How a regulatory framework impacts the evolution of offshore wind in Australia

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Introduction

With Australia's national regulatory framework for offshore energy in effect since June 2022, there has been an uptick in the offshore wind sector as domestic and international players and developers regularly announce new and enhanced projects. There is significant variance in ownership structure outcomes and the operation of associated assets, which are fundamental to making strategic investment decisions. PSC attempts to navigate these possibilities with a perspective that informs and continues the discussion on the direction of offshore wind in Australia.

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Australia's offshore energy framework

Australia's offshore renewable energy infrastructure is regulated under the [Offshore Electricity Infrastructure (OEI) Act 2021] and the [OEI Regulations 2022]. The framework aims to facilitate the development, construction, operation and decommissioning of fixed and floating renewable generation and transmission projects (e.g., offshore wind and solar farms, wave energy plants, and undersea interconnectors) within Australia's territorial sea.

There are three essential components of this framework:

1. **Legal structure:** The OEI Act creates the mechanism to license and operate offshore wind. It establishes the legal entity or entities responsible for enforcing regulations and sets the stages of project development. The OEI Act enables flexibility in the ownership and sale of the power (i.e., how transmission assets are owned and operated).

2. **Licensing:** Offshore renewable energy infrastructure projects require a license. Commercial licenses allow offshore renewable energy infrastructure projects for up to 40 years.

   - Transmission and infrastructure licenses permit the installation and operation of undersea interconnectors to transmit electricity.
   - Research and development (R&D) licenses enable short-term projects (up to 10 years) to trial and test new offshore renewable energy technologies.[1]
   - A feasibility license is required before getting a commercial license. The feasibility license allows the holder to identify viable land and sea areas to implement projects for up to seven years.
   - There is also a license to purchase for project development, including wind farm generation and ownership and operations of the transmission assets that connect the wind farm to the main line.

   After these preliminary licenses, there are standard license conditions for each licensable activity, such as transmission, offshore transmission, distribution, interconnector, generation, and supply.

3. **Regulations:** The regulations component of the offshore energy framework operates as a user's guide or standard operating procedure (SOP) for administering the OEI Act. It provides higher granularity and details around the technical and economic processes and procedures. Some regulations can prompt technical re-evaluation, but generally, they don't instigate wholesale changes in approach. It is reasonable at this stage of the licensing implementation to assume the process may be elongated, based on the experience of most jurisdictions thus far.

The OEI Act and OEI Regulations outline how and where infrastructure projects for renewable energy generation or transmission can operate. Offshore energy projects require a significant investment, so it's important to optimise implementation. This necessitates advanced strategic planning to ensure alignment with the offshore energy framework. The Act and Regulations don't stipulate the ownership/operational structure of offshore transmission assets that connect to the mainland. As such, it's still unclear if there would be a separate entity to own and operate the offshore transmission assets: Does the wind farm generator take ownership of the assets? Or, potentially, does the onshore transmission system operator take ownership of the associated assets and augment its existing license to enable this structure? Currently, it's all up for grabs.

1 *Australian Government, Department of Climate Change, Energy, the Environment and Water. «Establishing offshore wind: Licensing offshore renewable energy projects.» https://www.dcceew.gov.au/energy/renewable/establishing-offshore-infrastructure#toc_2*

Offshore wind schemes: a few examples worldwide

Determining which offshore wind scheme to use results from a confluence of events, including preference, geographic accessibility, investment and alignment with regulatory structures that various countries currently operate under. The selected offshore wind scheme must also maintain a degree of alignment with the current regulatory framework, like the OEI Regulations or the wider price control structures in Australia.

Evaluating the schemes used in various geographies worldwide can provide insight into the evolution of the offshore wind sector and help new entrants determine the best approach for their specific projects and regions.

United Kingdom

The UK's adopted offshore transmission operator (OFTO) scheme is more standalone, and at present, each OFTO is a separate transmission operator between the wind farm point of connection and the onshore point of connection with the onshore transmission system owner. The transmission assets comprise the offshore connection between the generator and the OFTO, the submarine cables connecting the offshore substation to the mainland and the onshore transmission assets connecting to the UK transmission network. The activities of generators, transmission operators, system operators, distribution operators and suppliers are separately licensed by the Office of Gas and Electricity Markets (Ofgem), the government Regulator for energy markets in Great Britain.

The UK wanted to ensure the best value for money for the consumer by taking the assets risk off the generator and not allowing the onshore operator to own the assets either. This was accomplished by separating the assets and packaging them into an auctionable commodity that someone could own—with a set return on investment over a set number of years, providing contractual safety and stability. Another goal of this approach was to stimulate competition, limit the scope and limit the risk to the investor, providing a safer and more stable investment.

United States

The U.S., up to this point, employs "generator-led lines" as its primary mechanism to connect offshore wind to the mainland. An offshore system operator mechanism is possible, though this is still hypothetical. The generator-led lines scheme means the offshore wind farm is connected and owns and operates those transmission assets to the connection point. Therefore, the generator carries the risk of the transmission assets and the wind farm itself. The offshore system operator route is when different wind farms connect to an offshore transmission operator who effectively coordinates and dispatches into the U.S. system. It is unclear how this would be renumerated, but presumably, a tariff-based mechanism similar to that deployed on the mainland would be the preferred solution.

Ireland

Ireland uses the transmission system operator (TSO) scheme, where the operator transmits electrical power from generation plants over the power grid to regional or local electricity distribution operators. The TSO owns and operates the transmission assets, but the onshore assets aren't necessarily owned and operated. EirGrid Group, Ireland's TSO, plans, manages and operates the national electricity transmission grid. ESB Networks operates, maintains and develops the electricity distribution network in Ireland. The mechanism enables a degree of separation in price control structure, which works in Ireland but may not be suitable in jurisdictions where transmission assets and owned and operated by the same entity.

Central Europe

Germany and Denmark plan to collaborate on offshore "energy hubs," enabling offshore wind development and the potential for green hydrogen production. A Dutch TSO proposed building an offshore transmission hub in German waters to connect three offshore farms to onshore green hydrogen projects, which could later be expanded to interconnect with other Central European countries' grids. It is still undetermined whether the schemes in the European space (particularly the one Germany uses) would maintain alignment and coherency with how things operate in Australia.

Takeaway

Although there are various options for offshore wind schemes, the longer-term question is how regulators choose to disaggregate these options. The new regulations provide flexibility because the generator doesn't have to be the transmission operator, but both have to have licenses to that effect. This approach offers adaptibility in long-term decision-making, which can then be optimised based on the long-term decisions made by the Australian Government. It is envisaged that consultation on such schemes would enable developers and broader stakeholders to support shaping the regime.

It should be noted that one offshore wind scheme is not necessarily better or worse than another regarding regulations. It is a culmination of preference, aligning with the overarching regulatory framework and assessing how to make the best-value decision in tandem with the practicalities of the project parameters.

Lessons learned from the UK

Offshore wind is still in its infancy and evolving in many geographics. In contrast, the UK is ahead by 10 years, having experienced various challenges and offering lessons that other countries can use to tackle the dynamic offshore wind sector.

Inspiring a competitive environment

One of the most critical lessons learned from the U.K. has to do with competition. The U.K. learned that the only way to drive prices down is to be as competitive as possible. The OFTO scheme was used to inspire competition/bidding and obtain the best value for the consumer. Unfortunately, after several bidding cycles, the costs of doing the due diligence on the transmission assets were too high. Due diligence work is typically \$2–\$4M for assessment analysis.

Developers and due diligence providers have become good at the assessment process. They know how and what to evaluate and ensure their bidding price is competitive enough to secure the investment. This practice diminishes the likelihood of new players wanting to compete. Those who can't "master" or afford the due diligence process don't win, making the bidding environment less attractive.

To inspire and maintain an effective competitive environment, ensuring as many credible bidders as possible can participate is important. This might require either underwriting/subsidising the bidding process or guaranteeing that the initial costs to prepare the bids would be covered for new entrants into the market.

The high cost of cable failure

Offshore cable technology has advanced in the last decade. And while the technology is still evolving, these cables are relatively new in the larger context of the renewable energy market.

"One of the biggest problems to affect the industry are issues with subsea cables. Failures and issues during installation and maintenance of subsea cables have cost companies millions of dollars and have caused many delays in this new and quickly rising industry."[2]

Stability in cable performance is critical to the success of the offshore wind project. Industry insurance brokers and underwriters report that approximately 80% of all financial losses and insurance claims are attributed to power cable failures, originating primarily from inadequate design and installation damage. Cable issues and failures can shut down an offshore wind operation, resulting in financial and societal impacts.

- **Installation:** Offshore cables are often large and long and must be buried underwater. Common installation complications include not being buried deep enough, inadequate tension during installation causing looping, and kinking or bending past the cable's maximum bend radius.
- **Inspections and repairs:** Cable inspections and repairs are time- and cost-intensive. Repairs from damages caused by ship anchor snags, fishing-trawler equipment, subsea landslides, and more can take two weeks to several months due to weather conditions, accessibility and availability of equipment and repair vessels. This activity can impair revenue and reduce the technical lifespan of an offshore wind farm.
- **Recovery:** Cables can be retrieved from the seabed for repairs, replacement or removal. In all cases, there are economical and time-related costs to recover the cable, which generally includes locating the cable and determining if a repair is required, retrieving the cable, and lifting the cable to the surface for removal or repair.
- **Assessments:** Environmental Impact Assessments (EIA) ensure that any environmental effects of cable laying and maintenance are accounted for before authorisation is given for the cable to be laid on the seabed. Schedules for completing an EIA range from a few weeks to a year or longer. This timeframe depends on the quantity and quality of data needed, the level of documentation and consultation required, and the presence of sensitive environmental resources within the project's bounds.[3]

All these scenarios can result in service interruptions, which come with associated penalties. As a result, there is a growing demand for better protection as projects move further offshore. The situation has become a "Catch-22": The projects need better protection, but insurance has become unaffordable because of increasing cable failures. One example was the significant number of failures at an offshore wind farm off the coast of Wales to the point where insurance companies wouldn't cover the cables, and ultimately, the insurance in the region became cost-prohibitive. As a result, Ofgem/the UK Government became the underwriters.

Takeaway

The UK's experience has shown that with comprehensive due diligence, there is potential to obtain the best-value solution. The initial investment will pay off in the end. Achieving the best-value solution will require (1) providing comprehensive and high-quality "due diligence" to give investors the confidence that the project is going to work and (2) driving down the cost of insurance. Regulators will need a new perspective to determine if actuary responses or signals are necessary to ensure investment stability and provide market confidence.

2 *PMI Underwater Cable Solutions. Subsea Cable Damage a Risk to Offshore Wind Farms. January 27, 2016. https://pmiind.com/damage-to-subsea-cables-a-huge-risk-to-offshore-wind-farms/*

3 *ICPC UNEP Report: Submarine cables and the oceans: connecting the world 2009.*

Potential impacts of new offshore energy regulations in Australia

The new regulations in Australia will have various impacts that utilities must consider, including asset ownership, geographic suitability, and asset resilience.

Asset ownership

The first thing to consider is if the onshore operator should take ownership of the assets. There could be distortions in the determined weighted cost of capital (WACC) should these large offshore assets join a regulated asset base (RAB). The risk is that a utility may outperform its determination levels with such a large single asset base integrated with a different operational profile. It may be possible to disaggregate the allotted WACC to enable this. The financing for offshore assets is slightly different compared to onshore assets, so a well-considered approach by the regulator would be needed.

Geographic suitability

To enable the integration of offshore renewables, there will inevitably be a requirement to reinforce the onshore network. Whilst the associated load centres in Australia are predominantly coastal in nature, ensuring that the need to transmit power over larger distances may be lessened, it will be necessary that current plans for network reinforcement consider these changes in order to maximise asset utilisation. This works both for the utility and potential developers in considering connection points.

A knock-on point to this will also be optimal sizing of the wind farm to meet demand needs locally unless there is a practical interconnection to facilitate wider energy transfer. If not, there is a risk of instruction to curtail generation, or a lengthy process of facilitating the interconnection.

Asset management and resilience

Asset evaluation at the start of a project and ongoing asset management will maximize the life expectancy of an offshore wind project. This is often a complex but necessary task to develop effective strategies for enhancing the wind farm's value, output and longevity. There are two key asset bases to consider when evaluating the resiliency of offshore wind projects: generation and transmission.

The **generation base** is the wind farm. It is similar to a power station build and includes the turbines, (generally) 66 kilovolts (kV) inter-array cabling, and connections from the wind farms to the collector. Each asset within the generation base will have a different "resilience" profile based on the manufacturers' and components' reliability and performance (i.e., hub, blades, nacelle, tower, foundation, and array cables). Generation base resiliency will be affected by factors such as wind turbine fatigue, asset integrity and depreciation, manufacturer reliability and warranties, cable management and subsea structural integrity.

The **transmission base** is a smaller piece in the larger puzzle and is the connection between the substation and transmission to the mainland. Transmission reliability and resilience generally have a higher obliged availability (Ofgem's typical value is 99.9%). Additionally, transmission asset resilience is impacted by cable insurance reliability. This can be an area of concern. As discussed above, actuary businesses have become hesitant to offer insurance to minimize their exposure to specific problems and risks related to cable failure.

Takeaway

Society depends on a reliable, on-demand, uninterrupted energy supply. Establishing the appropriate asset ownership, ensuring a suitable geography for reliable power flow from the offshore assets, and providing contractual availability and effective asset management are critical elements that determine the success of an offshore wind project.

"Offshore energy projects require a significant investment, so it's important to optimise implementation."

Considerations for new Australia offshore wind entrants

The offshore wind market is expected to grow significantly, with the APAC region showing significant long-term growth potential.[4] Banks want to diversify their portfolios away from carbon-intense technologies and toward net-zero projects. However, it takes several elements working together to get these projects off the ground and running smoothly and continuously. These projects are complex. They have a 30- to 40-year investment profile, dealing with large assets and the seabed, which greatly impacts costs, operations and maintenance. The ROI for offshore wind projects averages 20 years, but these projects are a relatively secure long-term investment. Having the appropriate experience and knowledge to deliver these projects adequately with the right infrastructure is key to success. Before getting too deep into the water, ensure common project requirements are evaluated, such as:

Project Consideration	Questions to ask and answer
Feasibility	Was it done to a standard that is comprehensive?
Asset location	Is adequate data available for long-term bathymetric changes (and other factors) available for the proposed location?
Existing documentation	If procuring existing assets, how comprehensive is the data room, are commissioning logs complete with supporting evidence?

Going on this journey alone can be cost-prohibitive for a new entrant. Consider engaging a firm with specialist strategic advisory services and deep experience in these areas and in different geographies—one that understands how to (1) integrate best practices from other areas where Australia doesn't and (2) work with dynamic regulatory structures and legislations. A strategic advisor could share lessons learned and best practices from previous projects to help you avoid unnecessary financial, business, or reputational loss.

4 *McKinsey & Company. How to succeed in the expanding global offshore wind market. April 2022.* https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/how-to-succeed-in-the-expanding-global-offshore-wind-market

PSC Advantage

PSC has been a technical advisor to offshore wind farm owners, OFTOs, and interconnector developers in various geographies. We are trusted advisors with subject matter expertise with significant experience offshore industry-wide.

We collaborate and support all market players with their aspirations by providing preliminary advice to help utilities, developers and regulators approach offshore wind projects with open eyes.

PSC has significant experience through the full life cycle of project feasibility through to delivery to becoming operational. As such, we provide robust and constructive advice throughout the process. We also ensure our clients have access to specialist advice through our network of SMEs.

In the international arena, PSC engineers have provided technical advice and/or concept design for the Bin Hai OWF in China, the Ishikore OWF in Japan, and the Virginia Offshore Wind development in the USA.

PSC is actively working with utilities, regulators, governments, and wider stakeholders to ensure the successful delivery of offshore wind projects in APAC countries. Because PSC has 28 years of global experience and expert power systems engineers, we can provide detailed assessments of various options and ultimately recommend a beneficial path to implement any offshore renewable energy project.

Learn more about PSC's specific capabilities and experience in offshore wind, and contact us to find out how we can help you navigate the regulatory aspects of your next project.

About the Author

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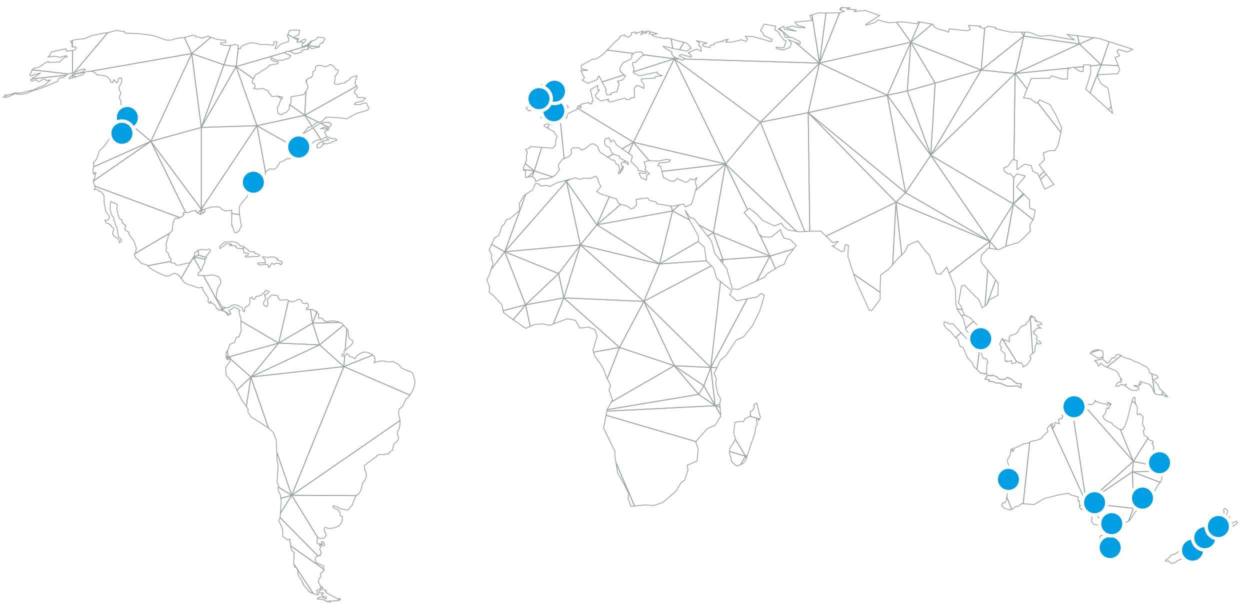
Dr Graeme Hutchison is a chartered electrical engineer and leads the Regulation and Business Advisory Team for PSC in Europe. He has been involved in numerous projects relating to power system planning, investment appraisal, privatisation and regulatory studies, system operations and security, and rural electrification. Graeme also fulfills the role of compliance officer for six UK Offshore Transmission Owners.

At PSC, we're helping power a more sustainable world

Our global team of electricity experts has been tackling the thorniest problems for some of the most prominent industry players for over 25 years. By empowering people to make a difference and do the right thing, we help our clients and employees innovate and thrive in a rapidly changing industry.



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