standard is sufficient to display the discharge of the duty of care.

Japan

Key policies and guidance for health and safety practices in Japan are:

- Industrial Safety and Health Act, and ¹³⁸
- Guidelines on Occupational Safety and Health Management Systems established by the Ministry of Health, Labour, and Welfare, based on the international ILO-OSH-2001 standards for occupational safety and health management systems.¹³⁹

In the most recent leasing OSW auction in Japan, part of the scoring was based on how well the bidders addressed the risk scenarios outlined in the public offering and occupancy guidelines. More points would be awarded if the bidders plan to obtain ISO45001 or create a Construction Occupational Health and Safety Management System (COHSMS).

Netherlands

Health and safety (HSE) requirements evolve across delivery phases of OSW projects to ensure compliance, protect workers, and protect the marine environment. The primary enforcement authority is the Enforcement Unit of Rijkswaterstaat Zee en Delta (RWS ZD).

Inspections begin when wind farm owners initiate construction activities. RWS ZD's Enforcement unit holds information sessions, conducts inspections, and reviews work plans in collaboration with developers and grid operators. These plans cover seabed cable installation, wind turbine, and platform construction and involve consultations with relevant regulatory bodies. Early assessments of draft plans ensure compliance with regulations like the Water Decree and the Water Act, along with specific Site Decision requirements related to wildlife and archaeology.



Throughout construction, both on-site and factory inspections verify adherence to regulations. Activities are monitored for their HSE and environmental impact.

After the wind farm becomes operational, RWS ZD's Enforcement unit continues its oversight by inspecting management and maintenance procedures. The focus is on proper organisation, prevention, and addressing potential incidents.

Enforcement actions are taken when breaches are identified, employing administrative, regulatory, and legal measures as necessary. This enforcement authority spans all phases of the wind farm's life cycle, from preparation to construction, operation, and eventual dismantling.

In addition to RWS ZD, the State Supervision of Mines (SodM) and the Coast Guard are authorised to take immediate action in response to offshore violations identified during inspections. This comprehensive approach ensures that health and safety standards are upheld throughout the entire life of the wind farm.¹⁴⁰

The OSW developers in the Netherlands adhere to international health and safety best practices and actively participate in industry forums, such as The Global Offshore Wind Health and Safety Organisation G+. ¹⁴¹ They are also active members of the Dutch Wind Energy Association (NWEA), where industry-specific safety issues are discussed.

Only a limited number of OSW farms are accessible for navigation in the Netherlands. These areas are open to vessels under 24 m and can only be traversed during daylight hours by vessels equipped with an AIS transponder. Only recreational rod fishing is allowed, and vessels must maintain 50 m from turbine foundations and 500 m from substations. They are currently under review considering increased deployment targets by a specialised body established by the Department of Waterways and Public Works. 142

Dutch working time restrictions at OSW farms are governed by legislation originally developed for the mining industry, covered in the Working Hours Decree. This legislation restricts offshore workers to a 2-week on, 2-week off work pattern, allowing a maximum of 14 shifts in 28 days for offshore workers.¹⁴³

United Kingdom

There are three important policies for health and safety in the UK^{144,145,146}:

- Health & Safety at Work etc. Act 1974
- The Management of Health and Safety at Work Regulations 1999, and
- The Construction (Design & Management) Regulations 2015.

These health and safety provisions also apply within the UK's territorial sea, which extends 12 m from the coast. Health and safety law also extends beyond the 12 m limit in geographical areas covered by the *Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 2013*.¹⁴⁷

The Health and Safety Executive (HSE) was set up under the *Health & Safety at Work etc. Act 1974* and is a UK Government agency responsible for the encouragement, regulation, and enforcement of workplace health, safety, and welfare, and for research into occupational risks in the UK. HSE investigates industrial accidents and arranges and encourages research and publication, training, and information in connection with its work. The HSE oversee the Offshore Major Accident Regulator (OMAR). OMAR is the Competent Authority (CA) responsible for regulating major accident hazards offshore. The role of the CA is to oversee industry compliance with the respective offshore legislation and undertake related functions such as accepting, assessing, approving, and inspecting relevant safety cases, oil pollution emergency plans, and oil and gas well notifications. Reporting of incidents is included as are intervention planning and investigation work.

The Maritime & Coastguard Agency (MCA) published *Offshore Renewable Energy Installations:*Requirements, guidance, and operational considerations for SAR and Emergency Response in 2021.¹⁴⁸ It provides a description of the MCA policy, guidance, advice, and specific requirements to assist and enable



Search and Rescue, and other emergency response operations to, within, and in the vicinity of offshore renewable energy installations (OREI).

US (New York State)

In 2017 NYSERDA published their Offshore Wind Master Plan which included a Health and Safety Study outlining the various requirements and standards that must be met for OSW farms and their development.¹⁴⁹

In the United States, activities in federal waters are subject to federal laws surrounding health and safety, but any operations in state waters (up to 3 nm from shore) or onshore projects are subject to both state and federal regulation.



Applications submitted to BOEM must include a Safety Management System (SMS). The requirements of the SMS are outlined in the Code of Federal Regulations, Title 30, Part 585 Renewable Energy and Alternative Uses of Existing Facilities on the Outer Continental Shelf. ¹⁵⁰

For activities in state waters or onshore, the Occupational Safety and Health Administration (OSHA) is responsible for the safety regulations, and they are set out in the Code of Federal Regulations Part 1910 – Occupational Safety and Health Standards. ¹⁵¹

4.7.2 Current status of offshore wind in India

Within India's existing health and safety policy framework, there is no overarching sectoral policy for OSW health and safety compliance. Nonetheless, multiple documents associated with the OSW sector, including the *National Offshore Wind Energy Policy*, *Guidelines for Offshore Wind Power Assessment Studies and Surveys*, and the *Draft RfS tender*, have addressed various health and safety requirements that should be adhered to throughout the process from surveying to decommissioning.^{43,46}

The HSE requirements for OSW are explained below xxii,xxiii:

- In the bidding process, the chosen bidder must meet a pre-qualification criterion, which is a pass or fail
 assessment for progression to subsequent stages. This criterion necessitates the submission of an OSW
 specific health and safety policy following international standards, along with a record of health, safety, and
 accident performance.
- During the survey stage, it is mandatory that policies and guidelines exist for the use of equipment and to submit certificates about cargo ship safety construction, safety equipment, and safety management. HSE reporting must be performed throughout the survey stage.
- During the construction and operations and maintenance phases, reporting element is covered in the following manner:
 - As per the draft survey lease deed, any incident related to personal injury must be reported within 7 days after each guarter under the category of Health and Safety incidents.
 - Clause 17 in the concessionaire agreement of the draft RfS document specifies that incidents must be reported within a 12-hour window from the time of occurrence.
- In the decommissioning stage, India does not presently have any specific guidelines or procedures for Health and Safety

A high-level summary of the health and safety framework (plan, do, and check) followed across the different stages of OSW development in India is presented in Figure 15.

xxii As per clause 40 of the draft RfS document

As per Guidelines for Offshore Wind Power Assessment Studies and Surveys





Figure 15 Health and safety framework during offshore wind development. 43,46,48,48

There is a need for a comprehensive policy that can address all facets of health and safety throughout the various stages of a project life cycle. Parallel examples can be drawn from sectors such as oil and gas and the marine industry which have set out guidelines that may be relevant for the OSW sector in India^{152,153,154,155}.

- Dock Workers (Safety, Health, and Welfare) Act 1986 and Regulations, 1990
- The Building and Other Construction Workers (Regulations of Employment and Condition of Service) Act,
 1996
- The Petroleum and Natural Gas (Safety in Onshore Operations) Rules, 2009 and,
- The Petroleum and Natural Gas (Code of Practice for Emergency Response and Disaster Management Plan) Regulations, 2010.

Additionally, SECI has suggested adoption of the health and safety guidelines of the International Finance Corporation for World Bank funded onshore wind projects in India. ¹⁵⁶ This document guides occupational and community health and safety measures.

4.7.3 Discussion and recommendations

Discussion

Both established and emerging OSW markets have invested significantly in fostering a culture of health, safety, and environmental protection. They've developed robust legislation, and comprehensive practices to prioritize the well-being of workers, the surrounding environment, and local communities. The Netherlands uses best practices from global training bodies and participates in industry forums. These organizations possess a wealth of technical expertise and valuable data for emerging markets to leverage on.

The Indian OSW lacks a dedicated sectoral policy for OSW health and safety leading to a fragmented approach. Existing documents address certain aspects but lack comprehensive coverage across all project phases. While initial stages like bidding and surveying outline requirements for health and safety policies and equipment certifications, the construction, operation, and decommissioning phases lack detailed guidelines and procedures. Drawing from parallel industries' guidelines is beneficial, but there's a necessity for sector-specific regulations tailored to the unique challenges of OSW projects.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

MNRE in partnership with NIWE, establishes stringent regulations and standards specifically tailored to OSW
health and safety from development and survey work through to construction, operations, and
decommissioning. It also collaborates closely with industry players to develop and update safety protocols,
harnessing expertise from global training bodies and private enterprises.



- NIWE, in partnership with Ministry of Skill Development and Entrepreneurship, invests in training
 programmes and capacity building initiatives for workers involved in OSW projects, including safety training,
 emergency procedures, specialized skill development and building a culture of safety.
- NIWE establishes dedicated bodies or assign existing agencies to monitor and enforce compliance with health and safety standards through regular inspections, audits, and certifications.
- NIWE promotes transparency by sharing safety guidelines, best practices, and incident reports within the industry, readily available to all stakeholders.

4.8. Standards and certifications

4.8.1 Learning from global markets

Australia

There are currently no Australian standards or accreditation systems specific to OSW. For wind turbines with rotor diameters up to 200 m Australian Standard AS61400.2 (Int)-2006 applies. This interim standard has been adapted from IEC 61400-2.

The government does list general standards that must be followed when manufacturing, supplying, or installing a wind turbine as laid out in the *Renewable Energy (Electricity) Act 2000* and the *Renewable Energy (Electricity) Regulations 2001*. These are administered by the Department of Climate Change, Energy, the Environment and Water and are as follows:

- AS / NZS 3000:2018 Electrical Installations
- AS / NZS 4509.1:2009 Stand-Alone Power Systems Safety and Installation
- AS / NZS 4777.1:2016 Grid Connection of Energy Systems via Inverters Installation Requirements
- AS / NZS 5139:2019 Electrical Installations Safety of Battery Systems for use with Power Conversion Equipment
- AS 1768:2021 Lightning Protection
- AS / NZS 1170.2:2021 Structural Design Actions Wind Actions

While no specific Australian standards or accreditation systems for wind turbines or farms currently exist, IEC WT01:2001 is accepted as the current default standard for wind turbine design. ¹⁵⁸

Japan

Under the Electricity Business Act, METI is responsible for establishing the technical standards for electricity facilities, including OSW farms. METI is responsible for relevant Japanese Industrial Standards (JIS) relative to OSW, under the coordination of the Japanese Industrial Standards Committee. A key standard is the JIS C 1400-3 Design requirements for OSW turbines.

In 2020, METI's Offshore Wind Power Facility Review Committee updated its report on the technical standards for OSW power. ¹⁵⁹ This report includes the relevant standards to abide by including IEC, ISO, API, JIS, and DNV-GL.





Netherlands

In terms of establishing standards for other offshore structures, the Netherlands Normalisatie Instituut (NEN) plays a central role. NEN is responsible for developing and publishing standards that govern various aspects of offshore structures. These standards often align with international norms set by organisations like DNV GL, the ISO, and the IEC.

The Netherlands has traditionally realised OSW farms by using turbines designed to meet the IEC design standards for Class 1. These standards are tailored for very high-speed wind sites where wind speeds at hub height exceed 10 m/s. It's worth noting that wind turbines installed in the Netherlands are not required to conform to the IEC standard 61400-1, which specifically addresses hurricane, typhoon, and cyclone storm systems.

The Dutch electricity grid operates at 230 v with a frequency of 50 Hz, which is consistent with its European Union neighbours.

United Kingdom

The British Standards Institute (BSI) has been at the forefront of developing offshore renewable energy standards via membership of IEC's TC 88 and TC 114 committees. The Standards Policy and Strategy Committee (SPSC) is responsible for advising and reporting to the Board on the preparation of British Standards. They work with the PEL/88 Committee on IEC TC 88 and CENELEC TC 88 for standards for wind turbine generator systems. Industry uses standards including DNV-ST-0119 for the design of floating wind turbine structures and DNV OS-D201 covering electrical installations. A full list of industry standards used in OSW can be found in the Offshore Renewable Energy Standardization Review document. 160 Ramboll on behalf of OREC, authored a report for standards and certifications used in FOW. 161 It features industry standards by ABS, Bureau Veritas, DNV GL, and IEC. The UK has taken steps to work internationally and support

agreements that can affect the development of OSW sites.



To obtain financing from international lenders, projects need to meet GIIP standards such as IFC PS6 and WBG ESS6, which include specific environmental and social requirements. 3,162

US (New York State)

In January 2023 the oversight of safety regulations and facility design for OSW farms was transferred from BOEM to the Bureau of Safety and Environmental Enforcement (BSEE). It is the developer who must ensure that the design of the facility meets all appropriate standards according to the process and requirements outlined in 30 CFR 258.700-714. The developer is required to use an independent Certified Verification Agent (CVA) to review and certify the design and installation plans. 163



There is no US specific set of standards and the approval for use of turbines or foundation designs on sites is approved on a case-by-case basis through the CVA review process. Again, the American Wind Energy Association's (now American Clean Power Association) Offshore Compliance Recommended Practices 2012 presents recommended standards for OSW design which includes its standards as well as the use of IEC and ISO standards where relevant. As these standards were compiled in 2012, they do not include the most recent research and knowledge or guidance for floating foundations. 164



4.8.2 Current status of offshore wind in India

NIWE, the nodal agency for OSW development is responsible for establishing standards and certifications during the project life cycle of OSW projects. **xiv* Currently, India has set out standards and certifications on the survey stage for bidding under Model B. At the survey stage, specific standards for offshore measurements for meteorological mast and instruments and platform mounted lidar are laid out. **xv* These guidelines specify the use of certified equipment and the required formats for reporting equipment details to be employed by the developer.

During the bidding phase, there is a lack of specific and detailed standards and certifications that developers are required to adhere to. It has been touched upon as a pre-qualifying criterion for submitting a quality assurance policy specific to offshore infrastructure. The quality assurance policy is mentioned in the bidding documents as a pass or fail criterion for developers. Again, the bidding documents do not outline the criteria for an effective quality assurance policy or provide clarity on its scope.

During the construction and operation phase, there is a lack of clarity on the applicable standards and certifications. Currently, this is incorporated as a component of the DPR, which must be submitted within 90 days after the survey's completion. The developer is required to outline crucial project components, such as wind turbines, foundations, substations, power cables, and their routes, along with detailed technical specifications. Again, it is unclear regarding specific criteria for evaluating and accepting or rejecting the DPR. xxxvii

During the concessionaire period of 35 years, the documents specify that the standards and certification must be adhered to and are subject to inspection by the concession authority at any time, and that failure to meet these standards may lead to termination unless the concessionaire rectifies the non-compliance within 7 days of notice. Again, the standards and specifications to be adhered to are currently not explicitly mentioned under the concessionaire period. xxviii

Looking at parallel industries like onshore wind in India, MNRE approved NIWE as the type certification body for wind related matters. NIWE provides the certification services based on IEC 61400-22:2010. 165 Such certification may be provided by NIWE for OSW projects as well. Additionally, MNRE issues a Revised List of Models and Manufacturers (RLMM) of wind turbines periodically as per the provisions of Guidelines for Development of Onshore Wind Power Projects which lists the type and quality of certified wind turbine models eligible for installation in the country for onshore wind projects. 166,167,168 It is expected that MNRE and NIWE will also create RLMM for OSW projects.

4.8.3 Discussion and recommendations

Discussion

Examples from established and emerging markets show that a robust framework that includes adherence to technical legislation, and comprehensive design codes is fundamental to the success of the OSW. Such a framework not only ensures the safety and well-being of workers but also contributes to the overall sustainability and attractiveness of OSW projects for international investments.

The Indian OSW sector faces gaps and challenges across various project phases regarding standards and certifications. During the bidding phase, specific and detailed standards for developers are lacking, with the quality assurance policy being a pass or fail criterion without defined criteria or scope. Similarly, during the construction and operation phases, while developers must submit a DPR, criteria for evaluation and acceptance or rejection are unclear. Additionally, though standards must be followed during the concessionaire

xxiv As per National Offshore Wind Energy Policy

As per annexure 4, Guidelines for Offshore Wind Power Assessment Studies and Surveys

xxvi As per draft RfS tender - Clause 40.2

xxvii As per Draft Survey lease deed

xxviii As per Draft concession agreement



period, specific standards and specifications are not explicitly outlined. There's an expectation for certification mechanisms for OSW projects to be like onshore wind, yet these structures are not yet established, leading to uncertainties and inconsistencies in compliance and evaluation throughout the project lifecycle.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

 MNRE engages with international standard organisations and the industry to support the development and application of standards suitable for the Indian OSW environment, adopting international industry codes where appropriate.

4.9. Community awareness

4.9.1 Learning from global markets

Australia

Community engagement and awareness are key features of the Australian wind industry, both on and offshore. As part of the area declaration process outlined in Section 4.2.1 community stakeholders are invited to comment on potential sites in their area. This public consultation involves Traditional Owners, communities, and industries in the area that would be affected by potential wind farm developments. More generally, public consultation in Australia is routinely invited at both a federal and state level during many regulatory and legislative processes, as well as during planning for the construction of projects and infrastructure development processes.



The Clean Energy Council encourages developers to engage with communities throughout the development process and has released community engagement guidelines providing best practices for wind developers. ¹⁶⁹ Developers who are members of the Clean Energy Council have released Partnership and Engagement Strategies for their proposed offshore developments, intended to enhance relationships with public stakeholders and Traditional Owners. These documents outline the community engagement strategy relating to the development, which includes potential opportunities such as public investments, job training, community funds, and opportunities for the local supply chain that may result from the proposed development.

Japan

Community engagement is a key component of site selection, the EIA process, and the occupancy plan submitted by developers during the site auction.

Under the Renewable Energy Sea Area Utilization Act, Promotion Zones can only be established in areas found not to hinder fisheries, and METI and MLIT must establish a council to discuss the issues related to Promotion Area designation and invite public participation. Building consensus amongst fishing cooperatives has been particularly challenging due to a low level of understanding about OSW amongst the fishing cooperatives and little local evidence of the impact of OSW development.



In theory, once a developer has won an auction for a seabed area, they must begin a local coordination process but in practice due to the timescales of development developers will start engaging with relevant public stakeholders before the auction.



The key issue in Japan with public participation has been the burden placed upon impacted parties by many developers engaging at the same time. This is being addressed in part by the new environmental assessment system and permitting process rationalisation.

Netherlands

Communities play a pivotal role in OSW development, actively participating in statutory consultations during the MSP and consent processes for OSW farms. TenneT also maintains robust community engagement through regular stakeholder workshops when strategizing and obtaining grid connection approvals. Research indicates a high level of awareness regarding the importance of OSW in the Netherlands and a substantial public acceptance of OSW farms. Communities demonstrate a significant degree of trust in the ability and competence of governments, TSOs, private companies, and energy developers to responsibly achieve OSW deployment targets.

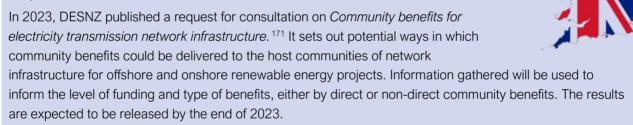


Again, despite this positive sentiment, research reveals that the public and communities desire greater involvement in the OSW planning process and development process.¹⁷⁰

United Kingdom

In the UK stakeholder and community engagement is an integral part of the project design, development and permitting process Developers hold information meetings with local communities throughout the wind farm development process.

The Public Attitudes Tracker conducted by BEIS (now DESNZ), aims to provide data to guide departmental policy, monitor attitudes towards energy sources, and understand public awareness of energy sources. OSW received strong support from the public, at 83%.



The industry supports community awareness by carrying out targeted and relevant sponsorships of local organisations and events. Rampion wind farm aims to have an active role and bring benefits to the local community by setting up a Community Benefit Fund of £3.1 million. The Vattenfall committed £15 million of funding for local communities at the Norfolk Zone OSW farms. The Communities in support of the Gwynt y Môr OSW farm. The Communities in support of the Gwynt y Môr OSW farm.

US (New York State)

Community awareness is gathered at all stages of OSW development in the United States.

During the leasing process, awareness is raised when BOEM issues Call of Information and Nominations and subsequently when they issue the Proposed Sale notice. Both stages require the solicitation of public comment through an online portal as well as community meetings.





During the environmental impact review process, public comment is also required as part of the EIS document.

The US development process specifically requires the engagement of Tribes, as the ocean areas that BOEM is proposing to develop are used by many Native Americans or are near where they live. BOEM has issued quidance on how to consult with Tribes through memorandums.¹⁷⁵

4.9.2 Current status of offshore wind in India

India has progressed towards identifying key stakeholders, and key messages to be delivered. Studies such as OSW outlook for Gujarat and Tamil Nadu have identified an exhaustive list of key stakeholders such as:

- Gram panchayats which will help to create awareness and engage in discussions with villagers through gram sabhas.
- Civil society representatives from NGOs, environment and nature protection groups, local industrial bodies, local tourism committees, and trade unions who would voice the opinions of the locals.

To date no engagement plans or initiatives have been established to educate and engage communities regarding OSW.

Parallel industries such as the marine sector have programmes in place that can be used as a reference point to develop similar programmes for the OSW sector ¹⁷⁶, for example:

• Sagarmala, the flagship programme of the Ministry of Ports, Shipping and Waterways, has a dedicated structure for community outreach encompassing skill development training, eco-tourism promotion, coastal community development programmes, and marine conservation awareness programmes.

4.9.3 Discussion and recommendations

Discussion

Examples from established and emerging OSW markets show that engaging communities throughout the development process of OSW projects is crucial. Robust engagement builds mutual trust between communities and the stakeholders responsible for developing the sector. Communities need to comprehend the role of OSW in the energy mix and the benefits it brings. Measuring public attitudes towards OSW helps understand acceptance and concerns. Drawing from successful examples in other Indian infrastructure and energy projects can offer valuable insights into fostering community engagement and ensuring robust support for OSW development.

India has identified key stakeholders in the OSW sector, including gram panchayats and civil society representatives. There is presently a lack of a structured engagement plans and initiatives for effectively educating and engaging communities. A critical systemic challenge arises from the dearth of awareness about OSW among local and district-level stakeholders, community representatives, industry associations, and civil society organizations. OSW initiatives primarily reside within specific institutional segments, limiting their reach and impact. To address these gaps, a comprehensive stakeholder mapping exercise is necessary to identify roles, responsibilities, and engagement strategies aligned with the OSW strategy roadmap and marine infrastructure development norms.

Efforts should focus on understanding challenges faced at the local level, particularly within district and gram panchayat units, while gauging the perspectives of civic authority groups. Targeted engagement strategies can then be designed to bridge identified gaps, leading to the establishment of localized consultation plans. Anticipating the surge in stakeholder activation post-tender awards, proactive planning and stakeholder preparation will be crucial in driving successful OSW projects in India.

Drawing from successful programmes in related sectors, which focus on community outreach and development, could serve as a reference for building similar engagement strategies in the OSW sector. The current challenge lies in bridging the gap between stakeholder identification and the establishment of



comprehensive, effective engagement programmes tailored specifically for OSW, addressing education, awareness, and community involvement.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- District Collectorate offices, state-level fisheries departments, SCZMA, Gram Panchayats and civil bodies, develops clear policies and guidelines that outline the Government of India's commitment to community welfare, environmental protection, and sustainable development of OSW projects.
- NIWE establishes targeted education programmes that explain the benefits of OSW, its role in addressing climate change, and the potential socioeconomic advantages for local communities. These programmes can be conducted through workshops, seminars, and information campaigns.
- District Collectorate offices introduces public consultation throughout the development process to collaborate with local leaders, gram panchayats, and community representatives to involve them in discussions, gather feedback, and address concerns.
- MNRE, in partnership with NIWE, creates incentives or benefits for communities involved in OSW projects, such as job creation and skill development programmes, building of community facilities, community development funds.
- MNRE, in partnership with NIWE, ensures transparent communication channels to disseminate projectrelated information, milestones, and potential impacts. This could involve setting up dedicated websites, and information centres, or hosting community meetings to provide updates and address queries.



5. Delivery

Emphasis on flexible delivery, continuous improvement through stakeholder engagement, bankability, and long-term vision are fundamental principles for the successful delivery of OSW projects in emerging markets. Effective implementation of OSW policies and frameworks requires ongoing flexibility, learning, and consultation on the priority areas of supply chain, ports, transmission, and financing. Success factors include:

- Partnerships between government, industry, and stakeholders provide critical feedback for continuous improvement, especially regarding supply chain and transmission which can be bottlenecks.
- A focus on adaptability enables stakeholders to adjust to evolving conditions.
- Consistent attention to bankability attracts financing and reduces costs for projects, manufacturing, ports, and logistics.
- Finally, long-term planning is essential for associated infrastructure like transmission and ports that require substantial lead times.

This section presents learnings on OSW delivery models from Australia, Japan, the Netherlands, the United Kingdom, and the US (New York state), representing a combination of emerging and established OSW markets across the world. It also summarises the MSP process in India and offers a set of recommendations for the Government of India to consider as the next steps in developing the OSW industry. The analysis and findings of this section are based on research and stakeholder engagement.

5.1. Port infrastructure

5.1.1 Learning from global markets

Australia

While no Australian ports are currently suitable for OSW, the Port of Hastings, has recently been identified as the most suitable location to facilitate OSW activities by the Victorian Government. 177 The Port of Hastings Corporation has recently submitted its Environmental Referrals to the Australian and Victorian Governments as part of the process outlined in the EPBC Act described in 4.3.1. If approved, development of the Victorian Renewable Energy Terminal located at the port will commence. The Victorian Government has set aside AU\$27 million for investment into the terminal. 178



It is not yet clear if the identification of ports and upgrade of infrastructure will be state-led or a private endeavour. While the Port of Hastings is state owned, many ports in Australia are privately held. Victoria needs ports capable of handling OSW development to meet its renewable energy targets, and state investment in the Port of Hastings will likely provide confidence for privately owned ports to follow suit and capitalise on the growing OSW opportunity.



Japan

In Japan, polices regarding port infrastructure are administered by MLIT, specifically the Ports and Harbours Bureau. The Port and Harbour Act outlines the technical standards and requirements for Japanese ports.

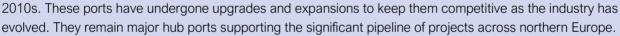
For OSW development and operation, specific ports are designated Base Ports during the leasing process. These are the ports that developers must use for construction, operations, and decommissioning. The winner of an auction will be awarded a lease to use the port for the duration of their seabed lease period.

Five ports were designated Base Ports for development in the most recent auction and four of those were recently upgraded specifically to accommodate for OSW development, strengthening the load bearing capacity of quaysides and marshalling areas. The four ports are Noshiro and Akita ports in Akita prefecture, the Port of Kashima in Ibaraki prefecture, and the Port of Kitakyusyu in Fukuoka prefecture.

Japan has cabotage rules under the Ship Act Article 3 which prevent foreign flagged vessels from being used for the construction and operation of OSW projects. MLIT are working to clarify a process to grant exceptions to these cabotage rules.

Netherlands

Ports are key strategic infrastructure in the Netherlands, which has a very strong maritime economy and hosts major European ports. Both Rotterdam and Vlissingen have existing heavy-lift quays, large lay-down areas, deep birthing pockets, and cranage. They also host supply chain companies specialised in OSW logistics, fabrication, and vessel mobilisation and management. This has enabled Dutch ports to support the growth of the domestic OSW industry. The key OSW locations, Vlissingen's BOW Terminal and Rotterdam's Maasvlakte 2 were established as the European OSW industry emerged in the early



United Kingdom

The UK supports the building of new port infrastructure and upgrades to existing ports for OSW delivery. It has dedicated ports capable of supporting OSW installation, operations, and maintenance. Examples include The Port of Blyth (pictured in Figure 16), which has been upgraded with a £3 million redevelopment at its Bates Terminal to adapt one of the terminal quays for OSW. The Port of Barrow and The Port of Talbot are also in line to be upgraded to support FOW.

The UK has recently invested around £100 million in port upgrades to support OSW in Teesside and Humber. These locations will home research, development, and testing facilities such as the Offshore Renewable Energy Catapult (OREC). This has attracted international investment, such as the South Korean steel manufacturer SeAH Steel Holdings investing in a monopile factory at Teesside. 179



As part of the UK Governments initiative to support the supply chain, the Floating Offshore Wind Task Force (FLOW TF), was set up in 2022 by Government and key stakeholder organisations, including TCE and RenewableUK. ¹⁸⁰ FLOW TF aims to support the development of ports for FOW. The UK Government launched the Floating Offshore Wind Manufacturing Investment Scheme (FLOWMIS) in 2023. The scheme provides CAPEX monetary grants from a £160 million funding pot for port infrastructure upgrades to support the delivery of FOW. ¹⁸¹



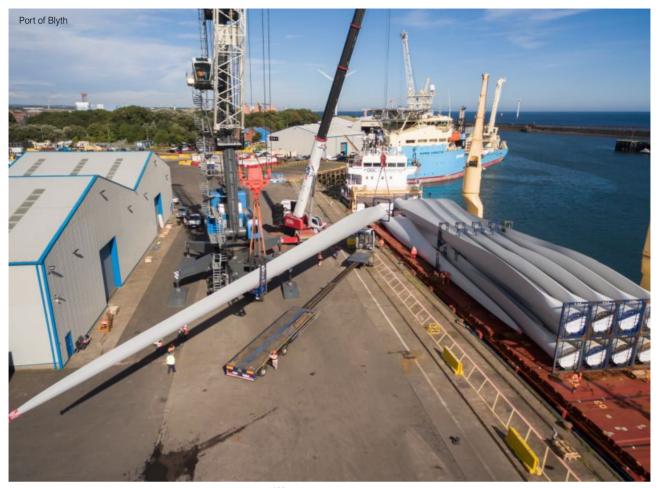


Figure 16 Wind turbine blades at Port of Blyth. 182

US (New York State)

The state has extensive port infrastructure across New York Harbor, Long Island, and the Hudson River with five active OSW port development projects. These are:

- Port of Albany for OSW manufacturing
- Port of Coeymans for manufacturing secondary steel
- South Brooklyn Marine Terminal for staging and assembly facility and Equinor operations and maintenance hub
- Port Jefferson for Ørsted and Eversource regional operations and maintenance hub and dockage for service operations vessel, and
- Montauk Harbor for Ørsted and Eversource operations & maintenance for South Fork wind farm and dockage for crew transfer vessel

New York's second OSW solicitation in 2020 included an innovative investment plan that required OSW generators to partner with any of the 11 prequalified New York ports to stage, construct, and manufacture key components, or coordinate operations and maintenance activities. The state also committed US\$200 million in funding for resilient port facilities. In 2022, the New York Government announced a further US\$500 million investment to support ports, manufacturing, and supply chain infrastructure to advance its OSW industry.





5.1.2 Current status of offshore wind in India

Several studies in India have explored the selection of ports suitable for OSW development and assessed their feasibility. The first such study, the FOWIND pre-feasibility study conducted in 2015 identified construction ports in Gujarat and Tamil Nadu based on distance to potential project locations, maximum vessel dimension, area for storage and heavy-duty components, and transport connection. These are:

- Seven ports in Gujarat: Jafrabad, Pipavav, Hazira, Nargol, Dahej, Porbandar, and Magdalla.
- Three ports in Tamil Nadu: Ennore, Chennai, and V.O.C (Tuticorin) along with 23 minor ports.

In 2016, a further ports assessment was developed by DNV GL as follows: 183

- In Gujarat two out of the seven initially identified in the FOWIND 2015 study were assessed, Pipavav, Hazira (including the Adani container port facility and Larsen and Toubro's fabrication facility), and two additional ports Bhavnagar, Port Okha
- In Tamil Nadu, Ennore, Chennai, and V.O.C (Tuticorin)

The DNV GL study concluded that it would not be cost-effective to upgrade ports for every vessel and turbine type. Further assessments would be required on a project basis after narrowing down turbine and foundation options during FEED studies, and when the OSW project capacities and development areas are more established.

The latest study was conducted in 2022 by the Centre of Excellence for Offshore Wind and Renewable Energy (COE), an initiative between MNRE and the Danish Energy Agency, in a report titled the *Offshore Wind Port Infrastructure Study for India*. ¹⁸⁴ This study undertook further assessment of the existing ports with potential to serve the installation and operations for OSW projects in Gujarat and Tamil Nadu. Key port infrastructure benchmarks including distance to potential OSW farms, channel depths, clearances, and berth dimensions were considered in a screening process to identify two priority ports in both Gujarat and Tamil Nadu:

- In Gujarat Hazira port and Pipavav port were identified as priority ports out of the ports identified in the FOWIND 2016 study, and
- In Tamil Nadu V.O.C (Tuticorin) port was prioritised and an additional port, Vizhinjam, was identified as having potential for OSW development.

The COE study concluded that these identified ports fulfil basic navigation and access criteria to support the installation of turbine components and foundations. While they are well adapted to handle their current operations, each of the identified candidate ports lacks readily available key infrastructure such as berths and yards that have the physical capacity necessary for the marshalling of turbine components. Purpose-built terminals are proposed for each of the locations, which are aligned with the existing port masterplan.

Additionally, in 2022, a virtual roundtable conference was held under the EU-India Clean Energy and Climate Partnership (CECP) to discuss OSW with a focus on port infrastructure. ¹⁸⁵ The conference shared European expertise on the requirements for ports to support OSW and identify any gaps. Detailed presentations were given by the V.O.C. Port in Tamil Nadu, which highlighted their preparedness and experience in handling large cargo for onshore wind projects and their readiness for OSW. ¹⁸⁶ The port of Pipavav, Gujarat, emphasised the surveys and upgrades needed to enable OSW projects and the government's role in supporting investments in port infrastructure. ¹⁸⁷The port of Pipavav, Gujarat, emphasised the surveys and upgrades needed to enable OSW projects and the government's role in supporting investments in port infrastructure. ¹⁸⁸



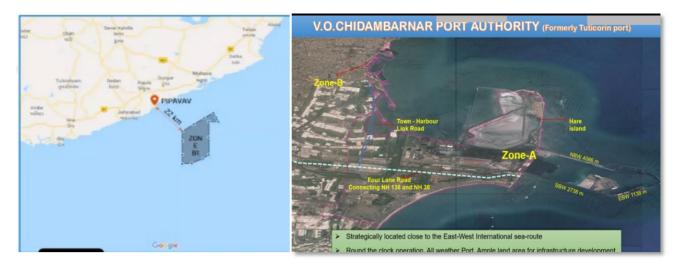


Figure 17 Port of Pipavav, Gujarat on the left and the Port of Tuticorin, Tamil Nadu on the right.

MNRE is preparing a proposal to revamp the ports of Pipavav and Tuticorin to accommodate OSW projects. MNRE mentioned that the development of Pipavav port is estimated to require INR 62,200 lakh, while Tuticorin would need INR 73,200 lakh. The decision on funding for these projects—whether through government funds or by seeking financing from international sources like the World Bank—will be determined by the Indian government. ¹⁸⁹

5.1.3 Discussion and recommendations

Discussion

Ports supporting OSW projects require access to channels and berthing pockets sufficiently deep for modern installation and transport vessels. They also require long, reinforced quaysides for handling components and large laydown areas with high load-bearing capacities. Established markets such as the Netherlands and the UK show that ports have benefitted from support from national, local, and regional governments. Support can come in the form of direct investments, grants, business support, and the ability to offer favourable rates. The need for strong support is greater for ports lacking commercial expertise or limited in their investment capacity as they may otherwise struggle to raise the investment needed to make major port improvements.

Indian ports fulfil basic navigation criteria but lack physical capacity to meet the demands of OSW projects, especially in terms of marshalling and handling large OSW components. Although they are well equipped for current operations, they lack yards and berths suitable for marshalling turbine components. While some ports have experience in handling large cargo for onshore wind projects, their readiness for OSW projects is limited, requiring purpose-built terminals and additional infrastructure. The need for government support in enabling investigations and investing in port infrastructure has been emphasised during recent government and industry discussions.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- Ministry of Ports and Shipping, in partnership with Gujarat Maritime Board, Tamil Nadu Maritime Board and similar in other states, finalises funding responsibility to invest in key port infrastructure upgrades to facilitate import, manufacture, assembly and load-out of major OSW farm components, ensuring capacity is aligned with market expectations.
- Ministry of Ports and Shipping develops a long-term multi-phased plan for developing an offshore renewable energy hub within the port facilities of Hazira, Pipavav, Tuticorin, and Vizhinjam. This should sit alongside securing permits for future expansion to keep pace with the growing demand for services within the OSW



sector, and a strategy of attracting major anchor tenants around which wider supply-chain businesses and infrastructure can grow.

5.2. Supply chain

5.2.1 Learning from global markets

Australia

On a federal level, the Australian Government has not set local content requirements relating to OSW. At a state level, Victoria announced its intention to apply the Local Jobs First policy to ensure local content in Victorian OSW developments. The policy mandates that Victorian labour be used for a certain percentage of total estimated labour hours, with specific requirements depending on contract value. ¹⁹⁰ Again, the Victorian Government also recognises that Australian OSW supply chains are not well established, and thus a balance must be struck between local content and



international expertise. It will therefore set initial local content requirements, with the expectation that these will be ramped up over time as local capacity and expertise improves. It is currently engaging with businesses and other industry stakeholders to assess local capability and expects to release local content guidance and targets by the end of 2023. 191

The Australian OSW industry will likely encounter challenges sourcing installation vessels during project construction. Due to the growing international pipeline of OSW projects and targets, it is expected that demand for vessels will outpace supply relatively soon. To exacerbate the problem, vessel operators may be weary of accepting Australian contracts due to the relatively small market size and long voyages required. ¹⁹²

Japan

Japan has set an aspirational 60% local content target for its projects. As part of this effort, GE and Toshiba have committed to localise the production of components for GE Haliade-X turbines that will power 1.7 GW of projects successful in the Round One auction. The local industry has also seen positive developments as Shimizu and Penta Ocean placing orders for installation vessels that will be required to overcome cabotage restrictions. Prominent European marine contractors have entered joint ventures to operate in Japan, with Van Oord and Kajima taking on the role of EPCI contractors responsible for delivering Round One projects. Japan Future Enterprise (JFE) has also pledged to construct a facility for managing and transition pieces. Japan already has production capabilities for her



for monopiles and transition pieces. Japan already has production capabilities for both high-voltage and medium-voltage subsea cables.

Netherlands

The Netherlands boasts a rich maritime heritage and hosts a comprehensive OSW supply chain encompassing foundations, substations, array cables, offshore site investigations, heavy lifting, and EPCI services, all of which play a pivotal role in facilitating domestic project development. Consequently, the Dutch Government has refrained from imposing local content restrictions on OSW developers, instead adopting a more lenient approach. This approach entails assigning a degree of importance to non-price evaluation criteria in bid assessments, focusing on each developer's dedication to enhancing the contributions of local suppliers throughout the project lifecycle.





The Dutch Government's strategy for developing its supply chain revolves around aiding domestic firms in expanding their influence across global markets. This objective is primarily accomplished through robust government branding and international promotion of domestic expertise. High-quality publications such as the Dutch Offshore Wind Guide and active participation in international trade missions play a crucial role in this endeavour. ¹⁹³ The Government has also established a team of OSW advisors dedicated to facilitating international business development, as well as conducting and disseminating research to address the specific requirements of the domestic supply chain.

United Kingdom

The UK has a relatively strong supply chain to support OSW development. Regulations require developers to have a government-approved supply chain plan, including innovation, skills, and competitive local supply, before bidding into its revenue support mechanism for OSW. Supply chain plans must include commitments and ambitions to the local supply chain.

The UK Government opted not to impose a local content requirement initially to prevent hindering industry growth. As the market matured, a sector-wide target of achieving 60% local content by 2030 was established as part of the Offshore Wind Sector Deal³⁵, instead of enforcing specific local content requirements on individual project developers. This approach grants developers the flexibility to determine the



most advantageous means to integrate local content. Local content requirements are not formally marked as part of a CfD bid and do not contribute to the success of a supply chain plan. 194

Schemes and incentives by the Government or other stakeholders exist to support the supply chain and encourage investments in the industry. This includes 195,196,197:

- Offshore Renewable Energy Catapult (OREC), which leads technology innovation and research for offshore renewable energy. OREC delivers the Offshore Wind Growth Partnership (OWGP).
- The Offshore Wind Growth Partnership (OWGP) is a long-term business transformation programme established as part of the 2019 UK Offshore Wind Sector Deal with an investment of up to £250 million. It promotes closer collaboration across the supply chain, implements structured productivity improvement programme, and facilitates shared growth opportunities between developers and the supply chain. Delivery is focused on direct support to supply chain companies through a combination of strategic capability assessments, advisory services, and grant funding. The Sector Deal also has a target to increase exports to £2.6 billion per year by 2030.
- The UK Government introduced the Offshore Wind Manufacturing Investment Support Scheme (OWMIS) in 2020 to provide CAPEX monetary grants for OSW manufacturing facilities. The scheme has supported the creation of industrial clusters at Humber (US\$104 million) and Teesworks (US\$28 million).

These offerings and support schemes give developers confidence that government and industry support the supply chain and that the UK market is stable. To enable clear communication about local supply, the UK Government and industry worked together to establish the UK Content Methodology to document UK content on OSW projects. ¹⁹⁸ As part of the Offshore Sector Deal, the UK Government has committed to revising the methodology for measuring local content and increasing transparency with industry.

US (New York State)

New York State has made commitments to invest US\$700 million in the OSW supply chain infrastructure, ports, and manufacturing in New York. NYSERDA plans to make these investments through a three-stage process:





- Stage 1: NY3 Paired Supply Chain Investment Proposals. In NYSERDA's 2022 solicitation projects were
 required to submit at least one bid with a Supply Chain Investment Proposal (SCIP). The proposals must
 be for substantial industry components, such as ports, blades, cables, foundations, etc. To leverage
 private financing, the SCIP proposals were to have at least a 2:1 ratio of non-NYSERDA to NYSERDA
 funding.
- Stage 2: Supply Chain RFP. Now that the winners of the 2022 solicitation have been announced, there will
 be a further RFP for supply chain investment plans that are not paired with an OSW project bid. The
 proposals are limited to major OSW components such as foundations.
- Stage 3: Supply Chain Support RFP. This RFP will be like Stage 2 but be open to sub-component manufacturing and smaller businesses.

With the announcement of the 2022 solicitation winners in October 2023, an award of US\$300 million was made to support the development of a nacelle manufacturing and assembling facility and a blade manufacturing facility.

Another mechanism for supply chain investment is the Inflation Reduction Act's (IRA) Advanced Manufacturing Production Tax Credit scheme. This offers tax credits to domestic manufacturers and sellers of wind farm components.

5.2.2 Current status of offshore wind in India

The current Indian frameworks do not include any local content requirements (LCR) for OSW development. Neither the prequalification criteria nor the technical evaluation for bidders given in the *draft RfS* tender states the need or gives any weighting to local content requirements for OSW projects.

No investments have been announced for the OSW supply chain in the country. The degree of investment in OSW supply-chain development in the country will depend on the scale achieved within the next 5 years, which will provide more clarity regarding potential investors.

Establishing a local OSW industry and supply chain in India will present challenges, underscoring the significance of cooperation with foreign suppliers. As India gains expertise in the development process and witnesses the growth of operational wind farms, new areas of expansion within the local supply chain will likely emerge. Multiple studies have been conducted to assess the readiness and feasibility of OSW supply chain in the country ¹⁹⁹:

- Capability Assessment of India's Offshore Wind Supply Chain analyses the feasibility of seven core work
 packages (nacelles, blades, towers, foundation, substation, cables, and vessels) required for OSW
 construction which comprise most of the capital expenditure across five key parameters:
 - Indian supply chain record
 - market readiness
 - o logic of Indian supply, and
 - o R&D readiness.

The study highlights the need for extensive R&D by companies to adapt their technical capabilities for OSW requirements and investment support from the government.

Supply Chain, Port Infrastructure and Logistics Study provides an overview of key supply chain elements
required for OSW and gives a high-level appraisal regarding the feasibility of local supply for key components
in the medium and long term. The study concludes that while local companies have the potential to move
into the OSW sector, they will require some collaboration and capacity building with experienced partner
organisations, particularly during the initial development stages. The study proposes that if India builds a
substantial project pipeline and introduces attractive incentives, it is expected that the local supply chain will
expand in tandem, attracting both domestic and overseas manufacturers to invest and grow their operations.



Supply Chain Study for Offshore Wind in India provides an extensive overview of past studies examining the
essential components needed for OSW development in the supply chain. It presents the existing gaps in the
supply chain and proposes the necessary infrastructure enhancements to optimise OSW operations. The
study emphasises that while the supply chain requirements for OSW farms in India offer significant business
prospects, the presence of a robust framework is imperative to reduce risks for businesses. The study also
indicates that in the initial development phase (0 GW to 5 GW), cooperation between Indian and European
companies will be essential. Again, post 2030, when India aims to achieve 30 GW of OSW capacity, a fully
established local supply chain is anticipated to be in operation.

The onshore wind sector has not enforced any LCR for manufacturing in India. Nevertheless, despite the absence of LCR, the industry presently boasts a local content manufacturing rate of 80%, primarily attributed to the substantial market volumes attained between 2012 and 2017.²⁰⁰

5.2.3 Discussion and recommendations

Discussions

The COVID-19 pandemic disrupted global OSW supply chains, causing delays in manufacturing, transportation, and delivery of critical components for OSW projects. This led to bottlenecks in the availability of turbines, cables, and other essential components, impacting project timelines and costs within the sector. The aftermath of this continues to impact the industry as supply chains recover. These delays, combined with general inflation and increased demand for skilled labour components have caused price escalation, impacted project budgets, and challenged the financial viability of OSW projects. This illustrates the key role that functional global and local supply chains have on the overall health of the OSW sector.

To build resilience within the OSW supply chain, it is essential that governments encourage diversification of suppliers and manufacturing locations, enhance logistics and transportation networks, and strengthen local supply chain.

The Indian supply chain faces significant challenges marked by minimal investments and a lack of definitive plans for future supply chain development. India's supply chain opportunity is to establish a high-volume market by laying down a robust policies and frameworks and enhancing market visibility. Established markets such as the UK and Netherlands show the efficacy of this approach in fostering local economic advantages without necessitating stringent local content requirements. It also allows reduction in cost to consumers and creates a more sustainable, internationally competitive supply chain. For example, to drive innovation, skills, and competitive local supply, the UK Government mandates a government approved supply chain plan for bidding into its revenue support mechanism.

Indian companies show potential for OSW sector entry but require capacity building and collaboration with experienced organizations, especially during initial development stages. Established markets highlight the necessity for extensive R&D and facility investment by companies to adapt technical capabilities for OSW requirements. Investment support from the Government along with a robust framework is essential to mitigate risks for businesses venturing into the OSW supply chain. The onshore wind sector in India has achieved a high local content manufacturing rate despite the absence of enforced LCR, primarily attributed to substantial market volumes achieved in a specific time frame.

Given India's vast size, it holds immense potential to become a significant player in the global (and especially the South Asian) OSW market. Achieving an annual installed capacity of 3 to 5 GW would enable India to establish at least 2 or 3 factories for each major component, meeting much local demand as well as enabling export, based on India's long-term experience of onshore wind and its competitive supply capability.

Efficient and competitive manufacturing facilities for foundations, subsea cables, blades, nacelles and towers each need to be of a scale to supply 1 to 2 GW per year of components (so upwards of the equivalent of one foundation per week). To obtain good local competition, a government needs at least 3 local facilities to compete. The business case for most OSW manufacturing facilities will be based on supply to more than one national market.



Indicatively, a market of 3 GW per year could enable 3 local 1.5 GW-scale facilities each to supply 1 GW locally and up to 0.5 GW for export. Each of these facilities then needs a supply chain to provide input components, materials and services.

Some facilities, such as for some types of foundation are often the first to be localised, whilst nacelle assembly is often the last, due to the specialist supply chain required and the relatively low cost of final product transport compared to other components.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- Ministry of Finance in partnership with MNRE, Ministry of Heavy Industries, Ministry of Steel, Ministry of
 Commerce, and Industrial development boards of Gujarat and Tamil Nadu and other states, invests in
 publicly funded innovation programmes to reduce levelized cost of energy (LCOE) and help increase local
 supply content.
- NIWE, in partnership with Indian Institute of Technologies and other engineering and technical institutes, invests in incubation and apprenticeship programmes to help coach local suppliers and businesses, including training of parallel sector workers.
- MNRE facilitates investment in local supply chain by offering financial incentives such as grants, tax credits, or subsidies to establish local manufacture of towers, foundations, and port facilities.
- MNRE develops measures to encourage local supply chain investment, including consideration of including non-price factors in leasing and revenue models and the inclusion of supply chain plans as part of the bidding criteria, taking care to avoid stringent local content requirements that might add risk and cost to projects and slow deployment.
- MNRE establishes robust, usable methodology for measuring and aggregating local content (at national or state level) to enable clear communication between industry and Government.
- MNRE creates policies and frameworks that incentivise technology transfer collaboration between Indian
 organisations and organisations with offshore wind experience in other markets. Provide financial incentives
 or tax benefits to encourage joint ventures, partnerships, and knowledge sharing. Support European
 manufacturers in setting up local manufacturing facilities or production units in India to cater to the South
 East Asian countries.
- State Maritime Boards facilitates the early stakeholder and public engagements, with a focus on establishing a local supply chain.
- Ministry of Ports and Shipping, Chief Minister offices and Development Authorities of Gujarat and Tamil Nadu and other states, facilitates the development of industrial clusters through supportive policies, funding for business networks, and other initiatives encouraging industry collaboration and investment.
- NIWE facilitates skills development and skills transfer from other sectors to develop the workforce required to
 deliver the OSW targets. Invest in incubation and apprenticeship programmes to help coach local suppliers
 and businesses, including training of parallel sector workers.



5.3. Transmission networks

5.3.1 Learning from global markets

Australia

Australia is still highly dependent on coal and natural gas for electricity generation. The current transmission infrastructure will require upgrades as penetration of renewable generation increases.

While the Australian federal Government is responsible for identifying and declaring zones with potential for OSW development in the form of REZs, the investigation into transmission network upgrades is be led at a state level. In preparation for the emerging OSW industry in Victoria, VicGrid has released its *Offshore Wind Transmission Development and Engagement Roadmap*. The roadmap outlines how the state will approach the transmission network upgrades required for the introduction of OSW into the grid.²⁰¹ VicGrid's investigation is still in its early phases, and whilst recognising the key role that transmission networks play in the development of OSW it has yet to confirm a firm upgrade strategy or next steps.

Japan

A key challenge for Japan is that the eastern and western parts of the country each have different grid frequencies of 50 Hz and 60 Hz, respectively. This limits the amount of electricity transfer that can occur within the country without the construction of new frequency converter facilities and is a limiting factor in the growth of renewable energy. METI is currently considering a new master plan to upgrade the grid nationally, which if realised will benefit OSW operators.



Netherlands

The integration of OSW energy into the Netherlands' electricity grid is facilitated through a comprehensive planning and upgrade system, orchestrated by the Dutch Government in collaboration with energy companies and various stakeholders. This process leads to the formulation of OSW development plans that outline the location and timing of wind farms. Tenne T, the national transmission system operator, assumes responsibility for permitting, constructing, and maintaining offshore substations, offshore export cables, and onshore export cables, thus connecting OSW farms to the onshore grid.



To achieve deployment targets, Tenne T is set to construct seven 700 MW HVAC connections by 2026, with plans to transition to 2 GW HVDC connections from 2028, due to the increasing size and distance from shore of future developments. Tenne T has also outlined its vision for a North Sea power hub, collaborating with TSOs in neighbouring countries on a 'hub and spoke' offshore concept designed to enhance interconnection between Germany, the Netherlands, and the UK. This concept encompasses the realisation of energy islands and explores potential power-to-x applications.



United Kingdom

England, Scotland, and Wales

Communities raised objections to onshore grid infrastructure associated with approved OSW projects in East England. Campaigners called for better coordination and integrated solutions to minimize onshore impacts. A cost-benefit analysis revealed that a more holistic, integrated approach to future wind pipeline export systems could yield significant capital savings. Ongoing UK planning aims to balance these considerations for effective future infrastructure development.

yield significant capital savings. Ongoing UK planning aims to balance these considerations for effective future infrastructure development.

BEIS (now DESNZ) launched the Offshore Transmission Network Review (OTNR) in July 2020 with the objective of ensuring that electricity generated by OSW farms is delivered appropriately. This includes using a more coordinated approach to transmission planning rather than that deployed to date which had relied on individual p

transmission planning rather than that deployed to date which had relied on individual point-to-point connections between a wind farm and landfall. ²⁰² Historically OSW projects in the UK have been connected by point to point or radial connections. Non shared components, such as cables or substations, are expensive and require a long time to plan out and obtain the necessary permits. The review, which has been underway for 3 years, aims to reform the export system and grid. The Holistic Network Design (HND) was published in 2022 to provide an integrated approach for connecting 23 GW of OSW to the UK.

OSW projects are required to have a transmission connection with the National Grid ESO. This has been done on a first come first serve basis where transmission connection applications were placed in a queue. In November 2023, Ofgem announced new rules to speed up the electricity grid connection process. It involves cancelling grid connection agreements for dormant projects and reforming the first come first serve system to a queue management milestone system. On 27 November 2023, the reformed system will apply to existing and new grid connection agreements and National Grid ESO will release guidance on how it will use its powers with first terminations likely to happen as early as 2024. ²⁰³

Northern Ireland

SONI is responsible for the operation and planning of the transmission system. SONI began a multi-year programme in 2011 known as DS3 (Delivering a Secure, Sustainable Electricity System) to meet the challenges of operating the electricity system and increase the potential volume of renewable generation on Northern Ireland's power system and to reach the goal of reaching 95% electricity consumption generated by renewable sources by 2030. ²⁰⁴

US (New York State)

To accommodate New York State's goals of 70% of electricity coming from renewable sources by 2030 and 9 GW of OSW energy by 2035 the electricity grid will need to be upgraded to increase capacity and effectiveness of the transmission system. ²⁰⁵

d Part of this study was the

In 2021, the New York Power Grid study was published by NYSERDA, NISO, and New York utility companies for the New York State Public Service Commission. Part of this study was the *Offshore Wind Integration Study* which concluded that ²⁰⁶:

- Major onshore bulk transmission upgrades were required to accommodate the state's OSW goals
- A meshed offshore network for OSW projects would be a solution to achieve a more reliable energy supply, and
- Collaborative planning will be necessary to overcome the cable routing and permitting challenges through New Yorks Harbour.



Recommendations from the study have already been implemented, such as the 2022 NYSERDA solicitation requiring that proposed project substations be meshed ready.

5.3.2 Current status of offshore wind in India

Transmission planning for high-voltage transmission assets in India is the responsibility of the Central Electricity Authority (CEA) and is addressed on a 5 year to 10 year time horizon. Recently, in 2022, CEA released a blueprint for a transmission system for integration of over 500 GW RE capacity by 2030.²⁰⁷ This plan encompasses the establishment of a 10 GW OSW grid with an investment value of INR 281,000 million, with 5 GW allocated for Gujarat and another 5 GW designated for Tamil Nadu by the year 2030.

In Gujarat, the FOWIND study recommended a 400 kV transmission line from Amreli with 800 MW capacity. The current transmission plan calls for the integration of 5 GW in Gujarat through two substations, one with 2.11 GW to be completed by 2027 in Mahuva, and the other with 2.38 GW by 2030 in Ubhrat, as illustrated in Figure 18.

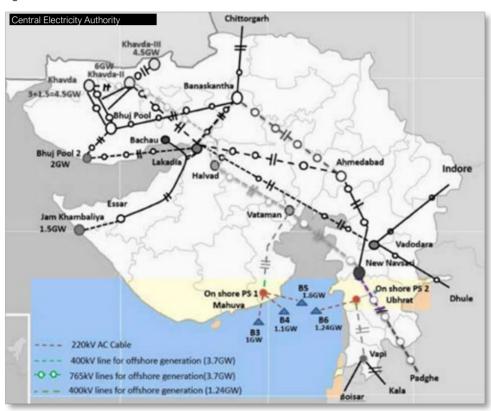


Figure 18 Transmission system for offshore wind potential zones in Gujarat. 207

Based on a prior study conducted by FOWIND in 2016, the identified substation for Tamil Nadu was Samugarengapuram, which had an 824 MW capacity. Again, in the current transmission plan, there is a proposal to establish a single substation at Avaraikulam in Tirunelveli District to integrate 5 GW of Inter State Transmission System with 12x500 MVA, 400 kV to 230 kV lines. The evacuation of this 5 GW of capacity is planned in two stages: 2 GW by 2027 and the remaining 3 GW by 2030 as illustrated in Figure 19.



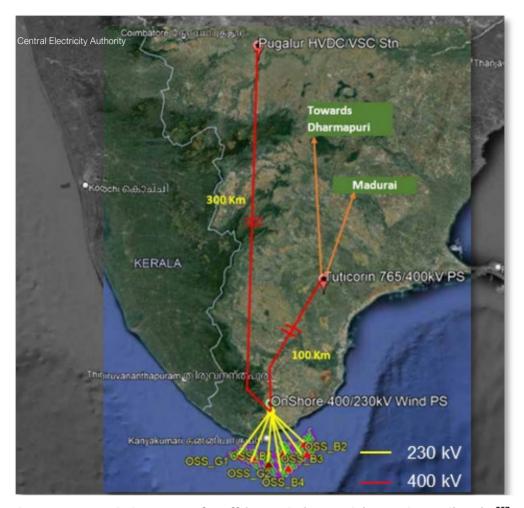


Figure 19 Transmission system for offshore wind potential zones in Tamil Nadu.²⁰⁷

Although budgeting has been carried out for the onshore substation of the OSW grid as part of the transmission plan to integrate 500 GW of renewable energy capacity by 2030, there is currently a lack of information regarding the budgeting for the export grid and offshore pooling substations. Based on engagement with MNRE discussions are being held with the Ministry of Finance to allocate a budget for the construction of export grids and offshore pooling substations in India. It is essential to address this gap and establish a clear budgeting plan for OSW grid planning in Gujarat and Tamil Nadu.

5.3.3 Discussion and recommendations

Discussion

Transmission links OSW to the onshore grid, enabling power evacuation and access to electricity markets. Without proper planning, grid connections can become a major bottleneck to the development of an OSW industry. Established markets such as the Netherlands and the UK undertake a planned approach to identify key reinforcement needs and work closely with developers and stakeholders.

The demand created by net zero targets will require substantial upgrades to India's transmission and distribution network over the next three decades. While current plans mark the initial phase of upgrades, a more expansive and forward-looking vision out to 2050 is imperative to effectively support India's energy transition. The current transmission plan outlines the integration of 10 GW of OSW capacity in Gujarat and Tamil Nadu by 2030. It budgets onshore substations but lacks clarity on export cables and offshore substation costs. Discussions are underway to allocate budget for export cables and offshore substations which demonstrates the necessity for government support and funding, but no firm plans have been announced yet. Lack of finalized budgeting plans can pose a serious challenge to timely infrastructure development for OSW projects. This necessitates a more aligned and structured approach to transmission planning for OSW projects.



The substation capacities identified in the FOWIND study fall short of the current transmission plan requirements. For instance, the proposal for a single substation in Tamil Nadu at Avaraikulam aims to integrate 5 GW of OSW capacity, a significant increase from the previously identified substation capacities. This highlights a need for substantial scaling up of infrastructure to match the envisioned OSW integration.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE and CEA, with support of CTU, publishes a 2070 vision for a nationwide transmission network
 development plan for a decarbonized energy system, with short-, medium- and long-term milestones and
 consideration of finance. This incorporates OSW development zones defined through MSP into the
 transmission network development plan.
- CTU and STU, with support from Regional Transmission Planning Committee, includes participation and coordination across key stakeholders such as developers, transmission network operators, energy regulators, and government during the planning process of the transmission network development plan.
- Grid India undertakes power systems studies to understand the potential impacts of large volumes OSW on the future transmission network and ESIAs in line with GIIP and lender requirements to understand the environmental and social implications of transmission network upgrades, feeding these into MSP activities.
- CEA prepares a well-documented plan to review and invest in transmission system upgrades with budget clarity for onshore substation, offshore substation, and export cables.

5.4. Financing mechanisms

5.4.1 Learning from global markets

Australia

No OSW project have been financed to construction in Australia to date. It is expected that future projects will follow the example of OSW in other markets where projects are financed with a combination of equity from the project developer and equity partners, and debt provided by domestic and international banks. The state of Victoria established its Energy Innovation Fund, which opened for application in February 2021 and has thus far completed two rounds of funding. The first round was focussed on OSW and provided funding towards feasibility and pre-construction activities. A total of AU\$37.9 million was awarded to three OSW projects²⁰⁸:



- Seadragon OSW Farm, receiving AU\$2.3 million
- Great Southern OSW Farm, receiving AU\$16.1 million, and
- Star of the South OSW Farm, receiving AU\$19.5 million.

Regarding Star of the South, expected to be Australia's first OSW farm, Copenhagen Infrastructure Partners (CIP) is providing 100% of the equity for the development of the project.²⁰⁹ In 2022, CIP sold a 10% stake in the project to Cbus.²¹⁰



Japan

In 2020, the Akita Noshiro Port project was financed by a combination of financial institutions and banks (MUFG Bank, Mizuho Bank, and Sumitomo Mitsui Banking Corporation).²¹¹ In 2022, the Ishikari project was financed by seven large banks (MUFG Bank, SMBC, SMTB, Mizuho Bank, Development Bank of Japan, Societe Generale, and Shinsei Bank). It had a debt finance of US\$73.74 million.²¹² In 2023, the Kitakyushu-Hibikina project was financed by three large banks (Mizuho Bank, MUFG Bank, and the Development Bank of Japan) and a syndicate of 34 other lenders.²¹³



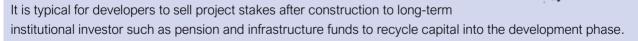
Netherlands

Dutch OSW projects employ a flexible financing approach, including equity stake sales, non-recourse project financing, and hybrid financing methods. International consortia of lenders, facilitated by early engagement with the European Investment Bank (EIB), ensure timely access to required funds, expediting final investment decisions. The EIB, a key supporter of green infrastructure in Europe, has historically committed to providing approximately €500 million for each new project before site concession tenders. Under these agreements, the EIB collaborates with the project winners to structure financing tailored to their preferences, incorporating loans, bonds, equity investments, or a combination of financial instruments.²¹⁴

United Kingdom

The UK has developed a range of OSW policies and frameworks that have been designed to meet needs of debt providers, for example the CfD mechanism which provides revenue certainty and stability over the course of a typical OSW wind farm debt term.

OSW farms in the UK are largely financed by long-term bank loans from large UK and international banks, for example, Barclays, HSBC, Lloyds Banking Group, and National Westminster Bank. A flexible financing approach is common for UK OSW projects, such as private investment (including international lenders), and limited and non-recourse debt.



US (New York State)

Under the Inflation Reduction Act (IRA) of August 2022, OSW projects are eligible for significant Investment Tax Credits (ITC). Two base rates are available, 6% and 30% depending on whether a project meets prevailing wage and apprenticeship (PWA) requirements. There are additional tax credits available of 10% each for meeting domestic content requirements and for location onshore facilities in certain areas such as fossil energy communities, low-income communities, or on tribal lands.²¹⁵



In October 2023, Vineyard Wind landed a US\$1.2 billion tax equity financing deal with Bank of America, JP Morgan Chase, and Wells Fargo. It further qualified for at least 30% ITC for capital investment under the IRA. ²¹⁶ The 30 MW Block Island wind project off the coast of Rhode Island was equity funded by Deepwater Wind at US\$ 70 million. It had a further debt finance of US\$297 million by nine banks.



Few projects have passed FID in the United States so there is no clear pattern of clear financing mechanisms yet.

5.4.2 Current status of offshore wind in India

India has public limited government companies including the Indian Renewable Energy Development Agency (IREDA), REC (formerly the Rural Electrification Corporation), and Power Finance Corporation (PFC), which provide funding for significant renewable energy ventures at interest rates typically ranging from 8.5% to 9.5%. ²¹⁷, ²¹⁸ These rates are contingent on the developer's credit rating assigned by external Credit Rating Agencies (CRAs). These agencies do have experience regarding financing for OSW projects, which require significantly greater levels of capital funding than onshore renewable energy and carry higher construction and operational risks.

The overarching policies and frameworks including 2015 *National Offshore Wind Energy Policy, 2023 Strategy Paper for Establishment of Offshore Wind Energy Projects and draft RfS* do not discuss the provision of government support in terms of concessional financing for the development and construction of OSW projects in India.^{43, 48, 84} The *draft RfS* issued for 4 GW of OSW in Tamil Nadu, under Model B, specifies that the developer is solely responsible for achieving financial close within 6 months of the date of the agreement, with a possible extension of further 6 months.

Within the industry, there are ongoing discussions regarding the financing of OSW projects in India. Notably, multilateral institutions such as the Asian Development Bank (ADB) and the World Bank have offered lines of credit for certain infrastructure development related to OSW energy projects, including ports and grid infrastructure. ²¹⁹ Similarly, private entities like L&T Financial Services, IDFC, Axis Bank, and various others are in the process of determining their strategy for financing OSW projects.

Several financing strategies are available for OSW projects, including credit enhancement, which is designed to enhance the credit risk profile of a project by securing a guarantee for a specific amount. Organisations like UK Export Finance provide credit enhancement services by backing loans and imposing fees and premiums for their support. The exact fees are determined based on factors such as the project's creditworthiness and risk. MIGA, an entity associated with the World Bank, offers a similar credit enhancement instrument. Notably, one of the significant challenges highlighted in various discussions is securing financing during the development stage when project risk is at its peak, especially under Model B where offtake arrangements are not clear. There is a need for concerted efforts to formulate a comprehensive strategy for OSW project financing in India.

In parallel industries in India, typically partial recourse financing is followed for renewable energy projects. During the construction phase balance sheet financing is followed to mitigate the risk of the lender. ²²⁰ Once the project becomes stable, it transitions to project financing, where the project itself serves as collateral. Financing for solar and onshore wind projects is typically provided by domestic public and private banks, international banks, and through recently emerging instruments such as green bonds.

Interest rates for onshore wind projects typically range from 8% to 9%, while solar projects tend to have lower rates, at around 7%. This difference in interest rates is primarily due to the higher risks associated with onshore wind projects, which is expected to be even more pronounced for OSW projects. Notably, in India, there is a trend of refinancing projects multiple times over their 20 years to 30 years lifecycle to reduce interest rates and extend the repayment period. This trend reflects the increasing maturity of the market. Furthermore, green bonds are gaining popularity as a means of refinancing operational projects. This leads to a clear opportunity for the government to address this gap and make OSW projects more viable.



5.4.3 Discussion and recommendations

Discussion

OSW is a highly capital-intensive industry requiring significant participation from the banking sector and the capital markets. Established OSW markets show the importance of flexibility in financing, early engagement with financial institutions, leveraging tax incentives, and exploring diverse financial instruments to raise capital for OSW projects. Collaboration between public and private sectors, tailored financing, and adapting to evolving regulatory incentives are crucial aspects that contribute to successful funding for OSW projects. For emerging markets such as Australia, attracting experienced international developers with a track record of successful projects and established relationships with global financial institutions will instil confidence in international lenders, making it easier to secure funding for projects.

Existing Indian policies and frameworks do not address concessional financing or specific government support for OSW projects. While multilateral institutions like the Asian Development Bank and private entities are exploring strategies for OSW financing, discussions between credit rating agencies and financial institutions regarding funding OSW projects are lacking. Despite the availability of credit enhancement strategies offered by entities like UK Export Finance and MIGA, securing financing during the high-risk development phase, particularly under Model B where offtake is uncertain, remains a significant challenge.

The prevailing financial models in parallel renewable energy sectors transition from balance sheet financing during the construction phase to project financing once stability is achieved. Again, OSW projects are expected to carry higher risks compared to onshore wind and solar projects, resulting in potentially higher interest rates. Additionally, the absence of an established market for OSW projects poses challenges for refinancing and reducing interest rates over project lifecycles.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE develops a plan for OSW considering the needs of lenders, especially with regard to issues such as PPA revenue stability, exchange rate risks, PPA counterparty credit worthiness, and curtailment risks.
- MNRE introduces investment incentives during the development and construction phases, including
 instruments such as tax credits, to accelerate the development of OSW.
- MNRE and Ministry of Finance, in partnership with multilateral and international lenders, provides financial mechanisms to reduce cost of capital, including access to climate finance and other concessional finance.
- MNRE supports the engagement of the local finance community with OSW including communication of
 environmental and social performance standards required to gain access to international concessionary and
 project financing.
- IREDA and REC, encourages early engagement with credit enhancement providers to prepare the financing of OSW projects.



5.5. Socioeconomic impact

5.5.1 Learning from global markets

Australia

The Australian Government has established the Net Zero Economy Taskforce to advise the government on how Australians can best benefit from renewable energy developments. The Australian Government has also set aside part of the national budget to invest in the burgeoning renewables industry. Budget initiatives relevant to OSW job creation are²²¹:



- AU\$1.9 billion to establish the Powering the Regions Fund, which is intended to support Australian industry to decarbonise, facilitate the development of new renewable energy industries and help develop the new energy workforce, and
- AU\$0.5 million in 2022 and 2023 to support the establishment of OSW and other renewables.

The Australian Government estimates that the OSW industry could create 3,000 to 8,000 jobs in regional coastal communities annually. Furthermore, through the Partnership and Engagement Plans that developers are encouraged to create by the Clean Energy Council, developers inform communities of potential job opportunities, scholarships, and community funds that are made available to communities affected by OSW development.

The Offshore Electricity Infrastructure Act 2021 operates under the principle of shared use of the offshore environment. The Australian Government is interested in facilitating the coexistence of OSW developments and fisheries. Throughout the area declaration and licence approval process, public stakeholders are invited to comment on proposed developments, and it is at these stages that the Australian fishing sector can provide input and seek collaborative measures to facilitate the coexistence of wind developments and fishing activity. The Clean Energy Council also encourages developers to perform community engagement. Developers are finding that effects on the fishing sector is a key area of stakeholder interest, and express interest in facilitating co-existence with the fishing industry. ²²³

Japan

Japan has a local content target of 60% by 2040 as part of the Vision for the Offshore Wind Power Industry.

Developers were not required to state their expected local content level in the Round 2 bidding documents but 8% of the developer's score is based on the anticipated domestic and regional 'economic ripple effect'. Again, it is unclear how this area is being assessed.

Prediction and assessment of anticipated local content in Japan is difficult because the auction occurs early in the project lifecycle and Japan's supply chain is still developing so predicting the availability of components at the time of eventual purchasing in the bid documents is challenging.

The Renewable Energy Institute, a Japanese renewable energy think-tank, estimates that offshore wind construction in Japan could generate between 26,000 and 14,000 direct offshore wind jobs per year between 2030 and 2050, based on their forecast of over 60 GW installed by 2050. They also estimate approximately 10,000 direct jobs in the operation of offshore wind power by 2050. ²²⁴



Netherlands

The Dutch OSW market has cultivated a robust pipeline of projects, offering a supportive regulatory environment with clear labour laws and prospects. This conducive atmosphere has attracted investment from globally competitive companies, fostering a thriving supply chain.

Concurrently, the RVO has collaborated with international recruitment firms to gain a deeper understanding of the future employment demands within the OSW sector.

Continuous assessment of personnel and skill requirements provides valuable insights for educational institutions seeking to design relevant courses.

Preliminary estimates indicate that the Dutch OSW industry will necessitate 2,484 full-time equivalents (FTEs) of domestic labour to deliver about 5 GW of new domestic capacity between 2019 and 2023. By 2023, there will be a consistent demand for 320 FTEs of directly employed labour annually to support operations, maintenance, and service (OMS) activities across installed projects in the Netherlands. These figures do not include the export opportunities available to Dutch companies serving the global OSW industry, but outline some of the benefits OSW development can realise.

United Kingdom

A 2023 report by the Offshore Wind Industry Council (OWIC) projected over 100,000 OSW jobs to meet 2030 targets and recommendations to achieve the 50 GW target. xxix,226 In support of socioeconomic growth, the UK Government set out plans and ambitious partnerships between government and industry in the 2019 OSW Sector Deal. 227 These includes:

- Setting a UK target of 60% local content by 2030 (rather than imposing any local content requirement on individual project developers), leaving it to developers to decide the most advantageous way to incorporate local content.
- Increasing the representation of women in the workforce to 33% (with a stretch target of 40%) by 2030 and improving representation from minority ethnic groups to 9% (with a stretch target of 12%).
- Setting up the Investment in Talent Group which aims to assess industry wide skill needs, create
 specialised training programmes, and offer accreditation. They are responsible for the Offshore Energy
 Passport for offshore workers, which enables smooth transitions between renewable and extractive
 industries. The group aims to establish a process to integrate ex-military personnel possessing relevant
 skills into the OSW sector.
- Establishing the Offshore Wind Innovation Group (OWIG) with industry, academic, and public sector representatives to develop an innovation support plan based on identified innovation gaps in OSW. The Offshore Wind Innovation Hub (OWIH) informs OWIG reports on areas of innovation that are needed in OSW and ranks how much UK benefit there is, including the potential to reduce LCOE and HSE impacts.
- Introducing the workforce and skills model to track and report workforce data developed by the National Skills Academy for Rail (NSAR).

xxix Established in May 2013, OWIC serves as a significant government-industry forum facilitating dialogue between the public and private sectors.



US (New York State)

In its 2019 and 2020 solicitations (revenue support auctions), New York state has balanced cost to consumers and local supply chain development. In a recent competition it awarded bidders 70% of marks for their per MWh price, 10% for viability (i.e., the likelihood that the project will be successful), and 20% for local economic benefits offered. In response, the winning bidder offered to establish in-



state facilities for the manufacturing of foundation components and towers, and port facilities for construction and operation.

To meet the goals of the Climate Leadership and Community Protection Act (CLCPA) NYSERDA has committed to US\$170 million in funding the workforce required for renewable energy development through different programmes until 2025. ²²⁸ Under the umbrella of their Workforce Development and Training Programmes, NYSERDA has six different initiatives including:

- NYS Offshore Wind Training Institute Workforce Training and Skills Development. Organisations such as community colleges, universities, non-profit organisations, or other groups can apply for funding to develop OSW training programmes.
- Clean Energy Internships. NYSERDA will help fund internships for students or recent graduates in clean energy businesses within the state.
- On-the-job Training: NYSERDA will provide eligible businesses with wage reimbursement at the start of a new hire's training period.

5.5.2 Current status of offshore wind in India

It is recognised that there is a gap between the existing skill set and the specialised requirements for OSW. Supply chain businesses require substantial investment in training programmes to equip workers with the specific skill sets essential for OSW projects.

The report *Gap Assessment of training and skill building in Offshore Wind energy sector in India* lists the key government and private institutes active in wind energy and offshore training programmes in India.²²⁹ It identifies the gaps and skills needed in the OSW sector value chain, maps the EU's technical expertise in training and capacity building for possible collaborations, and provides recommendations to improve the OSW sector skill base in India. The study also calculates the number of jobs created based on the average number of people required for a particular activity and the total wind turbine capacity installed. The total number of local direct jobs created for 30 GW installation by 2030 is estimated to be 31,150 person years.** The study also calculates local direct jobs created in depth related to the first 1 GW OSW projects during the construction and operation phase which is estimated to be around 900 person years. ^{230, xxxi}

The Global Wind Energy Council (GWEC) is working on a dedicated report to assess the socioeconomic benefits of OSW in India which is yet to be published. There has been no specific study to analyse the impact on GDP and gross value added (GVA) yet.

The National Offshore Wind Energy Policy mandates that project developers consider the project's impact on the livelihoods of local fishing communities during the planning phase. Efforts must be made to avoid encroaching on fishing grounds in the vicinity of the development site. In exceptional circumstances where the relocation of fishing grounds or fishing communities is necessary, the developer is required to offer appropriate compensation under the relevant policies established by the Central or state government. Again, there is no dedicated fund or programme currently in place to address these impacts.

xxx Person years is a unit of measurement used to measure the total amount of time that people are employed for. 10 person years is the equivalent of ten people working full-time for a year, one person working full-time for 10 years or five people working half-time for 4 years.

^{xxxi} During the construction phase, cumulative one-off direct work potential amounts to around 800 FTEs and during the operation phase, around 100 person years jobs will be generated.



5.5.3 Discussion and recommendations

Discussion

OSW projects create employment opportunities, and directly benefits local communities by offering jobs and stimulating economic growth. Projects often require upgraded infrastructure like ports, roads, and electricity grids, improving local infrastructure and accessibility, benefitting both the project and the community. Developers from both emerging and established OSW markets from the examples cited above are required to engage in community investment initiatives, contributing financially to local projects, charities, or community development funds, enhancing the area's social welfare. Established OSW markets such as the Netherlands and the UK and emerging market such as Australia involve local communities in the planning process, seeking input and addressing concerns. This engagement can foster a sense of ownership and support for the project. India is yet to extensively evaluate the socioeconomic impact of its OSW sector. A significant skills gap exists between existing skill sets and the specialized requirements for OSW, particularly in crucial areas like marine bed surveys and offshore construction. Substantial investments in training programmes are essential to equip workers with these specific skill sets. While the *National Offshore Wind Energy Policy* mandates consideration of local fishing communities' livelihoods during planning phases and offers compensation policies for necessary relocations, there's currently no dedicated fund or programme addressing these impacts.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE, in partnership with Ministry of Skill Development and Entrepreneurship, commissions a
 socioeconomic analysis to evaluate the economic benefits in terms of gross value added (GVA) and full-time
 equivalent (FTE) employment-years and to assess the impact of the about 40 GW OSW pipeline on local
 communities and industries.
- MNRE implements best practice to measure and address ethnic diversity, gender balance, and equality across Indian OSW.
- State Maritime Boards, SCZMA and, local maritime colleges, facilitates community engagement programmes to educate and involve local communities.

5.6. Decommissioning and circularity

5.6.1 Learning from global markets

Δustralia

While the commercial licence required for the construction of an OSW farm requires that projects be decommissioned at the end of life by the project owner, there are no current policies in place specifically outlining how decommissioning of OSW projects in Australia is to be undertaken. It is expected that as the industry develops, a detailed decommissioning plan will be developed.





Japan

Under the Marine Renewable Energy Act (MREA) the Occupancy Plan (OP) that is submitted by the developer during the leasing process in Japan must include the intended methods of decommissioning for the project. The developer must make assurances that funds will be available funds for the decommissioning process. The developer must either secure a guarantee through a financial institution to secure removal costs or must prove that they have the funds already in a protected account for decommissioning.



Netherlands

The Dutch OSW leasing process requires developers to provide a bank guarantee of €120,000/MW when a permit is issued to cover the future cost of decommissioning. This amount is indexed annually at 2% and is managed by the RVO which reviews decommissioning cost estimates after 12 years of operation. Developers are required to submit a full decommissioning plan for approval before decommissioning.

Guidelines covering the treatment of waste are covered by the *National Waste Prevention*Plan LPA3. This plan states that recovered metals must be recycled during disposal. For other materials, including thermoset plastics and composites that are used in the manufacture of turbine rotors and cables regulations are less clear. These are to be recycled if the price of disposal is less than €205/tonne. If disposal costs exceed this, recovered parts are to be burned for energy in facilities where emissions controls are regulated.

The first OSW farms in the Netherlands were realised in 2007 and 2008 and are likely to be operational until early next decade. Dutch seaports and their supply chains can capture significant value from supporting the decommissioning and recycling of OSW farms in Europe. If this is to be realised further policy development and investment research and development will be required in the years ahead.

United Kingdom

The *Energy Act 2004* contains the statutory decommissioning scheme for OSW.¹²⁹ BEIS (now DESNZ) has released guidance to assist developers in understanding the decommissioning process in the UK.²³¹ The developer is responsible for decommissioning, including costs, of their OREI at the end of its useful life. The UK Government seeks to protect the taxpayer from liabilities relating to OREI decommissioning. To ensure this, developers must provide financial security for the decommissioning of OREIs and submit a decommissioning programme to DESNZ. The Secretary of State approves decommissioning programme. Failure to deliver on decommissioning may result in fines or imprisonment. The typical stages for a decommissioning programme are:



- Preliminary discussions Developers should include an indication of decommissioning proposals as part
 of the process of securing consent. Submit a draft decommissioning programme, including financial
 security. This is to be submitted no later than 12 months before construction.
- Consultation with interested parties and show that comments have been addressed.
- Submit the decommissioning programme no later than 9 months before construction.



- Further reports and reviews are to be undertaken and submitted, no later than 6 months before
 construction. For example, a post-construction report on issues that arose during construction that may
 affect decommissioning.
- Once decommissioning is complete, a post-decommissioning report should be submitted to DESNZ.

Circularity is a growing area of challenge for the offshore wind industry and there has been an increasing focus on circular economy principles to reduce the environmental impact of waste and greenhouse gas emissions in the development, construction, and operations of OSW projects. Importance is given to the design of components for durability and recyclability and manufacturers have started to implement sustainable designs. ²³² In March 2023, the Coalition for Wind Industry Circularity (CWIC) was launched to drive creation of a circular supply chain for renewables in the UK. ^{233,234}

US (New York State)

Under the Code of Federal Regulations, Title 30, Part 585 Renewable Energy and Alternative Uses of Existing Facilities on the Outer Continental Shelf, the COP submitted to BOEM must include a section on the developer's decommissioning plan. The developer is required to submit a decommissioning application at the latest 90 days after the expiration of their lease. Once this has been approved, the



developer must submit a decommissioning notice 60 days before any decommissioning activities begin.

5.6.2 Current status of offshore wind in India

The guidelines issued about decommissioning effectively cover all aspects of the plan, do, and check (three phases of decommissioning) in the draft *RfS* document and construction and operation (C&O) lease deed.

- During the plan phase, the bidder is required to submit a decommissioning plan that serves as a prequalification criterion which is a pass or fail test to move on to further stages. Yaxii Further to this, the C&O lease deed requires the lessee to submit a decommissioning and site restoration programme to NIWE before the commencement of any construction. The programme shall be a part of EIA, and necessary clearances will be required from the Ministry of Environment and Forests (MoEF). A deposit or a financial guarantee will also be submitted by the developer to ensure proper decommissioning. The programme must be compliant with international best practices, applicable laws such as OSW energy lease rules 2023, and any such guidelines and norms as may be issued. Yaxiii
- In the do phase, the C&O lease deed lists out the obligations to be met by the lessee at the time of
 decommissioning in terms of clearance of seabed, removal of equipment, in a time bound manner of 5 years
 from termination of lease. It also touches upon circularity wherein the government promotes either the reuse
 or recycling of OSW energy components such as cables, equipment, wind turbines, and their parts.
- During the check phase, the lessee is required to furnish a report on the physical and financial progress of the decommissioning of the project (including any health and safety incidents that may have occurred) every quarter and promptly give any other relevant information as may be required.

In the case of onshore wind projects, the proposal to establish a wind power project should necessarily include a decommissioning plan of the wind turbine after the completion of its useful life. NIWE is responsible for formulating guidelines for decommissioning of the wind turbines for onshore wind projects, however, like OSW, currently, there is no policy in place for onshore wind as well.^{235, 236} The Draft National Repowering Policy for Wind Power Projects states that Wind Repowering Project Aggregators (WRPA) nominated by the Central and

xxxii As per draft RfS tender- Clause 40.2

xxxiiii As per National Offshore Wind Energy Policy- Clause 7.4.7, Draft C&O lease deed- Clause 8.3.1

xxxiv As per Draft C&O lease deed- Clause 8.3.1

xxxv As per Draft C&O lease deed- Clause 8.3.1



State nodal agencies will be responsible for decommissioning of the existing assets, including removal, lawful disposal of all scrap from the site, and disposal of the wind turbine blades. The turbine blades must be disposed of as per the applicable norms of MoEF and the Central State Pollution Control Board and a certificate from the appropriate authority must be produced.²³⁷

5.6.3 Discussion and recommendations

Discussion

Although some decommissioning has been carried out in established markets, solutions are yet to be optimised. Established markets such as Netherlands and the UK show that OSW decommissioning necessitates the development of comprehensive and clear policies that outline specific responsibilities, procedures, and environmental considerations. Robust enforcement mechanisms and technology-driven approaches for sustainable waste management are equally essential even though it is globally lacking. While guidelines exist for decommissioning in India, there's no policy specifically addressing OSW decommissioning leading to uncertainties and potential inconsistencies in executing decommissioning activities. The guidelines mandate the submission of decommissioning plans, financial guarantees, and quarterly reports. Again, there's a lack of clarity on how these requirements will be enforced and the repercussions for non-compliance. The guidelines promote circularity but lack detailed strategies for recycling or reusing components, especially concerning the specialized technology used in offshore projects. While guidelines mention compliance with international best practices and applicable laws, there is a need for explicit standards and protocols for environmental protection during decommissioning, especially concerning seabed clearance and disposal of materials.

Recommendations

Based on the findings, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant Ministries and agencies to maximise the benefits that offshore wind can bring.

- MNRE, in partnership with NIWE, publishes regulations on decommissioning of OSW projects including requirements on how to avoid developers defaulting on their obligations.
- NIWE establishes strategies for reusing and recycling materials and equipment to reduce waste. Set up a
 collaboration programme including stakeholders, industry players, and government bodies to foster best
 practices in circularity for the more established onshore wind and provide shared learning for OSW.



6. Conclusion and recommendations

6.1. Conclusion

India's ambition for delivery of large volumes of clean energy from OSW is evident in its leasing target of 37 GW by 2030, supported by significant groundwork and collaborations. The FOWIND project and other international partnerships have contributed to research, attracting investors, and starting to formulate frameworks. While progress has been made, comparing against established OSW markets highlights gaps in policies and frameworks. India can leverage learnings from these markets to expedite its development, understanding that success factors in OSW evolve over time.

Current gaps hindering progress include incomplete frameworks, limited local alignment, complex regulations, and inadequate stakeholder engagement. Addressing ambiguities in leasing, environmental assessment, and grid connection is vital. Enhancing coordination among agencies, fostering community awareness, and refining regulatory alignment are also pivotal for India's OSW growth.

This report presents examples and insights from different OSW markets, globally. The overview of OSW strategy, policy, frameworks, and delivery models in these countries has provided insights and diverse approaches that have propelled the growth of OSW energy in these countries and globally. These insights, while not direct recommendations for India, offer a broader perspective on what has worked and what challenges have been encountered.

An integrated approach – blending global learning with local implementation is key to India's aspiration to become an OSW leader. In doing so, India will not only advance its own green energy objectives but also contribute significantly to the global climate action efforts.

Central to this strategic pursuit is the role of stakeholder engagement. The diverse stakeholder landscape, as illustrated in this report, underscores the need for robust engagement and collaborative efforts. India must foster strong alliances and actively engage with both national and international stakeholders. Establishing communication and trust will be pivotal in overcoming technical hurdles, establishing robust and effective frameworks and unlocking investment and innovation in OSW.

India's path in OSW development will be uniquely its own, informed by global experiences but tailored to its specific needs and circumstances. The insights presented in this paper contribute to a deeper understanding of the OSW sector, offering a lens through which India can view its potential and prospects in this dynamic field.

Table 3 presents a gap analysis of the Indian OSW sector.

Table 3 Gap analysis for offshore wind in India.

Category	Sub-category	Gap analysis (RAG)	Commentary
Strategy and policy	Strategy and policy	Amber	National and state OSW policies and targets are not wholly aligned.
Framework	Marine spatial planning	Green	Marine spatial plans published by the Danish Energy Agency for Gujarat and Tamil Nadu provide good basis for first projects, subject to further stakeholder consultation.
	Leasing	Amber	The stated ambition and timetable to lease 37 GW of capacity by 2030 is a positive market signal. There are discrepancies between guidance documents that have been issued. Simplification of leasing processes is required.



	Environmental and social impact assessment (ESIA)	Amber	India as mentioned the need for ESIA in various OSW documents but misses out on providing guidance on stakeholder consultation with expert groups, local communities, and with local and state governments.
	Permitting	Amber	Unclear timelines, incomplete information around application formats, associated timelines and varying stakeholder involvement. Process to obtain final set of approval is unclear.
	Offtake and revenue support	Amber	There is a lack of certainty over revenue and potential for developers to secure an offtake arrangement for Model B and Model C.
	Export system and grid connection	Amber	There is a lack of clarity around responsibility for grid connection process, guidance on bay allocation for the OSW substation, guidelines, and compensation mechanisms around curtailment.
	Health and safety (HSE)	Amber	There is a lack of dedicated sectoral policy. Existing documents address certain aspects but lack comprehensive coverage across all project phases including construction, operations, and decommissioning.
	Standards and certifications	Amber	There is a lack of clarity around adherence to standards and certification requirements across various project phases.
	Community awareness	Red	There is no structured engagement plan for effectively engaging with and educating communities that may be impacted by OSW.
Delivery	Port infrastructure	Amber	The Ministry of New and Renewable Energy (MNRE) has planned INR 135,400 lakh to develop Pipavav, Tuticorin ports for offshore wind projects. It is yet to be confirmed if funding will be provided by the government or the World Bank.
	Transmission network	Amber	Plans for transmission network upgrades are in place. There is lack of clarity on budgeting for transmission system upgrades.
	Financing mechanisms	Amber	Ongoing discussions but no policies or frameworks in place to address financing of Indian OSW projects.
	Stakeholders	Amber	Stakeholders have been identified. But there is a lack of awareness and limited stakeholder engagement at the state and local level.
	Supply chain	Amber	Some capabilities exist but requires extensive government support to guide and implement capacity building and investment.
	Socioeconomic impacts	Red	Frameworks lack consideration of socioeconomic impacts. No fund or programme exists for local community development.



Decommissioning and circularity



Guidelines have been issued but lacks regulations to provide clarity around how these will be enforced.

RAG rating	Rating description
Green	A functional policy or process is in place that is well aligned with the key factors required to develop OSW.
Amber	Partial policy or process is in place, additional focus required to fully meet the key factors required to develop OSW.
Red	No functional policy or process is in place, significant focus required to meet the key factors required to develop OSW.

6.2. Recommendations for Indian offshore wind

From the analysis and findings of this study, the report recommends the following actions to be taken by the Indian and state governments, with the support of relevant ministries and agencies to maximise the benefits that offshore wind can bring.

6.2.1 Strategy and policy

Targets

- 1. Ministry of New and Renewable Energy (MNRE) publishes medium- and long-term visions for OSW to 2070 as part of a decarbonised energy mix for India, considering targets for other renewable energy technologies, explaining the case for OSW in terms of cost benefits and long-term contribution to the energy mix, and its role in India's net zero targets. This vision should include maximising the energy system value of OSW and the steps that Government and industry should take to drive cost reduction over time.
- MNRE, in partnership with Central Electricity Authority (CEA), Gujarat Urja Vikas Nigam Limited (GUVNL) for Gujarat, and Tamil Nadu Generation and Distribution Corporation (TANGEDCO) for Tamil Nadu, aligns MNRE OSW bidding targets with national and state-level OSW targets, to create urgency and a clear policy thrust for OSW.
- 3. MNRE establishes clear and binding medium-term OSW milestone capacity targets to 2047 with consistent capacity addition targets to provide industry clarity.
- 4. MNRE, in partnership with CEA, demonstrates the advantages of OSW in providing round-the-clock power to industrial centres in coastal areas. Simulations include OSW and hydrogen or other storage solutions and consider daily and seasonal supply and demand.

Collaboration and stakeholders

- 5. MNRE establishes a long-term official Government of India-industry task force along the lines of UK's Offshore Wind Industry Council (OWIC) involving local and international project developers and key suppliers, to work together to align interests, address gaps, and formulate solutions. xxxvi
- 6. MNRE establishes memoranda of agreement between relevant government departments, to define interdepartmental cooperation on OSW, covering strategy and policy collaboration, frameworks like MSP, leasing, permitting, power purchase, transmission, health and safety, and other key areas of delivery including supply chain, ports, and finance.
- 7. MNRE ensures best, strategic impact of international donor support through dialogue and collaboration. India is fortunate to have a range of governments and agencies willing to support in establishing a vibrant OSW market. Coordinating and integrating this support will be key.

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xxxvi https://www.owic.org.uk/



6.2.2 Frameworks

Marine spatial planning

- 8. National Institute of Wind Energy (NIWE), in partnership with Department of Science and Technology (DST), Indian National Center for Ocean Information Services (INCOIS), Ministry of Environment and Forests (MoEF), Ministry of Earth Sciences (MoES), National Institute of Oceanography (NIO) and National Institute of Ocean Technology (NIOT), undertakes similar OSW MSP processes for other states with OSW potential, to inform future OSW development opportunities beyond the early projects anticipated for Gujarat and Tamil Nadu, establishing a national OSW spatial plan.
- 9. NIWE, in partnership with INCOIS, DST, NIO and NIOT, updates the Gujarat and Tamil Nadu marine spatial plans, implementing the identified next steps of stakeholder consultation and additional data collection, as recommended in the published reports.
- 10. Gujarat Maritime Board, in partnership with Hazira and Tamil Nadu Maritime Board in partnership with Port of Tuticorin, promotes transparency in the MSP process and engage stakeholders, including local communities, environmental groups, and industries, in decision-making. Seek feedback and input from diverse stakeholders to enhance the effectiveness and acceptance of Good International Industry Practice (GIIP) across the process.
- 11. NIWE to provide a common public data repository for data published by developers and other stakeholders, including from MSP activities.

Leasing

- 12. NIWE clarifies the discrepancies between issued guidance with regard to preliminary qualification criteria.
- 13. MNRE, in partnership with NIWE, updates guidelines to ensure a minimum gap of 10 km between sites for Model C.
- 14. MNRE allows transfer of ownership in OSW projects to help share risks and resources.

Environmental and social impact assessment

- 15. MNRE reviews the Environmental Social Impact Assessment (ESIA) regulations and process for OSW against international standards, Good International Industry Practice (GIIP) and lender requirements and makes necessary updates and clarifications. To facilitate lending, international funding organisations need to ensure that projects meet their environmental and social standards.
- 16. MNRE, in partnership with Ministry of Environment and Forests (MoEF), State Department of Environment & Forest, and State Coastal Zone Management Authority (SCZMA), ensures stakeholder engagement as part of the ESIA process, including engagement with communities, marine industries, and other sea users.
- 17. MoEF provides guidance and establishes regulations applicable to developments located beyond 12 nautical miles from shore.

Permitting

18. MNRE, in partnership with Green Energy Transition Research Institute (GETRI), Guidance Tamil Nadu, Ministry of Home Affairs, Department of Space, Ministry of Defence, SCZMA, MoEF, and State Department of Environment & Forest, establishes specific agencies, formats, guidelines, timelines, and a comprehensive procedure for the permitting process.

Offtake and revenue models

- 19. MNRE fast-tracks Viability Gap Funding (VGF) for initial auctioned capacity.
- 20. MNRE introduces national level Feed in Tariff or Feed in Premium or Renewable Power Obligation (RPO) to provide market certainty and incentivise investments.



- 21. MNRE, in partnership with GUVNL, TANGEDCO and the power ministries of other states, establishes a competitive system solely for OSW power purchase agreements (PPA), with a ceiling price to limit cost to consumers and potentially a floor price in early years to avoid the risk of unrealistic low bids. Consultation on ceiling and floor prices should be with relevant stakeholders in the run up to competitions to reflect evolving fossil fuel and OSW prices, especially recognizing current high fossil fuel and commodity prices. A mechanism should be included to address multiple bids being received at the floor price, which may include the consideration of non-price factors.
- 22. MNRE, in partnership with SECI, develops a standard-form PPA for adoption across OSW projects to accelerate market development that provides stable income per unit of electricity generated. Consider indexation for commodity price changes between bidding and completion, inflation, and foreign exchange rate variations.

Export system and grid connection

- 23. Central Electricity Regulatory Commission (CERC) details procedures, timelines, and transparent compensation mechanisms for delays to grid connection to new OSW projects.
- 24. CERC, in partnership with State Electricity Regulatory Commission (SERC) publishes simulations to show that there will be no curtailment of OSW operational from 2035 onwards.
- 25. Ministry of Power, in partnership with PGCIL, develops a transparent and well-defined process for bay allocation for OSW substations. Establish criteria and application procedures, ensuring fairness and transparency in the allocation process.
- 26. State Maritime Boards, District Collectorate offices, state level fisheries departments, SCZMA, Gram Panchayats and civil bodies, engages with local communities and stakeholders to address concerns, obtain buy-in, and ensure transparent communication regarding the necessity and benefits of grid connections for offshore wind projects.
- 27. Ministry of Skill Development and Entrepreneurship, in partnership with Sector Skill Councils (SSCs), fosters partnerships between government entities, offshore wind developers, and transmission system operators. These collaborations can help in planning, funding, and executing grid connection projects.
- 28. NIWE enables centralized survey activities through common agencies to optimise resources, standardise processes, and expedite project development while reducing environmental footprint and redundant expenses within the sector.

Health and safety

- 29. MNRE in partnership with NIWE, establishes stringent regulations and standards specifically tailored to OSW health and safety from development and survey work through to construction, operations, and decommissioning. It also collaborates closely with industry players to develop and update safety protocols, harnessing expertise from global training bodies and private enterprises.
- 30. NIWE, in partnership with Ministry of Skill Development and Entrepreneurship, invests in training programmes and capacity building initiatives for workers involved in OSW projects, including safety training, emergency procedures, specialized skill development and building a culture of safety.
- 31. NIWE establishes dedicated bodies or assign existing agencies to monitor and enforce compliance with health and safety standards through regular inspections, audits, and certifications.
- 32. NIWE promotes transparency by sharing safety guidelines, best practices, and incident reports within the industry, readily available to all stakeholders.

Standards and certifications

33. MNRE engages with international standard organisations and the industry to support the development and application of standards suitable for the Indian OSW environment, adopting international industry codes where appropriate.



Community awareness

- 34. District Collectorate offices, state-level fisheries departments, SCZMA, Gram Panchayats and civil bodies, develops clear policies and guidelines that outline the Government of India's commitment to community welfare, environmental protection, and sustainable development of OSW projects.
- 35. NIWE establishes targeted education programmes that explain the benefits of OSW, its role in addressing climate change, and the potential socioeconomic advantages for local communities. These programmes can be conducted through workshops, seminars, and information campaigns.
- 36. District Collectorate offices introduces public consultation throughout the development process to collaborate with local leaders, gram panchayats, and community representatives to involve them in discussions, gather feedback, and address concerns.
- 37. MNRE, in partnership with NIWE, creates incentives or benefits for communities involved in OSW projects, such as job creation and skill development programmes, building of community facilities, community development funds.
- 38. MNRE, in partnership with NIWE, ensures transparent communication channels to disseminate project-related information, milestones, and potential impacts. This could involve setting up dedicated websites, and information centres, or hosting community meetings to provide updates and address gueries.

6.2.3 Delivery

Port infrastructure

- 39. Ministry of Ports and Shipping, in partnership with Gujarat Maritime Board, Tamil Nadu Maritime Board and similar in other states, finalises funding responsibility to invest in key port infrastructure upgrades to facilitate import, manufacture, assembly and load-out of major OSW farm components, ensuring capacity is aligned with market expectations.
- 40. Ministry of Ports and Shipping develops a long-term multi-phased plan for developing an offshore renewable energy hub within the port facilities of Hazira, Pipavav, Tuticorin, and Vizhinjam. This should sit alongside securing permits for future expansion to keep pace with the growing demand for services within the OSW sector, and a strategy of attracting major anchor tenants around which wider supply-chain businesses and infrastructure can grow.

Supply chain

- 41. Ministry of Finance in partnership with MNRE, Ministry of Heavy Industries, Ministry of Steel, Ministry of Commerce, and Industrial development boards of Gujarat and Tamil Nadu and other states, invests in publicly funded innovation programmes to reduce levelized cost of energy (LCOE) and help increase local supply content.
- 42. NIWE, in partnership with Indian Institute of Technologies and other engineering and technical institutes, invests in incubation and apprenticeship programmes to help coach local suppliers and businesses, including training of parallel sector workers.
- 43. MNRE facilitates investment in local supply chain by offering financial incentives such as grants, tax credits, or subsidies to establish local manufacture of towers, foundations, and port facilities.
- 44. MNRE develops measures to encourage local supply chain investment, including consideration of including non-price factors in leasing and revenue models and the inclusion of supply chain plans as part of the bidding criteria, taking care to avoid stringent local content requirements that might add risk and cost to projects and slow deployment.
- 45. MNRE establishes robust, usable methodology for measuring and aggregating local content (at national or state level) to enable clear communication between industry and Government.
- 46. MNRE creates policies and frameworks that incentivise technology transfer collaboration between Indian organisations and organisations with offshore wind experience in other markets. Provide financial incentives



- or tax benefits to encourage joint ventures, partnerships, and knowledge sharing. Support European manufacturers in setting up local manufacturing facilities or production units in India to cater to the South Asian countries.
- 47. State Maritime Boards facilitates the early stakeholder and public engagements, with a focus on establishing a local supply chain.
- 48. Ministry of Ports and Shipping, Chief Minister offices and Development Authorities of Gujarat and Tamil Nadu and other states, facilitates the development of industrial clusters through supportive policies, funding for business networks, and other initiatives encouraging industry collaboration and investment.
- 49. NIWE facilitates skills development and skills transfer from other sectors to develop the workforce required to deliver the OSW targets. Invest in incubation and apprenticeship programmes to help coach local suppliers and businesses, including training of parallel sector workers.

Transmission network

- 50. MNRE and CEA, with support of CTU, publishes a 2070 vision for a nationwide transmission network development plan for a decarbonized energy system, with short-, medium- and long-term milestones and consideration of finance. This incorporates OSW development zones defined through MSP into the transmission network development plan.
- 51. CTU and STU, with support from Regional Transmission Planning Committee, includes participation and coordination across key stakeholders such as developers, transmission network operators, energy regulators, and government during the planning process of the transmission network development plan.
- 52. Grid India undertakes power systems studies to understand the potential impacts of large volumes OSW on the future transmission network and ESIAs in line with GIIP and lender requirements to understand the environmental and social implications of transmission network upgrades, feeding these into MSP activities.
- 53. CEA prepares a well-documented plan to review and invest in transmission system upgrades with budget clarity for onshore substation, offshore substation, and export cables.

Financing mechanisms

- 54. MNRE develops a plan for OSW considering the needs of lenders, especially with regard to issues such as PPA revenue stability, exchange rate risks, PPA counterparty credit worthiness, and curtailment risks.
- 55. MNRE introduces investment incentives during the development and construction phases, including instruments such as tax credits, to accelerate the development of OSW.
- 56. MNRE and Ministry of Finance, in partnership with multilateral and international lenders, provides financial mechanisms to reduce cost of capital, including access to climate finance and other concessional finance.
- 57. MNRE supports the engagement of the local finance community with OSW including communication of environmental and social performance standards required to gain access to international concessionary and project financing.
- 58. IREDA and REC, encourages early engagement with credit enhancement providers to prepare the financing of OSW projects.

Socioeconomic impact

- 59. MNRE, in partnership with Ministry of Skill Development and Entrepreneurship, commissions a socioeconomic analysis to evaluate the economic benefits in terms of gross value added (GVA) and full-time equivalent (FTE) employment-years and to assess the impact of the about 40 GW OSW pipeline on local communities and industries.
- 60. MNRE implements best practice to measure and address ethnic diversity, gender balance, and equality across Indian OSW.
- 61. State Maritime Boards, SCZMA and, local maritime colleges, facilitates community engagement programmes to educate and involve local communities.



Decommissioning and circularity

- 62. MNRE, in partnership with NIWE, publishes regulations on decommissioning of OSW projects including requirements on how to avoid developers defaulting on their obligations.
- 63. NIWE establishes strategies for reusing and recycling materials and equipment to reduce waste. Set up a collaboration programme including stakeholders, industry players, and government bodies to foster best practices in circularity for the more established onshore wind and provide shared learning for OSW.

Summary of recommendations

Our time-based prioritisation of these recommendations is presented in Figure 20. Many tasks require ongoing attention after the period of action, shown.



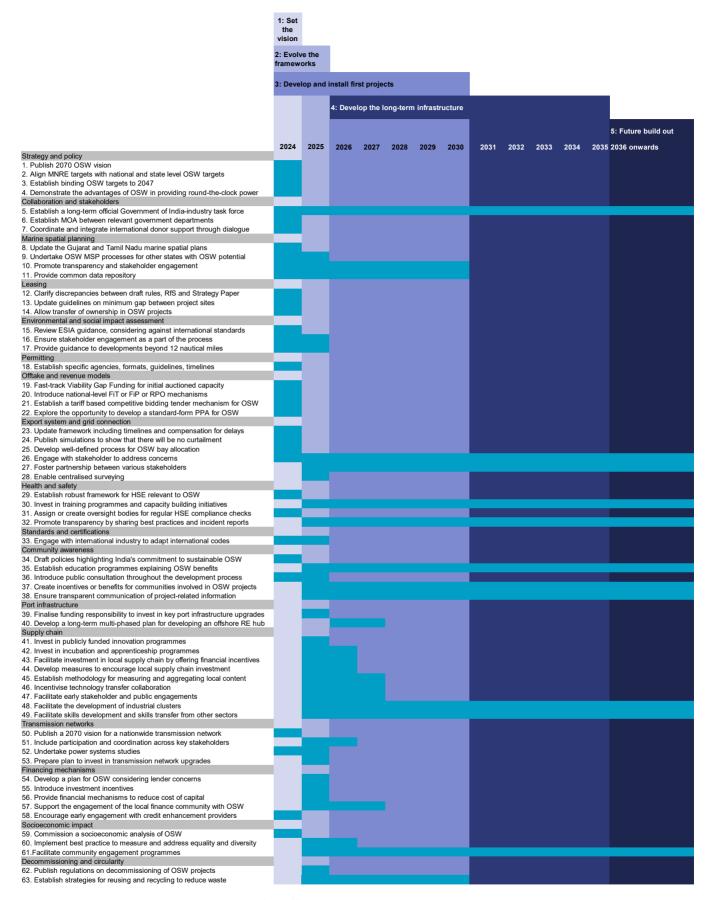


Figure 20 Prioritized recommendations for offshore wind in India.



Appendix A Glossary

Abbreviation	Definition
ACM	Authority for consumers and markets
ADB	Asian Development Bank
ALARP	As low as reasonably practicable
AR	Allocation round
ATL	Agreement to lease
AU\$	Australian dollars
BEIS	Department for Business, Energy, and Industrial Strategy
BOEM	Bureau of Ocean Energy Management
BSI	British Standards Institute
C&O	Construction and Operation
CA	Competent authority
CAPEX	Capital expenditure
CAPP	Community Awareness and Participation Plan
CEA	Central Electricity Authority
CECP	Clean Energy and Climate Partnership
CERC	Central Electricity Regulatory Commission
CES	Clean Energy Standard
CfD	Contract for difference
CIP	Copenhagen Infrastructure Partners
Climate Act	Climate Leadership and Community Protection Act
СОР	Construction and Operations Plan
CPPA	Corporate power purchase agreement
CRZ	Coastal Regulation Zone
CSTEP	Centre for Study of Science, Technology and Policy
СТИ	Central Transmission Utility
DAERA	Department for Agriculture, Environment and Rural Affairs
DCEEW	Department of Climate Change, Energy, the Environment and Water
DCO	Development consent order



Abbreviation	Definition
DEECA	Department of Energy, Environment and Climate Action
DEFRA	Department for Environment, Food & Rural Affairs
DESNZ	Department of Energy Security and Net Zero
DfE	Department for the Economy
DFI	Development Finance Institution
DIN	Deutsches Institut für Normung
DISCOM	Distribution Companies
DoEF	Department of Environment and Forests
DS3	Delivering a Secure, Sustainable Electricity System
DST	Department of Science and Technology
EA	Environmental assessment
ECA	Export credit agencies
EEZ	Exclusive economic zone
EEZ	Exclusive economic zone
EHS	Environmental, health, and safety
EIA	Environmental impact assessments
EIB	European Investment Bank
EIS	Environmental impact statement
EN	Euronorm
EOI	Expression of interest
EPBC	Environment protection and biodiversity conservation
EPCI	Engineering, procurement, construction, and installation
ESIA	Environmental and social impact assessment
ESO	Electricity system operator
EU	European Union
FID	Final investment decision
FIP	Feed-in premium
FIT	Feed-in tariff
FLOW TF	Floating Offshore Wind taskforce



Abbreviation	Definition
FLOWW	Fishing liaison with Offshore Wind and wet renewables
FOW	Floating offshore wind
FOWIND	Facilitating Offshore Wind in India
FOWPI	First offshore project of India
FTE	Full-time equivalent
GE	General Electric
GETRI	Gujarat energy training & research institute
GHG	Greenhouse gas
GIIP	Good international industry practice
GUVNL	Gujarat Urja Vikas Nigam Limited
GVA	Gross value added
GW	Giga watt
GWO	Global wind organisation
HRA	Habitats regulations appraisal
HSE	Health and safety
HV	High voltage
ICB	International competitive bidding
IEC	International electrotechnical commission
IFC	International finance corporation
IFI	International financial institute
INCOIS	Indian National Centre for Ocean Information Services
INTOG	Innovation and targeted oil and gas
ISO	International organisation for standardisation
ITC	Investment tax credits
JFE	Japan Future Enterprise
JOGMEC	Japan organisation for metals and energy security
LAP3	Third national waste management plan
LCCC	Low Carbon Contracts Company
LCOE	Levelized cost of energy



Abbreviation	Definition
LIDAR	Light detection and ranging
LOA	Letter of award
LRET	Large scale renewable energy target
LTESA	Long term energy service agreement
MCA	Maritime and coastguard agency
METI	Ministry of Economy, Trade, and Industry
MLIT	Ministry of Land, Infrastructure, Transport, and Tourism
ММО	Marine management organisation
MNRE	Ministry of New and Renewable Energy
MoD	Ministry of Defense
MoES	Ministry of Earth Sciences
MoEA	Ministry of External Affairs
MoEF	Ministry of Environment and Forests
МоНА	Ministry of Home Affairs
MoP	Ministry of Power
MPS	Marine policy statement
MREA	Marine Renewable Energy Act
MSP	Marine spatial planning
MV	Medium voltage
MWh	Megawatt hour
NEN	Nederlands Normalisatie Instituut
NEPA	National Environmental Policy Act
NGO	Non-governmental organisation
NIO	National Institute of Oceanography
NIOT	National Institute of Ocean Technology
NIWE	National Institute of Wind Energy
NSP	Network service provider
NWEA	Nederlandse Wind Energie Associatie
NWEA	Dutch wind energy association



Abbreviation	Definition
NYISO	New York independent system operator
NYSERDA	New York State energy research and development authority
оссто	Organisation for the cross region coordination of transmission operators
ocs	Outer continental shelf
OFTO	Offshore transmission owner
OH&S	Occupational health & safety
OMAR	Offshore major accident regulator
OMS	Operations, maintenance, and service
OREC	Offshore renewable energy certificate
OREC	Offshore renewable energy catapult
OREI	Offshore renewable energy installations
OSW	Offshore wind
OWGP	Offshore wind growth partnership
OWIC	Offshore wind industry council
OWMIS	Offshore wind manufacturing investment support scheme
OWSMRF	Offshore wind strategic monitoring and research forum
PER	Public environment report
PGCIL	Power Grid Corporation of India Ltd
PINS	Planning inspectorate
PPA	Power purchase agreements
PS	Performance standards
PSN	Proposed sale notice
PTC	Production tax credits
RE	Renewable energy
REC	Renewable energy certificate
REZ	Renewable energy zones
RFI	Request for interest
RfS	Request for selection
RLMM	Revised list of models and manufacturers



Abbreviation	Definition
RPO	Renewable purchase obligation
RPS	Renewable portfolio standard
RVO	Netherlands enterprise agency
RVO	Rijksdienst voor Ondernemend Nederland
RWS ZD	Rijkswaterstaat Zee en Delta
SCDS	Supply chain development statement
SCP	Supply chain plan
SCZMA	State coastal zone management authority
SEA	Strategic environmental assessment
SECI	Solar energy corporation of India
SERC	State electricity regulatory commission
SMS	Safety management system
SodM	State supervision of mines
SONI	System operator for Northern Ireland
SPSC	Standards policy and strategy committee
SSE	Scottish and southern electricity networks
SSC	Sector Skill Councils
STU	State transmission utility
TANGEDCO	Tamil Nadu Generation and Distribution Corporation
TSO	Transmission system operator
US\$	United States dollars
UXO	Unexploded ordnance
VGF	Viability gap finding
VRET	Victorian energy target
WEA	Wind energy areas



Appendix B India offshore wind development studies

Table 4 provides a non-exhaustive list of Indian offshore wind development studies.

Table 4 List of non-exhaustive Indian offshore wind development studies.

	Concernation					
Study	Year	Organisation	Government or private	Key insights	Reference	
Offshore Wind Potential Tamil Nadu	2011	Oldbaum	Private	OSW Potential Tamil Nadu's analysed 10-year period and evaluated existing wind data in the proposed zone.	<u>Oldbaum</u> <u>study</u>	
India				Proposed a wind measurement campaign and an OSW power development route map.		
FOWIND: Pre-feasibility study for Offshore Wind	2015	European Union (EU)	Government	Pre-feasibility study summarised: wind resource, zone selection, turbine selection, energy yield etc. in Gujarat and Tamil Nadu.	FOWIND	
FOWIND: Supply Chain, port infrastructure and logistics study for Offshore Wind development in GJ and TN	2016	EU	Government	 Overview of key supply chain elements required for OSW and high-level appraisal of local supply chain. Overview of key infrastructure and logistical requirements. Appraisal of suitability and readiness of India's existing port infrastructure for OSW development. 	FOWIND: Supply chain	
FOWIND: Feasibility study for Offshore Wind farm development in GJ and TN	2018	EU + Center for Study of Science, Technology and Policy (CSTEP)	Government	 Provide concept design for a demonstration project of 150 MW to 504 MW in Gujarat's most promising OSW development area Zone A identified in pre-feasibility study. Provide future detailed offshore FEED studies. 	FOWIND: Feasibility study	
FOWIND: Grid Infrastructure study for Offshore Wind project in GJ and TN	2017	EU	Government	Detail on preparing the state power systems to connect OSW projects in TN and GJ including Policy and industry background to Offshore grid development.	FOWIND: Grid Infrastructur e	



FOWPI: Procedures for Offshore Wind	2017	EU	Government	Underlining procedures for implementing OSW in India by detailing permitting procedures, Certification requirements and Health & Safety guidelines.	<u>FOWPI</u>
FOWIND: Offshore Wind outlook for GJ and TN	2018	EU + CSTEP	Government	Listed achievable roadmap for two states including identification of opportunities and challenges for developing OSW farms.	FOWIND: Outlook
FOWPI: Advisory Foundation Concept Design	2018	EU	Government	Detailing the e layout of the foundation elements, as well as the applicable loads and relevant environmental conditions in the current site for the design are defined in accordance with the European standards and guidelines.	FOWPI: Design
Report on first Offshore Wind Lidar wind data analysis	2018	National Institute of Wind Energy (NIWE)/MNRE	Government	Details on potential preliminary zones at Gulf of Khambhat, Gujarat which includes information on recourse assessment, speed distribution and frequency analysis, turbine performance, site suitability and viability.	NIWE: Lidar study
FOWPI: Weather Windows for Installation, Metocean study and Metocean data requirements	2018	EU	Government	Provides inputs on weather windows and weather downtime to be used at the location of a planned wind farm site in Gulf of Khambhat, Gujarat, India based on series data of wind speed and significant wave heights derived in the preliminary metocean study.	FOWPI: Weather windows for installations
Strategic sector co- operation (SSC) with Denmark	2019	MNRE and Denmark	Government	MNRE and Danish Ministry of Energy & Utilities signed SSC in 2019, focussed on knowledge exchange within: OW spatial planning, screening process and site identification De-risking processes for OW development OW tendering process Technical inputs to support the development of an OW roadmap	INDIA DK SSC- 2019
LIDAR and preliminary	2022	NIWE	Government	NIWE opens tender for Supply, installation and commissioning	<u>Tender</u>



investigation access award for Zone A1 at Tamil Nadu site LCOE/VGF tool for Offshore wind	2022	Centre of Excellence for Offshore Wind and renewable energy (CoE)	Government	of support structure for mounting offshore Lidar. 2. NIWE, OREC to collaborate on OW studies. 3. Process defined by Ministry for development of OSW project in India under model 2. 1. FIMOI released version 1 of report in Feb'2021 providing LCOE estimates for the first OSW farm in India and risks 2. NIWE to setup OSW energy	FIMOI Report
Gap Assessment of training and skill building	2022	Clean Energy and Climate Partnership (CECP)/Price Waterhouse Coopers (PwC)	Private	research centre in Tamil Nadu CECP report suggests that India lacks skills in construction and operations phase of OSW project development	Gap assessment training
Zone B3- Gujarat: Rapid Environmental Impact Assessment (EIA) report released	2022	National Institute of Oceanography/ NIWE	Government	 MNRE published a Strategy paper in July to officiate the tender trajectory which talks about 3 models in which OSW could be deployed in the country Rapid EIA report released for Zone B3 in Gulf of Khambhat region 	Rapid EIA report
Port infrastructure viability assessment and Maritime spatial planning in GJ and TN	2022	CoE	Government	1. DEA and MNRE have published a conceptual plan which consists of 3 reports: Port infrastructure viability assessment, Maritime spatial planning 2. Workshop on OSW model evacuation and business models -Aspire and KPMG	Maritime Spatial Planning
Supply chain readiness OREC	2023	Offshore Renewable Energy Catapult (OREC)	Government	Key risks to OSW supply chain development in India include unclear milestones in the 37 GW roadmap, absence of concrete infrastructure investment plans, and scepticism about the initial project's profitability due to government's lack of financial support.	Report



Appendix C Comparison table for Indian offshore wind lease models

Table 5 provides a comparison between the three offshore wind leasing models based on the 2023 strategy paper.⁴⁸ Details of the models are available in section 4.2 and elsewhere in the report.

Table 5 Comparison of Indian offshore wind lease models.

	Model A	Model B	Model C
Volume (GW)	1	14	22
Lease exclusivity	Yes, developer will have exclusivity over seabed during the survey period	Yes, developer will have exclusivity over seabed during the survey period	No, developer will not have exclusivity over seabed during the survey period (as this is before award)
Prequalificat ion	No	Yes	No
Award criteria	VGF-based	Technical and financial criteria	First come, first served for survey
Lease fees	Fixed lease fee of INR 1,00,000/sq km/year for the entire lease period	Winning Bid-based lease fee until the point and commissioning and fixed fee of INR 1,00,000/sq km/year after commissioning	No fees
Timeline of lease award	No information	90 days for Agreement to Lease + 6 months for survey lease	No information
Timeline of lease hold	35 years (from construction & operation lease deed signed to decommissioning)	5 years (additional 1 year maybe applicable on a case-to- case basis) for survey 35 years (from Construction & Operation Lease Deed signed to decommissioning)	5 years (additional 1 year maybe applicable on a case-to-case basis) for survey 35 years (from Construction & Operation Lease Deed signed to decommissioning)
Offtake agreement and guarantees	PPA with state Distribution Companies through SECI	Developers are expected to scout for potential offtakers and secure private PPAs. Power sales could be possible through bilateral and power exchange sales. After 2 years, the government could initiate bids for power procurement through DISCOMs.	Developers must identify their offtaker and conduct sales through open access or power exchanges.



Incentives	Central Financial Assistance (CFA) in the form of Viability Gap Funding (VGF)	None	None
Export system and grid connection	Developer responsible for connecting the inter-array cables. CTU is responsible for offshore substation, export cables, onshore substations and grid connection.	Developer responsible for connecting the inter-array cables. CTU is responsible for offshore substation, export cables, onshore substations and grid connection.	Developer responsible for connecting the inter-array cables. CTU is responsible for offshore substation, export cables, onshore substations and grid connection.
Data rights		Project developer will be required to relinquish the lease and deposit the data acquired during the study/survey in case of specific conditions	Project developer shall not share the study/ survey data with any third party other than its own affiliates, subsidiaries, or holding/parent company
Permitting	Stage 1 clearances to be secured by MNRE; Stage 2 clearances by developer	Stage 1 and Stage 2 clearance to be secured by developer	Similar to Model B but detailed guidelines missing



Appendix D List of non-exhaustive key offshore wind stakeholders in different markets

This section lists some of the key offshore wind stakeholders across the example countries.

Table 6 List of non-exhaustive key offshore wind stakeholders in Australia.

Stakeholder type	Stakeholder	Areas of expertise
Government	 DCCEEW DEECA Minister for Climate Change and Energy Offshore Infrastructure Regulator Offshore Infrastructure Registrar 	 OSW policy and regulation. Environmental approvals. Assessment and approval of OSW licences.
	Local Councils	Construction permits.
	Net Zero Economy Taskforce	Advises government on how Australia can maximise local benefits derived from the OSW industry.
	VicGrid	Transmission network upgrades.
Business	 BlueFloat Corio CIP Energy Estate Flotation Energy Vena Energy Various Ports Various Ports	OSW development. Port Infrastructure.
Non-governmental organisations (NGOs) and enabling bodies)	Clean Energy Council	Provision of information, guidance, and support for renewable energy in Australia.

Table 7 List of non-exhaustive key offshore wind stakeholders in Japan.

Stakeholder type	Stakeholder	Areas of expertise
Government	 Minster of the Environment Ministry of Economy, Trade, and Industry Ministry of Land, Infrastructure, Transport and Tourism 	 Designation of lease sites Auction of seabed areas and offtake agreements Design of permitting and EIA processes Assessment and approval of occupancy plans
Business	Chubu Electric Power (Choshi City, Noshiro City, and Yurihonjo City)	OSW farm developers, are responsible for the design, permitting, and environmental assessment.



Stakeholder type	Stakeholder	Areas of expertise
	Green Power Investment Corporation (Ishkari Bay New Port)	Almost all projects in Japan are led by Japanese companies, except a 2.4 MW demonstrator project lead by Orsted.
	Hibiki Wind Energy (Kitakyushu Hibikinada) Maruhagi (Nashira Partagal	Mitsubishi is a key developer as it was the lead developer on all three winning bids in the most recent Round 1 auction in 2021.
	Marubeni (Noshiro Port and Akita Port)	Toodhi Tooha Tadoho Tiin 2021.
	Mitsubishi (Choshi City, Noshiro City, and Yurihonjo City)	
	Toda (Goto City)	
	Venti Japan (Nyuzen and Yurihonjo City)	
	Wind Power Group (Kashima Port)	
	Japan Wind Power Association (JWPA)	
Non-governmental organisations (NGOs) and enabling bodies)	New Energy and Industrial Technology Development Organization (NEDO)	
	Public-Private Council on Enhancement of Industrial Competitiveness for Offshore Wind Power Generation	

Table 8 List of non-exhaustive key offshore wind stakeholders in the Netherlands.

Stakeholder type	Stakeholder	Areas of expertise
Government	Netherlands Enterprise Agency (RVO)	Co-ordination of market actors, provision of information, coordination of planning and consenting
Business	Orsted, Sif, TenneT, Van Oord, Vattenfall	Detailed design of projects, participation in processes and pre-launch design, supply chain engagement and development
Non-governmental organisations (NGOs) and enabling bodies)	Dutch Wind Energy Agency (NEWA)	Co-ordination of research, messaging, lobbying government on behalf of industry

Table 9 List of non-exhaustive key offshore wind stakeholders in the UK.

Stakeholder type	Stakeholder	Areas of expertise
Government	DAERA	Assessment and approval of OSW licences
	• DESNZ	
	The Crown Estate (TCE)	Environmental approvals OSW policy torquets and regulations
	Marine Scotland	OSW policy, targets, and regulations



Stakeholder type	Stakeholder	Areas of expertise
	• MMO	
	PINSSecretary of State	
Business	 Iberdrola Ocean Winds Ørsted RWE SSE Vattenfall 	OSW farm owners
Non-governmental organisations (NGOs) and enabling bodies	 Vatternall Offshore Renewable Energy Catapult (OREC) Offshore Wind Growth Partnership (OWGP) Offshore Wind Industry Council (OWIC) Offshore Wind Strategic Monitoring and Research Forum (OWSMRF) Renewable UK (RUK) Scottish Offshore Wind Energy Council (SOWEC) 	 Provision of information, guidance, and support for renewable energy in the UK. Research and development for OSW. Stakeholder consultations as part of OSW development.

Table 10 List of non-exhaustive key offshore wind stakeholders in New York State.

Stakeholder type	Stakeholder	Areas of expertise
Federal Government	• BOEM	Manages the development of offshore resources in federal waters.
		They administer the leasing of seabed areas for OSW energy and approve the construction plans for projects.
New York State Government	NYSERDA	Works to promote renewable energy in New York State. They provide research, planning, and funding for projects within the State of New York to support the state's renewable energy ambitions.
		They administer the procurement auctions for OSW Energy.
Business	BP & Equinor (Beacon Wind and Empire Wind)	
	Eversource & Ørsted (South Fork and Sunrise Wind)	OSW farm owners with offtake agreements into New York State
	National Grid and RWE (Community Offshore Wind)	



Stakeholder type	Stakeholder	Areas of expertise
	 TotalEnergies, Rise Light, and Corio Generation (Attentive Energy) Vineyard Offshore (a subsidiary of Copenhagen Infrastructure Partners) (Excelsior Wind) 	
Non-governmental organisations (NGOs) and enabling bodies)	American Clean Power Association	Research and lobbying the government on behalf of the industry.



References

- 1 'India must revitalise the growth of wind power to achieve the country's net zero goals', *Press release*, Global Wind Energy Council. September 2022, available online at https://gwec.net/accelerating-onshore-wind-capacity-additions-in-india-toachieve-the-2030-target/.
- ² World Bank Group. 2021. Key Factors for Successful Development of Offshore Wind in Emerging Markets. ESMAP, World Bank, Washington, DC. License: Creative Commons Attribution CC BY 3.0 IGO
- ³ IFC, https://www.ifc.org/en/insights-reports/2012/ifc-performance-standards.
- ⁴ EIA, (2022), available online at https://www.eia.gov/energyexplained/renewable-sources/portfoliostandards.php.
- ⁵ WINDExchange, available online at https://windexchange.energy.gov/projects/tax-credits.
- ⁶ Building Green: Sustainable Construction in Emerging Markets, October 2023, available online at https://www.ifc.org/content/dam/ifc/doc/2023/building-green-sustainable-construction-in-emerging-markets.pdf.
- ⁷ International Finance Corporation (IFC) of the World Bank Group, "Environmental, Health and Safety Guidelines," April 2021, available online at: https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-atifc/policies-standards/ehs-quidelines.
- ⁸ Basic Safety Training Standard, Global Wind Organisation, May 2023, available online at https://www.globalwindsafety.org/standards/basic-safety-training-standard.
- ⁹ Global Offshore Wind Health and Safety Organisation, available online at https://www.gplusoffshorewind.com/workprogrammeme/quidelines.
- ¹⁰ Wind energy generation systems Part 29: Marking and lighting of wind turbines, February 2023, available online at https://webstore.iec.ch/preview/info_iects61400-29%7Bed1.0%7Den.pdf
- ¹¹ DIN, https://www.din.de/en/about-standards/din-standards.
- ¹² Cen, https://www.cencenelec.eu/european-standardization/european-standards/.
- ¹³ Cen, https://www.cencenelec.eu/european-standardization/european-standards/.
- ¹⁴ ISO, https://www.iso.org/standards.html.
- ¹⁵ Offshore renewable energy standardization review, September 2014, available online at
- $\underline{https://www.bsigroup.com/LocalFiles/en-GB/standards/BSI-Offshore-renewable-energy-stan} dardization-review-UK-EN.pdf.$
- ¹⁶ Australian Government Climate Change commitments, policies and programmes, November 2022, available online at https://www.aofm.gov.au/sites/default/files/2022-11-28/Aust%20Govt%20CC%20Actions%20Update%20November%202022 1.pdf.
- 17 Offshore Electricity Infrastructure Bill 2021, 2021, available online at

https://www.aph.gov.au/Parliamentary Business/Bills Legislation/Bills Search Results/Result?bld=r6774.

- ¹⁸ Offshore Renewable Energy Generation, December 2021, available online at
- https://www.energymining.sa.gov.au/ data/assets/pdf_file/0011/845255/Offshore-renewable-energy-generation.pdf.
- ¹⁹ 'First round of renewable energy projects puts NSW one-third of the way to 12-gigawatt renewable energy goal', Minister for Energy and Climate Change, 1 May 2023, available online at https://www.nsw.gov.au/media-releases/first-round-ofrenewable-energy-projects-puts-nsw-one-third-of-way-to-12-gigawatt-renewable-energy-goal.
- ²⁰ Offshore Energy Implementation Statement 2, March 2023, available online at

https://www.energy.vic.gov.au/ data/assets/pdf_file/0017/622241/offshore-wind-implementation-statement-2.pdf.

- ²¹ Green growth strategy through achieving carbon neutrality in 2050, Ministry of Economy, Trade and Industry, June 2021, available online at
- https://www.meti.go.jp/english/policy/energy_environment/global_warming/ggs2050/pdf/ggs_full_en1013.pdf.
- ²² Plan for Global Warming Countermeasures, Ministry of the Environment, October 2021, available online at https://climatelaws.org/geographies/japan/policies/plan-for-global-warming-
- countermeasures#:~:text=The%20Plan%20for%20Global%20Warming.of%20Japanese%20emission%20reduction%20goal
- ²³ Sixth Strategic Energy Plan, Ministry of Economy, Trade and Industry, November 2021, available online at https://www.enecho.meti.go.jp/en/category/others/basic_plan/.
- ²⁴ Vision for Offshore Wind Power Industry, Ministry of Economy, Trade and Industry, December 2020, available online at https://www.enecho.meti.go.jp/category/saving_and_new/saiene/yojo_furyoku/dl/vision/vision_first_en.pdf.
- ²⁵ Offshore wind power generation in the exclusive economic zone (EEZ), Study committee on international law issues related to implementation, Study Group on International Law Issues, January 2023, available online at (Japanese):

https://www8.cao.go.jp/ocean/policies/energy/pdf/torimatome.pdf.

- ²⁶ Netherlands Enterprise Agency, https://english.rvo.nl/topics/offshore-wind-energy/plans-2030-2050.
- ²⁷ The Climate Change Act 2008 (2050 Target Amendment) Order 2019, available online at https://www.legislation.gov.uk/uksi/2019/1056/introduction/made.
- ²⁸ Net Zero Strategy: Build Back Greener, October 2021, available online at

https://assets.publishing.service.gov.uk/media/6194dfa4d3bf7f0555071b1b/net-zero-strategy-beis.pdf.

²⁹ Climate Change Act (Northern Ireland) 2022, available online at

https://www.legislation.gov.uk/nia/2022/31/contents/enacted.



- ³⁰ Report on the Climate Change (Wales) Regulations 2021, Welsh Parliament, March 2021, available online at https://senedd.wales/media/0kalampz/cr-ld14183-e.pdf.
- ³¹ Review of Wales' Renewable Energy Targets, Welsh Government, April 2023, available online at https://www.gov.wales/sites/default/files/consultations/2023-07/summary-of-responses-review-of-renewable-energy-targets.pdf.
- ³² Climate Change (Emissions Reduction Targets) (Scotland) Act 2019, available online at https://www.legislation.gov.uk/asp/2019/15.
- ³³ Scottish Government, https://www.gov.scot/policies/renewable-and-low-carbon-energy/.
- ³⁴ Scottish Government, https://www.gov.scot/news/increased-offshore-wind-ambition-by-2030/.
- ³⁵ Industry strategy: Offshore Wind Sector Deal, Department of Business, Energy and Industrial Strategy, March 2019, available online at
- $\underline{\text{https://assets.publishing.service.gov.uk/media/5c9e235740f0b625e647be07/BEIS Offshore Wind Single Pages web optimised.pdf.}$
- ³⁶ British energy security strategy, April 2022, available online at <a href="https://www.gov.uk/government/publications/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-strategy/british-energy-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-security-
- ³⁷ NYSERDA, https://www.nyserda.ny.gov/All-Programmes/Clean-Energy-Standard.
- ³⁸ New York State Offshore Wind Master Plan, NYSERDA, December 2017, available online at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Biomass-Solar-Wind/Master-Plan/Offshore-Wind-Master-Plan.pdf
- ³⁹ New York State's 10-Point Action Plan to Expand a Thriving Large-Scale Renewable Industry, NYSERDA, October 2023, available online at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/Offshore-Wind/10-point-plan.pdf
- ⁴⁰ India's Stand at COP-26, Press release, Ministry of Power on behalf of Government of India, March 2023, available online
- $\frac{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20of\%20its,net\%20zero\%20emissions\%20by\%202070}{\text{https://pib.gov.in/PressReleasePage.aspx?PRID=1795071\#:}\sim:\text{text=50\%20per\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20cent\%20c$
- ⁴¹ India's Updated First Nationally Determined Contribution Under Paris Agreement, Government of India, August 2022, available at https://unfccc.int/sites/default/files/NDC/2022-08/India%20Updated%20First%20Nationally%20Determined%20Contrib.pdf
- ⁴² Report on Optimal Generation Mix 2030 Version 2.0, Ministry of Power on behalf of Government of India, April 2023, available online at https://cea.nic.in/wp-
- content/uploads/irp/2023/05/Optimal mix report 2029 30 Version 2.0 For Uploading.pdf.
- ⁴³ National Offshore Wind Energy Policy, Ministry of New and Renewable Energy, 2015 available online at https://policy.asiapacificenergy.org/sites/default/files/Notification%20G.%20S.%20R.%20765%28E%29%20regarding%20National%20Offshore%20Wind%20Energy%20Policy.pdf
- ⁴⁴ Saumy Prateek, Mercom, (2018), https://www.mercomindia.com/mnre-announces-30-gw-offshore-wind-target-2030.
- ⁴⁵ Expression of Interest for 1000 MW Offshore Wind Farm in Gujarat, NIWE on behalf of MNRE, April 2018, available online at https://www.cecp-
- <u>eu.in/uploads/documents/fowpi/Policy%20And%20Regulations/India/eoi for development of 1000 mw offshore wind farm</u> <u>in gujarat 38244286879.pdf.</u>
- ⁴⁶ Guidelines for offshore wind power assessment studies and surveys, National Institute of Wind Energy, India, 2018, available online at https://niwe.res.in/assets/Docu/Guidelines for Offshore Wind Power Studies and Surveys.pdf
- ⁴⁷ Strategy Paper for Establishment of Offshore Wind Energy Projects, Ministry of New and Renewable Energy on behalf of Government of India, July 2022, available online at https://coe-osw.org/strategy-paper-for-establishment-of-offshore-wind-energy-projects/
- ⁴⁸ Strategy Paper for Establishment of Offshore Wind Energy Projects, Ministry of New and Renewable Energy on behalf of Government of India, September 2023, available online at
- https://web.archive.org/web/20231010142331/https:/mnre.gov.in/img/documents/uploads/file_f-1695789933625.pdf.
- ⁴⁹ Offshore wind energy lease rules, MNRE, 2023, available online at https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2023/12/202312208216880.pdf
 ⁵⁰ Quiarat Renewable Energy Policy 2023, Quiarat Energy and Potrochemicals Department on behalf of Government of the policy 2023 and Potrochemicals Department on behalf of Government of the policy 2023 and Potrochemicals Department on behalf of Government of the policy 2023 and Potrochemicals Department on behalf of Government of the policy 2023 and Potrochemicals Department on behalf of Government of the policy 2023 and Potrochemicals Department on the policy 2023 and Potrochemicals Department on the policy 2023 and 2
- ⁵⁰ Gujarat Renewable Energy Policy 2023, Gujarat Energy and Petrochemicals Department on behalf of Government of Gujarat, 2023, available online at https://www.eqmagpro.com/wp-content/uploads/2023/09/DOC-20230824- WA0016. compressed.pdf.
- ⁵¹ *Policy Note 2023-2024 Demand No. 14*, Energy department on behalf of Government of Tamil Nadu,2023, available online at https://www.tn.gov.in/documents/dept/7.
- ⁵² Offshore Wind Farm Projects: Stakeholder Engagement & Community Benefits, IPCA Global, May 2021, available online at https://iea-wind.org/wp-content/uploads/2021/11/Offshore-Wind-Stakeholder-Engagement-KEEGAN-May-31st-2021.pdf.



- ⁵³ Foreign, Commonwealth and Development Office (FCDO), Government of UK in association with the Ministry of Power (MoP) and the Ministry of New and Renewable Energy (MNRE), Government of India, https://www.linkedin.com/in/uk-india-aspire-programme/recent-activity/all/.
- ⁵⁴ 'India and Norway agree to conduct marine spatial planning in Lakshadweep and Puducherry', *Press release*, PIB Delhi, 3 March 2021, available online at https://pib.gov.in/PressReleasePage.aspx?PRID=1702137.
- ⁵⁵ Gap Assessment of training and skill building in Offshore wind energy sector in India study by CECP (Clean Energy & Climate Partnership), https://www.cecp-
- eu.in/uploads/documents/events/Gap%20Assessment%20of%20training_June%202022.pdf
- ⁵⁶ Geoscience Australia, (2023), https://www.ga.gov.au/scientific-topics/marine/jurisdiction/amsis
- ⁵⁷ Marine and Coastal Policy, March 2020, available online at
- https://www.marineandcoasts.vic.gov.au/ data/assets/pdf_file/0027/456534/Marine-and-Coastal-Policy_Full.pdf.
- ⁵⁸ Marine Spatial Planning in Regional Ocean Areas: Trends and Lessons Learned, May 2022, available online at https://brill.com/view/journals/ocyo/36/1/article-p346 12.xml?language=en.
- ⁵⁹ Act on Promoting the Utilization of Sea Areas for the Development of Marine Renewable Energy Power Generation Facilities, December 2018, available online at
- $\frac{\text{https://policy.asiapacificenergy.org/sites/default/files/Act%20of\%20Promoting\%20Utilization\%20of\%20Sea\%20Areas\%20in}{\%20Development\%20of\%20Power\%20Generation\%20Facilities\%20Using\%20Maritime\%20Renewable\%20Energy\%20Resources\%20\%28Act%20No.\%2089\%20of\%202018\%29\%28JP\%26EN\%29.pdf.}$
- ⁶⁰ Guidelines for the Designation of Promotion Areas, Ministry of Economy, Trade and Industry and Ministry of Land, Infrastructure, Transport and Tourism, July 2021, available online at (Japanese)

https://www.enecho.meti.go.jp/category/saving_and_new/saiene/yojo_furyoku/dl/legal/guideline.pdf.

- ⁶¹ UK Marine Policy Statement, HM Government, March 2021, available online at
- $\underline{\text{https://assets.publishing.service.gov.uk/media/5a795700ed915d042206795b/pb3654-marine-policy-statement-110316.pdf.}$
- ⁶² The Crown Estate, https://www.thecrownestate.co.uk/our-business/marine/offshore-wind-evidence-and-change-programmeme.
- ⁶³ Marine Plan for Northern Ireland, October 2022, available online at https://www.daera-ni.gov.uk/sites/default/files/publications/daera/Annex.pdf.
- ⁶⁴ Sectoral Marine Plan for Offshore Wind Energy, Scottish Government, October 2020, available online at https://www.gov.scot/publications/sectoral-marine-plan-offshore-wind-energy/documents/.
- ⁶⁵ Energy Policy Act of 2005, United States of America Government, August 2005, available online at https://www.congress.gov/109/plaws/publ58/PLAW-109publ58.pdf.
- ⁶⁶ Bureau of Ocean Energy Management, https://www.boem.gov/oil-gas-energy/leasing/outer-continental-shelf.
- ⁶⁷ Renewable Energy and Alternate Uses of Existing Facilities on the Outer Continental Shelf; Final Rule, Department of the Interior, Minerals Management Service, April 2009, available online at <a href="https://www.boem.gov/sites/default/files/renewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewable-energy-programme/FinalRenewab
- ⁶⁸ Guidelines for acquiring and producing geospatial data and services including maps, Department of Science and Technology on behalf of Government of India, 2021, available online at
- https://dst.gov.in/sites/default/files/Final%20Approved%20Guidelines%20on%20Geospatial%20Data 0.pdf.
- ⁶⁹ India and Norway agree to conduct marine spatial planning in Lakshadweep and Puducherry, *Press release*, PIB Delhi, 03 March 2021, available online at https://pib.gov.in/PressReleasePage.aspx?PRID=1702137
- ⁷⁰ Pre-Feasibility Study for Offshore Wind Farm development in Gujarat, GWEC on behalf of Indo-European Cooperation on Renewable Energy programme, 2015, available online at https://gwec.net/wp-content/uploads/2021/01/GWEC Prefeasibility-Study-for-Offshore-Wind-Farm-Development-in-Gujarat 2015.pdf.
- ⁷¹ Pre-Feasibility Study for Offshore Wind Farm Development in Tamil Nadu, GWEC on behalf of Indo-European Cooperation on Renewable Energy programme, 2015, available online at https://gwec.net/wp-content/uploads/2021/01/GWEC_Pre-feasibility-Study-for-Offshore-Wind-Farm-Development-in-Tamil-Nadu_2015.pdf.
- ⁷² Centre of Excellence for Offshore Wind and Renewable Energy, (2022): Maritime Spatial Planning for offshore wind farms in Gujarat, November 2022, available online at https://coe-osw.org/maritime-spatial-planning-for-offshore-wind-farms-in-gujarat/.
- ⁷³ Centre of Excellence for Offshore Wind and Renewable Energy, (2022): Maritime Spatial Planning for offshore wind farms in Tamil Nadu, November 2022, available online at https://coe-osw.org/maritime-spatial-planning-for-offshore-wind-farms-in-tamil-nadu/.
- ⁷⁴ Department of Climate Change, Energy, the Environment and Water,

https://www.dcceew.gov.au/energy/renewable/establishing-offshore-infrastructure.

⁷⁵ Cost Recovery Implementation Statement, Department of Climate Change, Energy, the Environment and Water, September 2022, available online at https://www.dcceew.gov.au/sites/default/files/documents/oei-cris.pdf.

⁷⁶ Federal Register of Legislation, https://www.legislation.gov.au/Details/F2022L01736.



- ⁷⁷ 'Designation of promotion areas based in the Renewable Energy Sea Area Utilisation Act, areas to be surveyed by the central method, and candidate areas for the GI Fund (floating demonstration)', Press release, Ministry of Economy, Trade and Industry, 3 October 2023, available online at https://www.meti.go.jp/press/2023/10/20231003002/20231003002.html. ⁷⁸ Noordzeeloket, https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/image-road-map/roadmap-2030-2031/.
- 60 Celtic Sea Floating Wind Programme: Draft Site Selection Methodology, The Crown Estate, July 2022, available online at https://www.thecrownestate.co.uk/media/4150/2022-floating-wind-site-selection-methodology-report.pdf.
- 81 The Crown Estate and the Department for the Economy, Northern Ireland Statement of Intent, January 2023, available online at https://www.economy-ni.gov.uk/sites/default/files/publications/economy/DfE-TCE-statement-intent.pdf.
- 82 The Crown Estate, (London: 2023), https://www.thecrownestate.co.uk/our-business/marine/Round4
- 83 NYSERDA, (Albany), https://www.nyserda.ny.gov/All-Programmes/Offshore-Wind/Focus-Areas/NY-Offshore-Wind-Projects.
- 84 Draft Tender Document: Seabed leasing of offshore wind projects in Tamil Nadu, National Institute of Wind Energy, November 2022, available online at https://niwe.res.in/assets/Docu/Circular%20draft%20tender%20document.pdf
- 85 Call for proposal for carrying out Offshore Wind Studies/Surveys within Exclusive Economic Zone (EEZ) of the country, MNRE, August 2023, available online at
- https://web.archive.org/web/20230824111758/https://mnre.gov.in/img/documents/uploads/file_f-1692354827178.pdf
- ⁸⁶ Environment Protection and Biodiversity Conservation Act 1999, available online at https://www.legislation.gov.au/Details/C2016C00777.
- 87 Environmental Impact Assessment Act. Ministry of the Environment, June 1997, available online at https://www.japaneselawtranslation.go.jp/en/laws/view/3375/en.
- 88 Environmental Impact Assessment Network, http://assess.env.go.jp/4_kentou/4-
- 1 kentou/reportdetail.html?page=4 kentou/index&kid=1055
- 89 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017, available online at https://www.legislation.gov.uk/uksi/2017/572/contents.
- 90 FLOWW Terms of Reference, August 2017, available online at https://www.thecrownestate.co.uk/media/2670/floww-termsof-reference.pdf.
- ⁹¹ Process for Identifying Alternatives for Environmental Reviews of Offshore Wind Construction and Operations Plans pursuant to the National Environmental Policy Act (NEPA), Bureau of Ocean Energy Management, June 2022, available online at https://www.boem.gov/sites/default/files/documents/renewable-energy/BOEM%20COP%20EIS%20Alternatives-202<u>2-06-22.pdf.</u>
- 92 Bureau of Ocean Energy Management, https://www.boem.gov/environment/environmental-assessment/whatenvironmental-impact-statement-eis-process.
- 93 The Forest Conservation Act, 1980, available online at https://www.dgms.net/HANDBOOK_GUIDELINES18_03_2019.pdf.
- 94 The Environment (Protection) Act. 1986, available online at https://lddashboard.legislative.gov.in/sites/default/files/A1986-
- 95 Rapid Marine Environmental Impact Assessment of the proposed Offshore Wind Farm in Gulf of Khambhat off Jafrabad Gujarat, NIO for NIWE, January 2020, available online at https://niwe.res.in/assets/Docu/offshore/EIA_report.pdf.
- ⁹⁶ The Wildlife (Protection) Act. 1972, available online at
- https://tribal.nic.in/downloads/FRA/Concerned%20Laws%20and%20Policies/Wildlife%20Protection%20Act,%201972.pdf.
- ⁹⁷ The Water (Prevention and Control of Pollution) Act, 1974, available online at
- https://lddashboard.legislative.gov.in/sites/default/files/A1974-6.pdf.
- 98 The Environmental Impact Assessment Notification, 2006, available online at https://www.environmentwb.gov.in/pdf/EIA%20Notification,%202006.pdf.
- 99 Policy Guidelines for Exploration and Exploitation of Shale Gas and Oil by National Oil Companies under Nominal regimereg., MoPNG, 2013, available online at https://mopng.gov.in/files/ExpAndProd/Unconventional/7.ShaleGasPolicy.pdf.
- 100 Hazardous and Other Waste (Management and Trans-boundary Movement) Rules, 2016, available online at https://www.npcindia.gov.in/NPC/Files/delhiOFC/EM/Hazardous-waste-management-rules-2016.pdf.
- ¹⁰¹ The Air (Prevention and Control) Act, 1981, available online at
- https://lddashboard.legislative.gov.in/sites/default/files/A1981-14.pdf.
- 102 The Scheduled Tribes and other Forest Dwellers (Recognition of Forest Rights) Act, 2006, available online at https://tribal.nic.in/downloads/FRA/FRAActnRulesBook.pdf.
- ¹⁰³ Environmental, Health, and Safety Guidelines, World Bank and IFC, 2007, available online at https://www.ifc.org/en/insights-reports/2000/general-environmental-health-and-safety-quidelines.
- 104 Equator Principles, July 2020, available online at https://equator-principles.com/app/uploads/The-Equator-Principles EP4 July2020.pdf.
- 105 State Government of Victoria, (2023), https://www.planning.vic.gov.au/guides-and-resources/legislation-regulation-andfees/legislation-and-regulations.



- ¹⁰⁶ Installation guidebook for Offshore Wind power generation, New Energy and Industrial Technology Development Organisation, March 2018, available online at (Japanese) https://www.nedo.go.jp/content/100889993.pdf.
- 107 Cabinet Office, https://www8.cao.go.jp/kisei-kaikaku/kisei/conference/energy/e_index.html
- ¹⁰⁸ Offshore Wind Energy Act 2015, Noordzeeloket, available online at https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/laws-regulations-international-treaties-policy/
- ¹⁰⁹ Planning Act 2008: Development Consent Order Fact, available online at
- ¹¹⁰ Marine Scotland Consenting and Licensing Guidance, Marine Scotland on behalf of the Scottish Government, October 2018, available online at <a href="https://www.gov.scot/binaries/content/documents/govscot/publications/advice-and-guidance/2020/02/marine-licensing-applications-and-guidance/documents/guidance/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/guidance-manual-for-offshore-wind-wave-and-tidal-energy-application/govscot%3Adocument/Guidance%2BManual%2Bfor%2BOffshore%2BWind%252C%2BWave%2Band%2BTidal%2BEnergy%2BApplication.pdf.
- 111 Table of Permits and Approvals, NYSERDA, August 2015, available online at https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Research/Biomass-Solar-Wind/Master-Plan/17-25x-Table-of-Permits-and-Approvals.pdf.
- 112 Offshore Wind COP Review Process, NYSERDA, August 2021, available online at https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programmes/Offshore-Wind/2021-08-11-COP-Review-Process.pdf.
- ¹¹³ Department of Energy, Environment and Climate Action, https://www.energy.vic.gov.au/renewable-energy/victorian-renewable-energy-target-auction-vret1.
- ¹¹⁴ EnergyCo, https://www.energyco.nsw.gov.au/industry/long-term-energy-service-agreements.
- ¹¹⁵ Australian Government, (2023), https://www.cleanenergyregulator.gov.au/RET/About-the-Renewable-Energy-Target/How-the-scheme-works/Large-scale-Renewable-Energy-Target.
- ¹¹⁶ Steve Hanley, CleanTechnica, 19 December 2017, https://cleantechnica.com/2017/12/19/netherlands-first-hold-subsidy-free-wind-power-auction/.
- ¹¹⁷ Contracts for Difference Allocation Round 4 results, July 2022, available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1103022/contracts-for-difference-allocation-round-4-results.pdf.
- ¹¹⁸ Contracts for Difference Allocation Round 5 results, September 2023, available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1183230/cfd-ar5-results.pdf.
- ¹¹⁹ DESNZ, https://www.gov.uk/government/consultations/introducing-a-contracts-for-difference-cfd-sustainable-industry-reward.
- ¹²⁰ DESNZ, https://www.gov.uk/government/news/boost-for-offshore-wind-as-government-raises-maximum-prices-in-renewable-energy-auction.
- 121 New York's 10-Point Action Plan to Expand a Thriving Large-Scale Renewable Industry, NYSERDA, October 2023, available online at https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programmes/Offshore-Wind/10-point-plan.pdf.
 122 Nyserda Comments On Petitions Requesting Price Adjustments To Existing Contracts, August 2023, available online at https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programmes/Clean-Energy-Standard/2023/NYSERDA-Comments-Petitions.pdf.
- 123 PSC Issues Decision To Preserve Competitive Renewable Energy Market And Protect Consumers, New York State Public Service Commission, October 2023, available online at https://dps.ny.gov/system/files/documents/2023/10/pr23105.pdf.
 124 Implementation of REC Mechanism, Grid Conntroller of India Ltd, December 2022, available online at https://www.recregistryindia.nic.in/pdf/REC_Procedures.pdf.
- ¹²⁵ Policy paper on Indian Carbon Market (ICM), Ministry of Power and Ministry of Environment, Forest and Climate change on behalf of Government of India, October 2022, available online at
- $\underline{\text{https://cer.iitk.ac.in/odf_assets/upload_files/blog/Draft_Carbon_Market_Policy_DocumentFor_Stakeholder_Consultation.pdf.}$
- ¹²⁶ Department of Energy, Environment and Climate Action, https://www.energy.vic.gov.au/renewable-energy/renewable-energy/renewable-energy/renewable-energy/renewable-energy-zones.
- ¹²⁷ How to complete your National Grid ESO application form, National Grid, available online at https://www.nationalgrid.com/electricity-transmission/document/131316/download.
- 128 Decision on Pathway to 2030, Ofgem, available online at https://www.ofgem.gov.uk/sites/default/files/2023-03/_Final_Decision_on_PT2030_290323.pdf.
- ¹²⁹ Energy Act 2004, available online at https://www.legislation.gov.uk/ukpga/2004/20/contents.
- 130 Electricity Act 1989, available online at https://www.legislation.gov.uk/ukpga/1989/29/contents.
- ¹³¹ The Electricity (Competitive Tenders for Offshore Transmission Licences) Regulations 2015, available online at https://www.legislation.gov.uk/uksi/2015/1555/contents/made.
- ¹³² Offshore Transmission Owner Regime, Department of Energy Security and Net Zero, November 2023, available online at https://assets.publishing.service.gov.uk/media/654d162a014cc9000d67739c/offshore-transmission-owner-regime-call-forevidence.pdf



- ¹³³ The NYISO Interconnection Process, Maintaining Reliability for a Grid in Transition, New York ISO, January 2023, available online at: https://www.nyiso.com/documents/20142/35688159/2023-NYISO-Interconnection-Process-Report.pdf
- ¹³⁴ Queued Up: Characteristics of Power Plants Seeking Transmission Interconnection As of the End of 2022, Joseph Rand, Rose Strauss, Will Gorman, Joachim Seel, Julie Mulvaney Kemp, Seongeun Jeong, Dana Robson, Ryan Wiser, April 2023, available online at: https://emp.lbl.gov/sites/default/files/queued_up_2022_04-06-2023.pdf
- ¹³⁵ Indian Electricity Grid Code regulations, CERC on behalf of Government of India, 2023, available online at https://cercind.gov.in/Regulations/180-GAZ.pdf.
- ¹³⁶ Model guidelines for Management of RE Curtailment for wind and solar generation, Forum of Regulators, 2022, available online at https://forumofregulators.gov.in/Data/study/FOR-Report-RE-Curtailment-Guidelines-Nov-2022.pdf.
- ¹³⁷ Standard Power Purchase Agreement For Procurement Of MW Wind-Solar Hybrid Power On Long Term Basis, SECI, available online at https://www.seci.co.in/Upload/Tender/SECI000047-2648427-StandardSECI-HPDPPA_1200MWT4_finalupload.pdf.
- ¹³⁸ Industrial Safety and Health Act, available online at:

https://www.japaneselawtranslation.go.jp/en/laws/view/3440/en#je_ch3

- 139 Japan Construction Occupational Safety and Health Association, https://www.kensaibou.or.jp/safe_tech/cohsms/about_cohsms/index.html
- ¹⁴⁰ Nordzeeloket, https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/laws-regulations-international-treaties-policy/.
- 141 Global Offshore Wind Health and Safety Organisation, https://www.gplusoffshorewind.com/whats-new.
- 142 Nordzeeloket, https://www.noordzeeloket.nl/en/functions-and-use/offshore-wind-energy/shipping-moswoz/.
- ¹⁴³ CMS Law-Now, https://cms-lawnow.com/en/ealerts/2016/11/the-netherlands-rules-regulating-working-time-at-offshore-wind-farms.
- ¹⁴⁴ Health and Safety at Work etc. Act 1974, available online at https://www.legislation.gov.uk/ukpga/1974/37/contents.
- ¹⁴⁵ The Management of Health and Safety at Work Regulations 1999, available online at https://www.legislation.gov.uk/uksi/1999/3242/contents.
- ¹⁴⁶ The Construction (Design and Management) Regulations 2015, available online at https://www.legislation.gov.uk/uksi/2015/51/contents.
- ¹⁴⁷ The Health and Safety at Work etc. Act 1974 (Application outside Great Britain) Order 2013, available online at https://www.legislation.gov.uk/uksi/2013/240/contents/made.
- ¹⁴⁸ Offshore Renewable Energy Installations: Requirements, guidance and operational considerations for SAR and Emergency Response, November 2021, available online at

https://assets.publishing.service.gov.uk/media/6195138f8fa8f50385f7eb6d/OREL SAR Requirements v3.pdf.

- ¹⁴⁹ New York State Offshore Wind Masterplan, Health and Safety Study, NYSERDA, November 2017, available online at: https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Publications/Research/Biomass-Solar-Wind/Master-Plan/17-25k-OSW-Health-Safety.pdf
- ¹⁵⁰ 30 CFR 585.810 What must I include in my Safey Management System?, available online at https://www.govinfo.gov/app/details/CFR-2022-title30-vol2/CFR-2022-title30-vol2-sec585-810/summary
- ¹⁵¹ Occupational Safety and Health Standards, OSHA, available online at https://www.osha.gov/laws-regs/regulations/standardnumber/1910/1910TableofContents.
- ¹⁵² Dock Workers (Safety, Health and Welfare) Regulations, 1990, February 1990, available online at https://upload.indiacode.nic.in/showfile?actid=AC CEN 6 6 00035 198654 1517807326854&type=regulation&filename=T he%20Dock%20Workers%20(Safety,%20Health%20and%20Welfare)%20Regulations,%201990.pdf.
- ¹⁵³ The Building and Other Construction Workers Act, 1996, available online at https://clc.gov.in/clc/acts-rules/building-and-other-construction-workers.
- ¹⁵⁴ Principles related to Health, Safety and Environment, Ministry of Petroleum and Natural Gas, available online at http://petroleum.nic.in/sites/default/files/rule_0.pdf.
- ¹⁵⁵ Codes of practices for emergency response and disaster management plan, available online at https://www.pngrb.gov.in/OurRegulation/Others-GSR39.html.
- ¹⁵⁶ Final Environmental and Social management framework, SECI, 2018, available online at https://www.seci.co.in/upload/static/files/ESMF%20June%202020.pdf.
- ¹⁵⁷ Australian Business Licence and Information Service (ABLIS), https://ablis.business.gov.au/service/ag/australian-standards-wind-turbines/41286
- ¹⁵⁸ Best Practice Guidelines For Implementation Of Wind Energy Projects In Australia, June 2018, available online at https://assets.cleanenergycouncil.org.au/documents/advocacy-initiatives/community-engagement/wind-best-practice-implementation-guidelines.pdf.



- ¹⁵⁹ Uniform explanation of technical standards for offshore wind power generation equipment, Offshore Wind Power Facility Review Committee, March 2020, available online at (Japanese):
- https://www.meti.go.jp/shingikai/safety_security/yojo_furyoku/pdf/20200327_01.pdf
- ¹⁶⁰ Offshore renewable energy standardization review, British Standards Institute, September 2014, available online at https://www.bsigroup.com/LocalFiles/en-GB/standards/BSI-Offshore-renewable-energy-standardization-review-UK-EN.pdf.
- 161 Floating Offshore Wind Application Of Standards, Regulations, Project Certification & Classification Risks And Opportunities, Ramboll on behalf of OREC, July 2021, available online at https://ore.catapult.org.uk/wp-content/uploads/2021/09/PN000405-RPT-002-D1-FOW-Standards-Certification-and-Classification-Mapping-Report_Formatted.pdf.
- ¹⁶² The World Bank Group, https://www.worldbank.org/en/projects-operations/environmental-and-social-framework/brief/environmental-and-social-standards.
- ¹⁶³ Code of Federal Regulations, 30 CFR 285.700-714, available online at https://www.ecfr.gov/current/title-30/chapter-ll/subchapter-B/part-285/subpart-G.
- ¹⁶⁴ New York State Offshoer Wind Master Plan Health and Safety Study, NYSERDA November 2017, available online at https://www.nyserda.ny.gov/-/media/Project/Nyserda/files/Publications/Research/Biomass-Solar-Wind/Master-Plan/17-25k-OSW-Health-Safety.pdf.
- ¹⁶⁵ NIWE, https://niwe.res.in/department_certification_introduction.php.
- ¹⁶⁶ MNRE, https://ccdcwind.gov.in/rlmm.html.
- ¹⁶⁷ Guidelines for Development of Onshore Wind Power Projects, NIWE, 2016, available online at https://niwe.res.in/assets/Docu/Latest%20Guidelines%20for%20Development%20of%20Onshore%20Wind%20Power%20Projects.pdf.
- ¹⁶⁸ Latest RLMM, MNRE, June 2022, available online at
- $\underline{https://cdnbbsr.s3waas.gov.in/s3716e1b8c6cd17b771da77391355749f3/uploads/2022/12/2022122740.pdf.}$
- ¹⁶⁹ Community Engagement Guidelines, Clean Energy Council, June 2018, available online at https://assets.cleanenergycouncil.org.au/documents/advocacy-initiatives/community-engagement/wind-community-engagement-guidelines.pdf.
- ¹⁷⁰Public Acceptance of Offshore Wind Farms in the Netherlands, University of Twente, 2019, available online at https://essay.utwente.nl/79333/1/DION_MSC_BMS.pdf.
- ¹⁷¹ Community Benefits for Electricity Transmission Network Infrastructure, March 2023, available online at https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1158490/community_benefits for electricity transmission network infrastructure.pdf.
- ¹⁷² Rampion Offshore Wind, https://www.rampionoffshore.com/community/benefit-fund/.
- ¹⁷³ Vattenfall, https://group.vattenfall.com/uk/what-we-do/our-projects/vattenfallinnorfolk/norfolk-zone-community-benefit-fund.
- ¹⁷⁴ CVSC, https://www.cvsc.org.uk/en/funding/gwynt-y-mor-community-fund.
- ¹⁷⁵ William Brown, 'BOEM Tribal Consultation Guidance', June 2018, available online at https://www.boem.gov/sites/default/files/about-boem/Public-Engagement/Tribal-Communities/BOEM-Tribal-Consultation-Guidance-with-Memo.pdf.
- ¹⁷⁶ Sagarmala, https://sagarmala.gov.in/project/coastal-community-development.
- ¹⁷⁷ Sophie Vorrath, Renew Economy, https://reneweconomy.com.au/victoria-port-submits-plans-for-australias-offshore-wind-terminal/.
- ¹⁷⁸ Service Delivery 2023-24, Treasurer of the State of Victoria, May 2023, available online at https://s3.ap-southeast-2.amazonaws.com/budgetfiles202324.budget.vic.gov.au/2023-24+State+Budget+-+Service+Delivery.pdf.
- ${\small \ \ \, }^{179}\, \textbf{Teesside Freeport}, \underline{\ \, }\underline{\ \, }\underline{$
- ¹⁸⁰ 'UK launches Floating Offshore Wind Task Force to seize world leadership in innovative technology', *Press release*, RenewableUK, 7 June 2022, available online at https://www.renewableuk.com/news/607735/UK-launches-Floating-Offshore-Wind-Task-Force-to-seize-world-leadership-in-innovative-technology.htm.
- ¹⁸¹ Department for Energy Security and Net Zero, https://www.gov.uk/government/publications/floating-offshore-wind-manufacturing-investment-scheme.
- 182 https://portofblyth.co.uk/offshore-energy/
- ¹⁸³ Supply Chain, Port Infrastructure and Logistics Study, GWEC, June 2016, available online at https://niwe.res.in/assets/Docu/FOWIND/FOWIND_SC.pdf.



- ¹⁸⁴ Offshore Wind Port Infrastructure Study for India, CoE on behalf of DEA and MNRE, November 2022, available online at https://coe-osw.org/wp-content/uploads/2022/11/Offshore-Wind-Port-Infrastructure-Study-for-India CoE final.pdf.
- ¹⁸⁵ CECP, https://www.cecp-eu.in/events/post/virtual-roundtable-on-off-shore-wind.
- ¹⁸⁶ 'Indian Port Readiness for Offshore Project Development', V.O. Chidambaranar Port Authority, available online at https://www.cecp-eu.in/uploads/documents/events/57/PPT Tuticorin port.pdf.
- ¹⁸⁷ Indian Port Readiness for Offshore Project Development, APM Terminals, available online at https://www.cecpeu.in/uploads/documents/events/57/PPT APM Terminals Pipavav.pdf.
- ¹⁸⁸ Indian Port Readiness for Offshore Project Development, APM Terminals, available online at https://www.cecpeu.in/uploads/documents/events/57/PPT APM Terminals Pipavav.pdf.
- ¹⁸⁹ M Ramesh, 'MNRE plans ₹1,354-crore projects to develop Pipavav, Tuticorin ports for offshore wind', *The Hindu,* 17 March 2023, available online at https://www.thehindubusinessline.com/news/science/mnre-plans-1354-crore-projects-to-develop-pipavav-tuticorin-ports-for-offshore-wind/article66606522.ece
- ¹⁹⁰ Victorian Government, https://www.vic.gov.au/tafe-toolkit-local-jobs-first-policy-compliance.
- ¹⁹¹ Offshore Energy Implementation Statement 2, Victorian Government, March 2023, available online at https://www.energy.vic.gov.au/ data/assets/pdf file/0017/622241/offshore-wind-implementation-statement-2.pdf.
- ¹⁹² Melissa Keane; Tristan Kelly; Anthony Tridgell; Emily Graham; Fahid Ifthekhar, Allens, https://www.allens.com.au/insights-news/insights/2023/09/Getting-offshore-wind-off-the-ground/
- ¹⁹³ *Dutch Offshore Wind Guide*, The Netherlands Enterprise Agency on behalf of Ministry of Foreign Affairs and International Trade, 2022, available online at
- https://www.rvo.nl/sites/default/files/2021/10/Dutch%20Offshore%20Wind%20Guide%202022.pdf.
- ¹⁹⁴ Department for Energy Security and Net Zero and Department for Business, Energy & Industrial Strategy, https://www.gov.uk/government/publications/contracts-for-difference-cfd-allocation-round-5-supply-chain-plan-questionnaire-and-guidance.
- ¹⁹⁵ Department for Business, Energy & Industrial Strategy. https://www.gov.uk/government/publications/offshore-wind-manufacturing-investment-support-scheme.
- ¹⁹⁶ Department for Energy Security and Net Zero, https://www.gov.uk/government/publications/floating-offshore-wind-manufacturing-investment-scheme.
- 197 ORE Catapult, https://ore.catapult.org.uk/what-we-do/supply-chain-growth/fit-4-offshore-renewables/.
- ¹⁹⁸ Methodology for measuring the UK content of UK offshore wind farms, BVG Associates, May 2015, available online at https://cdn.ymaws.com/www.renewableuk.com/resource/resmgr/Publications/Guides/uk_content_methodology.pdf.
- ¹⁹⁹ Capability Assessment of India's Offshore Wind Supply Chain, MEC+ and OREC on behalf of UKRI India, March 2023, available online at https://mecintelligence.com/home-screen/reports/India-offshore-wind-supply-chain.
- ²⁰⁰ Aditya Rebbapragada, Norton Rose Fulbright, 2023, available at
- $\underline{\text{https://www.nortonrosefulbright.com/en/knowledge/publications/bbbb6e0c/developing-offshore-wind-energy-in-india\#section5}$
- ²⁰¹ Engage Victoria, https://engage.vic.gov.au/project/offshore-wind-transmission-in-gippsland-and-portland/page/development-and-engagement-roadmap.
- ²⁰² Department for Energy Security and Net Zero, Department for Business, Energy & Industrial Strategy, https://www.gov.uk/government/publications/offshore-transmission-network-review.
- ²⁰³ Ofgem, https://www.ofgem.gov.uk/publications/ofgem-announces-tough-new-policy-clear-zombie-projects-and-cut-waiting-time-energy-grid-connection.
- ²⁰⁴ SONI, https://www.soni.ltd.uk/newsroom/press-releases/ni-grid-carrying-world-le/index.xml.
- ${}^{205}\,\textit{NYSERDA},\,\, \underline{\text{https://www.nyserda.ny.gov/All-Programmes/Offshore-Wind/Focus-Areas/Transmission-NY-Electricity-Grid.}$
- ²⁰⁶ Initial Report on the New York Power Grid Study, New York Department of Public Service Staff, New York State Energy Research and Development Authority Staff, The Brattle Group and Pterra Consulting on behalf of the New York State Public Service Commission, January 2021, available online at https://www.nyserda.ny.gov/-

/media/Project/Nyserda/Files/Publications/NY-Power-Grid/full-report-NY-power-grid.pdf.

- ²⁰⁷ Transmission System for Integration of over 500 GW RE Capacity By 2030, CEA on behalf of Government of India, December 2022, available online at https://cea.nic.in/wp-
- content/uploads/notification/2022/12/CEA Tx Plan for 500GW Non fossil capacity by 2030.pdf.
- ²⁰⁸ Department of Energy, Environment and Climate Action, https://www.energy.vic.gov.au/grants/energy-innovation-fund.
- ²⁰⁹ Australia and New Zealand Infrastructure Pipeline, https://infrastructurepipeline.org/project/star-of-the-south.
- ²¹⁰ Star of the South, (2022), https://www.starofthesouth.com.au/news-media-releases/cip-partners-with-cbus-in-the-australian-offshore-wind-project-star-of-the-south.



²¹¹ Implementation of Offshore Wind Farm Projects at Akita Port and Noshiro Port in Akita Prefecture and Conclusion of the Load Agreements, Marubeni Corporation, February 2020, available online at:

https://www.marubeni.com/en/news/2020/release/20200203E.pdf

- ²¹² Pattern Energy Closes Financing of Japan's Largest Offshore Wind Power and Storage Projects https://www.prnewswire.com/news-releases/pattern-energy-closes-financing-of-japans-largest-offshore-wind-power-and-storage-project-301621029. html#
- ²¹³ Mizuho, MUFG and DBJ jointly arrange project financing for Kitakyushu-Hibikinada Offshore Wind Farm, Mizho Bank, MUFG Bank, Development Bank of Japan, April 2023, available online at: https://www.dbj.jp/en/upload/dbj_news/docs/e98565f7b570f083494d5c173e8cf5c1_1.pdf
- ²¹⁴ Adnan Durakovic, 'EIB Greenlights EUR 500 million Hollandse Kust (Noord) Loan', *Offshorewind.biz*, May 12 2020, available online at https://www.offshorewind.biz/2020/05/12/eib-greenlights-eur-500-million-hollandse-kust-noord-loan/.
- ²¹⁵ Advancing the Growth of the U.S. Wind Industry: Federal Incentives, Funding, and Partnership Opportunities, U.S. Department of Energy, April 2023, available online at https://www.energy.gov/sites/default/files/2023-04/eere-wind-weto-funding-taxdav-factsheet-fy23.pdf.
- ²¹⁶ Tim Ferry, 'lberdrola and CIP in historic \$1.2bn Vineyard Wind tax equity deal with leading US banks', *Recharge*, 26 October 2023, available online at https://www.rechargenews.com/wind/iberdrola-and-cip-in-historic-1-2bn-vineyard-wind-tax-equity-deal-with-leading-us-banks/2-1-1542564.
- ²¹⁷ Interest Rates w.e.f. 15.09.2023, IREDA, September 2023, available online at https://www.ireda.in/interest-rate-matrix.
- ²¹⁸ Lending Rates effective from March 01, 2023 till further notification, REC Limited, March 2023, available online at https://recindia.nic.in/uploads/files/CO--ALM-Interest-rates-dt27-02-23.pdf.
- ²¹⁹ Chiranjeevi Kulkarni, 'ADB World Bank to support Offshore Wind energy projects', *Deccan Herald*, 5 Feb 2023, available online at https://www.deccanherald.com/india/adb-world-bank-to-support-offshore-wind-energy-projects-1188183.html.
- ²²⁰ Financing India's 2030 Renewables Ambition, BloombergNEF, June 2022, available online at
- $\underline{https://assets.bbhub.io/professional/sites/24/BNEF-Financing-India\%E2\%80\%99s-2030-Renewables-Ambition_FINAL.pdf.}$
- ²²¹ Creating jobs and spurring investment in new energy industries, Department of Climate Change, Energy, the Environment and Water, October 2022, available online at https://www.dcceew.gov.au/sites/default/files/documents/oct-budget-2022-23-jobs-fs.pdf.
- ²²² Chris Bowen, Department of Climate Change, Energy, the Environment and Water, (2022),

https://minister.dcceew.gov.au/bowen/media-releases/unlocking-power-offshore-wind.

- ²²³ EIS/EES Consultation Plan, Star of the South, March 2021, available online at
- $\frac{\text{https://static1.squarespace.com/static/5eb3699d1492806f7759caf4/t/608f5a1d527c290aeb568f16/1620007457275/SOTS}{\text{\pm EIS+EES+Consultation+Plan+v1.0.pdf.}}$
- ²²⁴ Socioeconomic Analysis of Offshore Wind Power Development in Japan, Renewable Energy Institute, December 2022, available online at: https://www.renewable-ei.org/pdfdownload/activities/REL_SocioEconomicAnalysis_EN.pdf
- ²²⁵ Employment analysis (2019-2023) of various fields of activities in the Dutch offshore wind sector, TKI Wind Op Zee, July 2019, available online at https://northseawindhub.com/wp-content/uploads/OW-Employment-NL-Report-TKI-Wind-op-zee.pdf.
- ²²⁶ Offshore Wind Skills Intelligence Report, Offshore Wind Industry Council, June 2023, available online at https://www.owic.org.uk/ files/ugd/1c0521 94c1d5e74ec14b59afc44cebe2960f62.pdf.
- ²²⁷ Department for Business and Trade, Department for Energy Security and Net Zero, and Department for Business, Energy & Industrial Strategy, https://www.gov.uk/government/publications/offshore-wind-sector-deal.
- ²²⁸ Clean Energy Workforce Development Overview, NYSERDA, August 2023, available online at

https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Publications/Fact-Sheets/workforce-fact-sheet.pdf.

- ²²⁹ Gap Assessment of training and skill building in Offshore wind energy sector in India, CECP, 2022 available online at https://www.cecp-eu.in/uploads/documents/events/57/Gap Assessment of training Off shore wind.pdf
- ²³⁰ Gap Assessment of training and skill building in Offshore wind energy sector in India, CECP, 2022 available online at https://www.cecp-eu.in/uploads/documents/events/57/Gap Assessment of training Off_shore_wind.pdf
- ²³¹ Decommissioning Of Offshore Renewable Energy Installations Under The Energy Act 2004, Department for Business, Energy & Industrial Strategy, March 2019, available online at

 $\underline{https://assets.publishing.service.gov.uk/media/5f5b2724e90e0718e212a22d/decommisioning-offshore-renewable-energy-installations-energy-act-2004-guidance-industry_1_.pdf.}$

- ²³² Siemens Gamesa, https://www.siemensgamesa.com/en-int/explore/journal/recyclable-blade.
- ²³³ SSE Renewables, https://www.sserenewables.com/news-and-views/2023/03/re-use-refurbishment-and-re-engineering-of-broken-wind-turbine-parts-could-create-20-000-uk-jobs-and-multi-billion-pound-supply-chain/.
- ²³⁴ *Circularity market analysis*, BVGA on behalf of SSE Renewables, March 2023, available online at https://www.sserenewables.com/media/234nrsfp/bvga-31410-circularity-market-analysis-r2-1.pdf.



²³⁵ Guidelines for Development of Onshore Wind Power Projects, Ministry of New and Renewable Energy, 22 October 2016, available online at

 $\underline{\text{https://niwe.res.in/assets/Docu/Latest\%20Guidelines\%20for\%20Development\%20of\%20Onshore\%20Wind\%20Power\%20Projects.pdf.}$

- ²³⁶ Indian Environmental Portal, http://www.indiaenvironmentportal.org.in/content/375793/offshore-wind-power-vs-onshore-wind-power-vs-onshore-wind-power/.
- ²³⁷ Draft 'National Repowering Policy, MNRE, 2022', Ministry of New and Renewable Energy, 17 October 2022, available online at https://prsindia.org/files/parliamentry-announcement/2022-11-
- $\underline{\texttt{01/Draft\%20National\%20Repowering\%20Policy\%20for\%20Wind\%20Power\%20Projects.pdf.}$