A Great Leap Forward? Offshore Wind in Ireland

A joint Cornwall Insight Ireland, ORE Catapult and Pinsent Masons paper 2018

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This Insight Paper discusses policy, market and technical developments necessary for deployment of large-scale offshore wind generation in Ireland. We make recommendations for additional changes that could enable new investment.

Foreword by IWEA

This report could not have come at a better time.

In recent months the European Union has set a target of 32 per cent renewable energy by 2030 to which Ireland will need to contribute, Enduring Connections Policy (ECP-1) provided a pathway for almost 600 MW of wind energy to connect to the grid and the publication of the high-level design for the Renewable Energy Support Scheme (RESS) has the potential to transform our industry.

It is more than 14 years since our only operational offshore wind farm, Arklow Bank, was fully commissioned.

For a generation we have seen some of the world's best offshore wind energy resources go unused. While other countries have forged ahead, using offshore wind energy as a core part of their transition to low-carbon economies, Ireland has fallen behind.

Instead of being leaders, we chose to stand idly by while others set the pace and over the summer the evidence mounted of our collective failure.

In June the Climate Action Network identified Ireland as the second worst country in Europe when it came to tackling climate change. A month later the Climate Change Advisory Council confirmed that our greenhouse gas emissions are increasing, not falling, and warned we are 'completely off course' in addressing climate change.

That is why this report is such an important call to action. It sets out the legislative and policy changes we need to see enacted to ensure that we can access the wealth of potential energy resources off our coasts, that can power our homes, our businesses and our economy with clean, renewable, energy.

It is no longer enough for Ireland to do the minimum. The RESS document strongly suggests that the Government's initial response to the new EU target will be to set a renewable electricity target of 55 per cent by 2030 when it presents its National Climate and Energy Plan at the end of the year.

We can, and must, do better. A target of 55 per cent is only a first step. IWEA and others in the renewable energy sector have united behind a call for a 70 per cent target by 2030.

A critical responsibility for policymakers is to make planning regulations and access to the grid for offshore energy as straight-forward and effective as possible.

The Maritime Area and Foreshore (Amendment) Bill must be released from legislative limbo. The legal and policy mechanisms needed to implement it must be introduced as quickly as possible.

We need clarity on how the ECP process will facilitate offshore wind and the detail of how the RESS auctions will work.

If this is done, industry will not be found wanting.

If policymakers ensure that offshore wind energy development is possible, that it is practical, we will see industry respond.

We will work with the TSOs and the regulator to compete in auctions, to keep prices as low as possible for consumers and to ensure that, finally, offshore wind energy can play its part in Ireland's carbon-free energy future.

2. Executive summary

There is untapped potential for the deployment of substantial offshore wind capacity in Ireland, taking advantage of large cost reductions seen in other comparable markets.

Ireland has some of Europe's best wind resource, but to date offshore wind deployment has lagged well behind other markets due to a lack of strong policy support. This situation may now change as energy policy, market frameworks and legislation evolve to promote more effective competition and new support arrangements emerge to encourage investment in renewable generation, expanding support to offshore wind in the future.

2.1 The evolving landscape for offshore wind in Ireland

Despite the fact that there is only 25MW of installed offshore wind capacity in Ireland, the high wind speeds and relatively benign sea conditions off the east coast mean that the technology has the potential to meet a large fraction of the renewable electricity targets across Ireland. This is evidenced by Eirgrid scenarios that suggest the potential for offshore wind capacity ranges between 250MW and 3GW by 2030.

To realise anything near this level of capacity will not be straightforward. The new Integrated Single Electricity Market (I-SEM) wholesale market arrangements being delivered this year will fundamentally alter the risk and reward dynamic for all generators and suppliers, with variable generation facing particular challenges. These include the ability to capture wholesale prices (which are likely to be volatile as weather conditions increasingly determine generation volumes) and managing imbalance price exposure.

The continuing disclosure on the next renewable support scheme in Ireland, the Renewable Electricity Support Scheme (RESS), which should allow offshore wind to access stable revenues via a contract for difference mechanism, is welcome. But detail is currently lacking on important elements such as auction design, strike price caps and any limits on technology specific volumes.

Moreover, the high levels of variable generation across I-SEM raises the prospect of price cannibalisation whereby low-marginal cost plant has the effect of suppressing wholesale prices to the point that conventional plant struggles to compete. This effect is seen in other markets and raises implications for how subsidised generation dispatches compared to non-subsidised plant and the costs and actions required by the Transmission System Operator to balance supply and demand in a wind dominated system. Adding offshore wind capacity will intensify those challenges.

New arrangements for releasing network connections are being developed through the Enduring Connections Policy work programme. Currently, the policy has only been clarified for the offering of connections to 'shovel ready' projects and not for a longer-term project pipeline. No offshore wind projects were included in the first batch of successful applicants for connections under this new approach.

The development of the Maritime Area and Foreshore (Amendment) Bill paves the way for a simpler consenting and planning regime to ensure offshore wind developers can secure the necessary permits and authorisations before entering auctions, but this has yet to be enacted into law and details on the exact process will only be available thereafter.

The timely completion of renewable support policy, network connection access and permitting are all surmountable, but further work by government bodies, regulators and industry is required to provide greater clarity and certainty for investors and developers. The work of the Offshore Renewable Energy Development Plan is now delivering on actions to coordinate support across government departments and other agencies. The input from industry should be formalised, as evidence from the Offshore Wind Cost Reduction Task Force in GB has shown the success this collaboration can deliver in bringing down costs, securing investment and meeting deployment timescales.

Industry working collaboratively with government and other authorities would ensure that the lessons learnt from neighbouring markets are utilised for Irish conditions. For example, decisions on port and quayside developments, operation and maintenance strategies and local supply chain opportunities.

Importantly, current indications of support for offshore wind by 2030 show that although the technology could represent a significant fraction of the overall generation mix in Ireland, the sector would be relatively small in comparison to other international markets. Our analysis suggests that current policy developments afford support for a maximum of 2.4GW by 2030 (which could be delivered by two to five projects).

To attract sufficient competitive tension from a large enough pool of developers (many of whom are active in other, larger markets), it is important that investors view Ireland as a market that has enduring appeal and a stable, coherent and long-term framework to establish a viable offshore wind sector, or where returns are likely to be attractive enough to warrant a less strategic, and more transactional approach.

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2.2 Recommendations

Issue	Recommendation
Simplifying the consenting and permitting regime	The Maritime Area and Foreshore (Amendment) Bill should be enacted into law at the earliest opportunity
Process to gain network connection agreement is uncertain for offshore wind	How the longer-term Enduring Connections Policy will manage offshore wind should be resolved as rapidly as possible, as a connection offer is necessary to obtain investor confidence and support under RESS
Final details on the levels of support, auction qualification and participation rules for offshore wind in RESS are not yet known	Details on the RESS auction rules should be forthcoming as soon as possible. The scale of offshore wind projects means that they require longer lead times to put in place finance and obtain the necessary consents and permits than most onshore developments
The potential size of the Irish offshore sector is presently too wide-ranging for international investors to take a view on whether to invest	The approach for introducing auction technology caps within RESS will determine the scale of the offshore wind sector in Ireland. The most up to date data on technology costs should be used to underpin the setting of caps, as well as consideration of how technology developments across Europe have significantly increased turbine capacities and load factors
It is not known if RESS support will take account of possible price cannibalisation impacts and system management costs.	The impact of increased volumes of variable generation on the Irish system and wholesale prices in the new I-SEM should be considered when appraising support costs and DS3 values so that whole-system impacts are adequately considered and planned for now
Industry has had a limited formal role to play in developing policy and supply chains	Efforts for collaboration between government, regulatory authorities and the offshore wind industry should be accelerated

> Offshore wind could contribute a significant volume of electricity and help meet renewables and carbon emission reduction targets

3. Current landscape for offshore wind

3.1 Introduction

Ireland is well placed geographically for the development of offshore wind due to high wind speeds and plenty of suitable areas for deployment.

Project 2040[1] set out ambitions to support up to 4.5GW of new renewables by 2030, around a doubling of current capacity. This ambition was supplemented by the proposed volumes of renewables to be supported under the Renewable Energy Support Scheme (RESS) High Level Design (HLD)[2].

Offshore wind could contribute a significant volume of electricity and help meet renewables and carbon emission reduction targets. The Offshore Renewable Energy Development Plan[3] (OREDP) indicated a potential of 4.5GW offshore wind capacity was attainable. EirGrid's Tomorrow's Energy Scenarios 2017 Locations Report[4], published August 2018, suggests offshore wind capacity could be in the range of 250MW and 3GW by 2030.

The wide range reflects uncertainty about future electricity demand, the impact of renewables support programmes and economic growth.

3.2 Carbon emission reduction targets

Ireland has a European Union (EU) target for Greenhouse Gas (GHG) emissions of a 20% reduction on 2005 levels by 2020. The European Commission Country Report 2018[5] states that Ireland will have only decreased emissions by 3% on 2005 levels by 2020. The Environmental Protection Agency's (EPA) recent forecasts[6] concluded that existing measures are set to increase emissions by 1% on 2018 levels by 2020 and 4% by 2030. Under its additional measures scenario emissions are estimated to increase by 2% by 2020 and decrease by only 1% by 2030.

The scenario for additional measures results in higher energy sector emissions out to 2025, primarily due to the assumption that peat continues to be used for co-firing with biomass after 2019. Forecast emissions fall from 2026 out to 2030, largely due to the accelerated phase out of coal fired generation and the commissioning of the Greenlink and Celtic interconnectors. The report stated, "Ireland is not on the right long-term trajectory in meeting national 2050 targets in the electricity generation, built environment and transport sectors".

Current targets are likely to increase with the EU setting a climate and energy framework with emission reductions of at least 40% on 1990 levels.

1. https://www.per.gov.ie/en/national-development-plan-2018-2027/
2. https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/renewable-electricity-supports/ress/Pages/default.aspx
3. https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/offshore/offshore-renewable-energy-development-plan-/Pages/Offshore-Renewable-Energy-Development-Plan.aspx
4. http://www.eirgridgroup.com/site-files/library/EirGrid/Tomorrows-Energy-Scenarios-2017-Locations-Report.pdf
5. https://ec.europa.eu/info/sites/info/files/2018-european-semester-country-report-ireland-en_1.pdf
6. http://www.epa.ie/pubs/reports/air/airemissions/ghgprojections2017-2035/#d.en.64039

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3.3 Renewable energy targets

Under the Renewable Energy Directive (RED), Ireland has a binding target of 16% of all energy consumption and 40% of total electricity demand to be met from renewable sources by 2020. According to SEAI, in 2016 Ireland generated 27.2% of its electricity demand from renewable sources, suggesting quite a gap to bridge.

Not only might Ireland miss its 2020 targets, but it faces an increase in the decade that follows. A binding target has been agreed of 32% share for renewable energy Europe-wide by 2030. Ireland must complete a draft 'National Energy and Climate' plan before the end of 2018 outlining how it will contribute to this EU wide target, so this work is currently underway by Irish policymakers. An indicative target of 26% renewable energy is mentioned in the High-Level Design of the RESS, which forms the justification for the 55% renewable electricity target mentioned in the same document.

As a result further growth in renewable capacity will be required to meet emissions and renewable targets.

3.4 Current offshore wind projects

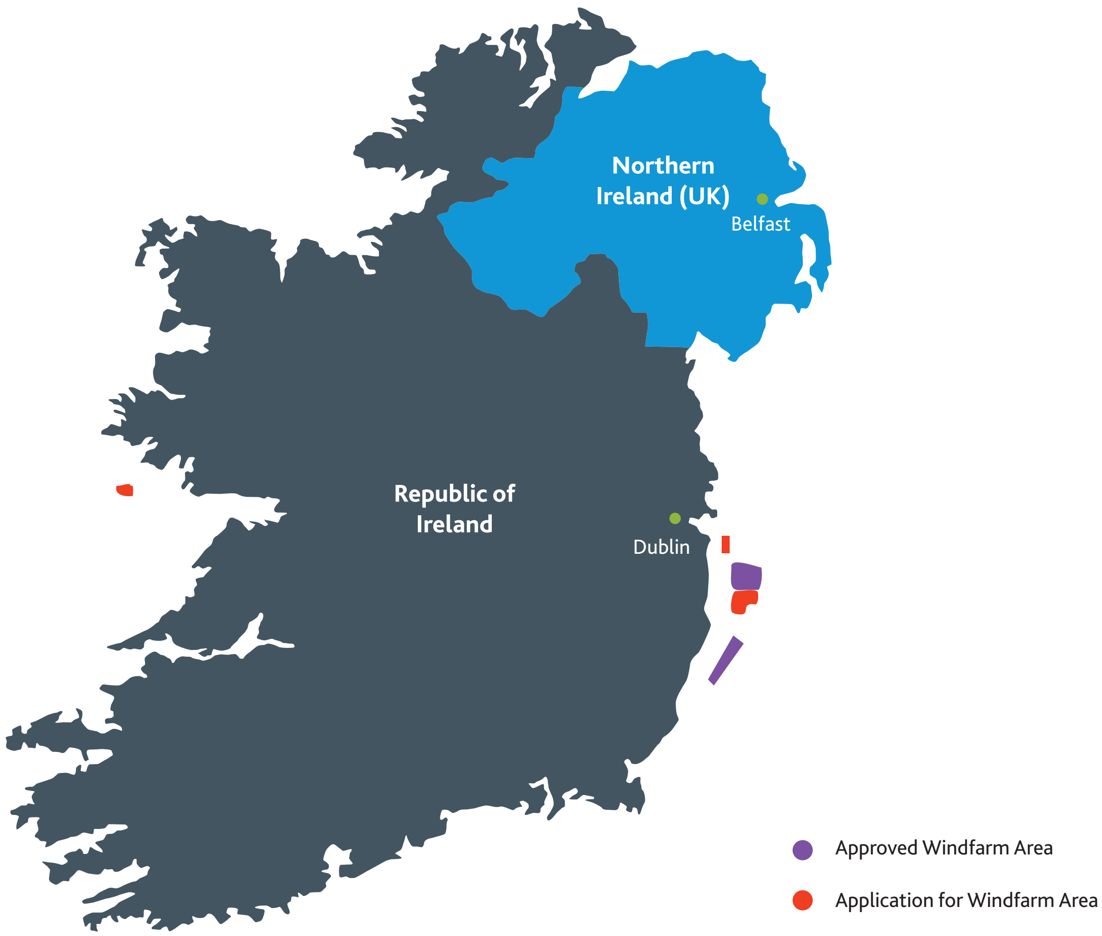
Ireland has only one operational offshore wind farm: the 25MW Arklow Bank situated on the east coast. It was fully commissioned in 2004 and funded without state assistance. The lack of adequate support was cited as a contributing factor to not expanding the project to 500MW capacity, as originally proposed.

Only now SSE has announced[7] that it is investing to develop phase II for Arklow Bank, with plans to increase capacity to 520MW.

Several other offshore projects have been in development over the years (see section 4.5). The location of the one existing and other potential projects are outlined in Figure 1.

The pipeline of projects relative to the scale of Ireland's generation market, electricity demand, and renewables and emissions targets is significant.

Figure 1: Offshore wind projects



Source: Cornwall Insight from industry data

7. http://sse.com/newsandviews/allarticles/2018/01/sse-tells-oireachtas-that-offshore-wind-can-power-the-future/

3.5 Legislative and consenting considerations

Offshore wind projects are subject to a number of legislative and consenting considerations which must be satisfied for a site to progress through planning and development, construction and commissioning.

3.5.1 Licensing Regulation

The Electricity Regulation Act 1999 (1999 Act)[8] requires any generating station that supplies final customers to obtain an Authorisation to Construct (Authorisation). Equally it is an offence under the same legislation[9] to generate electricity without first obtaining a Licence to Generate (Licence).

The Commission for Regulation of Utilities (CRU) is responsible for assessing and granting applications for Licences and Authorisations. Offshore wind farms in Ireland require both. The CRU also monitors ongoing compliance.

3.5.2 Foreshore Regulation

Additional specific consent requirements are in place for offshore generating sites. Currently the Foreshore Acts 1933 - 2014 (the Foreshore Act) remain the core legal instruments for managing the marine and coastal environment and the statutory basis on which an area of the seabed may be leased to a developer of an offshore wind farm.

The current Foreshore Act grants the appropriate Minister at the Department of Housing, Planning and Local Government the authority to lease or licence foreshore land belonging to the Irish state where it would be in the public interest to do so. Offshore generators applying for a network connection under the Enduring Connection Policy (see section 4.5) are required to provide evidence of a valid Foreshore Lease. In practice though, under the present process it is difficult to get projects approved, leased and consented as the developer has to interact with multiple parties simultaneously and decisions by one entity can impact on the outcome of other processes.

The Maritime Area and Foreshore Bill (Amendment) 2013 (the Maritime and Foreshore Bill) has been put forward with the intention of replacing the Foreshore Act and delivering a more efficient, robust and up to date leasing and consenting regime. It aims to streamline the development consent process, potentially reducing application costs (see Figure 2).

Before a Bill can be enacted into Irish law, it must be passed by both the Dáil and the Seanad. Several distinct stages must be progressed (i.e. to allow the Bill to be debated and amended) in each House to achieve this. The Maritime and Foreshore Bill has undergone significant preliminary work and engagement with relevant policy departments. Its contents appear to have been relatively uncontroversial. Given the work completed to date, rapid progress through the Dáil and Seanad should be attainable to enact into law soon. This urgency would be welcomed by the sector, as without this, the consenting process will remain an inhibitor to offshore wind growth.

Figure 2: Requirements of Maritime and Foreshore Bill

The Bill would require an Appropriate Assessment and Environmental Impact Assessment to be carried out by An Bord Pleanála, rather than the Department of Housing, Planning and Local Government as per now.

The developer will also need to obtain a Development Consent from An Bord Pleanála (or the relevant Local Authority if on the nearshore and no Environmental Impact Assessment is required) and a Maritime Option granted by the 'Appropriate Minister' (subject to change, but will most likely be a Minister at the Department of Housing, Planning and Local Government).

The new streamlined procedure will be similar to that for Nationally Significant Infrastructure Projects in England and Wales under the UK Planning Act 2008, which provides the relevant Secretary of State with the power to grant development consent for the entire project.

8. Under section 16 of the Electricity Regulation Act 1999 (1999 Act)
9. Under Section 14 of the 1999 Act

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3.6 Institutional Joint Working

Collaboration between government, industry and academia to date has tended to focus on understanding the environmental and economic impacts of offshore wind through the creation of the Offshore Renewable Energy Development Plan (OREDP). The plan, which issued its interim report in May 2018, is intended to inform and coordinate policy to support Ireland's offshore wind and ocean energy resources out to 2030. A selection of OREDP's recommendations and example of industry and government collaboration in the UK are provided in the Annex.

To deliver on the actions set out in the OREDP the Offshore Renewable Energy Steering Group[10] (ORESG) has been established to manage the implementation of the plan across its three work streams: environment, infrastructure, job creation and growth.

The ORESG is chaired by the DCCAE and includes representation from Government departments and agencies, but no members of industry or academia. However, separate plenary sessions are held on a regular basis with external stakeholders.

Nevertheless, external stakeholders are restricted to commenting on the developments in the sector through the ORESG rather than playing an active to role in the OREDP's implementation. The limited role for non-state actors may be a contributing factor to the lack of pace and momentum for the offshore wind sector in Ireland.

3.7 Deployment considerations

The majority of sites across northern Europe utilise fairly similar concept designs for offshore wind projects. Conditions at near term proposed Irish offshore wind projects are likely to be comparable to those in other European waters.

The depths at the majority of proposed Irish offshore sites are comfortably within the range of that which could already be considered 'business as usual', with an average across all proposed Irish offshore sites of around 22m water depth.

Contemporary projects in EU waters are currently installing turbines rated from 6 to 8MW with some projects expected to install turbines rated as high as 9.5MW in as little as two years. A steady increase in rated capacity of turbines is likely to continue, largely because of the dominant influence the increasing rated capacity exerts on the economics of offshore wind projects. Ireland is well positioned to capitalise on these improving trends.

As opposed to turbines which are relatively similar or identical across different sites, the balance of plant, foundations, cables, substations and supporting infrastructure are usually designed in a bespoke fashion to suit the needs of the site.

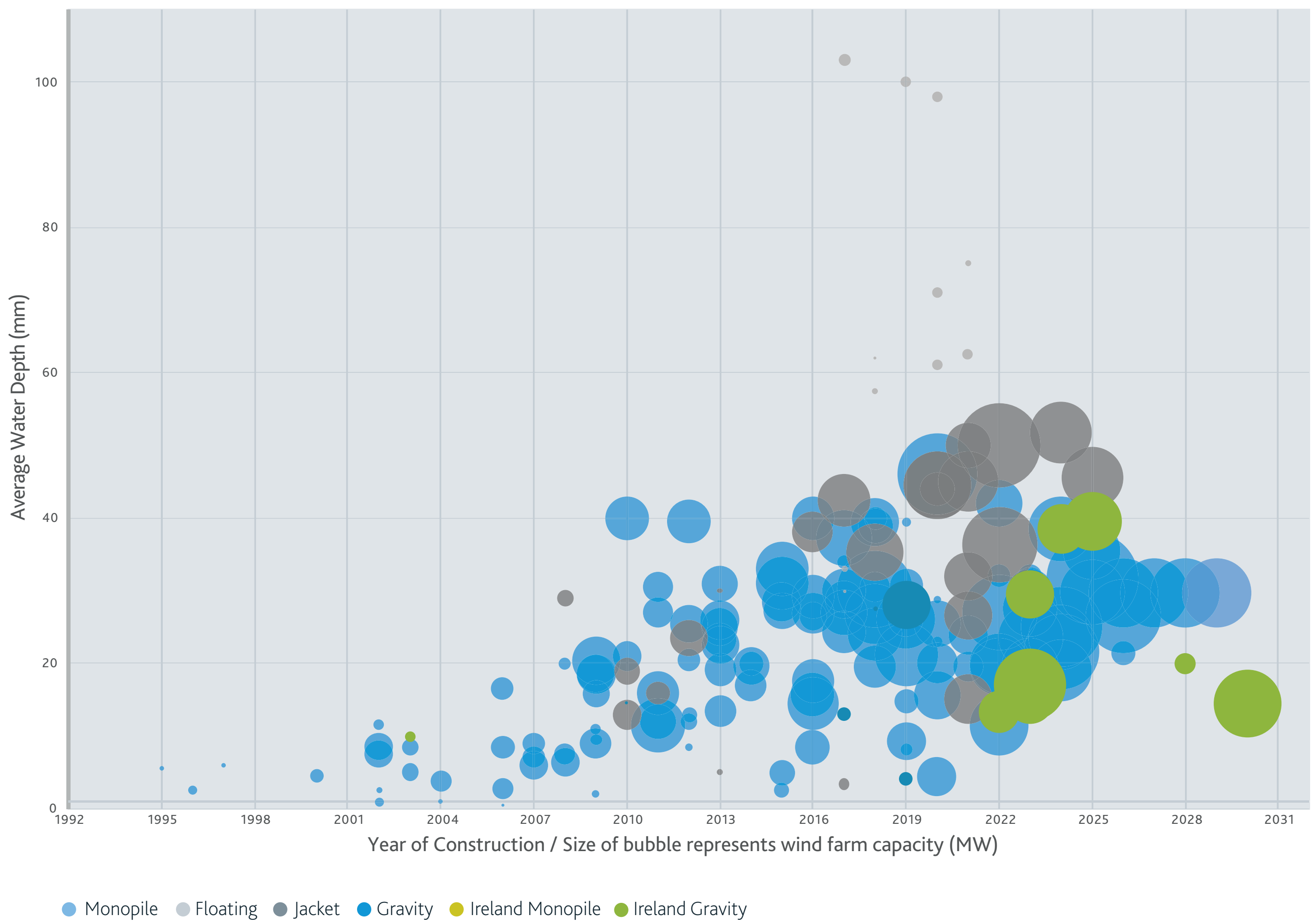
10. https://www.dccae.gov.ie/en-ie/energy/topics/Renewable-Energy/electricity/offshore/offshore renewable-energy-development-plan-/Pages/Offshore-Renewable-Energy-Development-Plan Meetings.aspx

3.7.1 Water depth and foundation technology

Water depth is a key driver in the conceptual design of an offshore wind farm. To date most projects across Europe have been deployed in relatively shallow water depths, but deeper waters will be accessed as foundation technology matures.

In Europe, monopile foundation technology is dominant with around 80% of sites using a variant of this technology. Jacket foundations make up almost all of the rest, with gravity and suction foundations seeing very limited application to date. Whilst generally a less mature technology there could also be some deployment of floating foundations at scale in Europe in the next 10 years.

Figure 3: Offshore wind foundation technologies - Europe



Source: ORE Catapult

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The depths at the majority of proposed Irish offshore sites are suitable for monopile foundations, which are common in up to 35m of water with jackets used up to around 55m depth (Figure 3). As such, Irish projects are unlikely to require significant leaps in technology to be able to be built economically.

Alternative foundation technologies, particularly gravity base foundations, have to date seen some application on sites comparable to the proposed Irish offshore sites. This foundation technology may be particularly attractive when there is a strong desire to increase the amount of fabrication work which can be completed locally. For example, concrete construction may be more accessible locally than steel fabrication, which requires specific facilities and skills.

Considering the cable, switchgear and sub-station hardware that will be deployed, it is likely that distances from shore for proposed Irish offshore windfarms will not pose any particular challenges. The majority of sites will likely be of a sufficient distance from shore and capacity to require an offshore substation (which tends to be the most economical solution for projects with a distance from shore of 10km or greater).

High Voltage Alternating Current (HVAC) export cables and substations are likely to be used for all currently proposed Irish offshore sites within 30km of the shore. It is unlikely that proposed Irish offshore sites will require High Voltage Direct Current (HVDC) export technology as this is only typical where distances from shore exceed 60km, which is unlikely in Ireland in the foreseeable future.

Alternative foundation technologies, particularly gravity base foundations, have to date seen some application on sites comparable to the proposed Irish offshore sites.

4. Market considerations

4.1 Introduction

The Integrated Single Electricity Market (I-SEM) will fundamentally change the way electricity is traded across Ireland. Renewables in particular face new challenges and opportunities. Offshore wind operators will need to secure power purchase agreements (PPAs) to capture wholesale power values and manage the commercial risk of being directly responsible for balancing their contracted position and physical operation. The impact of exposure to imbalance prices and volume will be significant for offshore wind. The Irish generation mix already has a relatively high proportion of variable generation; the deployment of large offshore wind farms could add to market and imbalance price volatility.

Additionally, lower de-rating factors compared to thermal power stations will mean offshore wind is unlikely to be able to capture significant revenues from the capacity auction.

The addition of more wind capacity will change the nature of the challenges faced by the Transmission System Operator (TSO) to manage system stability. The DS3 programme is intended to enable improved management of a system dominated by variable renewables through the development of energy storage, frequency response and reserve services (see Figure 4). EirGrid have announced that the DS3 programme has already allowed an increase of renewables on the system at any given time from 50% to 65%

Alongside this, investment in the North-South Interconnector and interconnectors linking Ireland with GB and France may allow for easier management of the system, should they all be constructed.

Figure 4: The DS3 programme

The DS3 (Delivering a Secure, Sustainable Electricity System) programme is a multi-year programme overseen by EirGrid in Ireland and SONI in Northern Ireland. It aims to meet the challenges of operating the electricity system with increasing amounts of variable non-synchronous renewable generation over the coming years.

The DS3 Programme is made up of 11 workstreams, which fall under the three pillars of System Performance, System Policies and System Tools.

At its heart is the development of system services that generators and the demand side can access in return for payment to help manage the system.

The DS3 programme aims to be able to accommodate 75% of variable non-synchronous renewable generation.

Source: Eirgrid

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4.2 Policy support for renewables

The most recent renewables support mechanism, the Renewables Feed-in-Tariff (REFIT), provided eligible renewable generators a minimum price for exported power for 15 years. The REFIT entitles suppliers that purchase electricity from generators via a commercially negotiated REFIT PPA to receive the feed-in tariff. There were three REFIT schemes, commencing in 2009 and ending in December 2015. The REFIT supported large and small (<5MW) onshore wind, biomass, hydropower and landfill gas. Offshore wind was not supported under REFIT schemes. Support was previously available under the Alternative Energy Requirement (AER) auction scheme which consisted of six auctions for renewable capacity between 1995 and 2003. No offshore wind projects were delivered under the scheme as capacity was capped at 25MW and there was an indicative ceiling price of 8.4€c/kWh. REFIT is to be replaced by the Renewables Electricity Support Scheme (RESS), which is currently expected to include offshore wind.

4.3 RESS

The detailed design of RESS is being developed, with the High Level Design (HLD) published in July 2018.

The HLD sets out a pathway to 55% Renewable Energy Sources – Electricity (RES-E) that suggests an additional requirement of 11-12TWh/yr RES-E by 2030, roughly equivalent to one third of current annual electricity demand. Support will be offered via competitive auctions, with an indicative timeline of four (potentially five) auctions between 2019 and 2025 (Figure 5).

Figure 5: Indicative timeline for RESS auctions

	Auction requirement (TWhs)	Auction year	Delivery year (end of)	Single technology cap
RESS 1	1	2019	2020	No
RESS 2	3	2020	2022	Yes
RESS 3	3	2021	2025	Tbc
RESS 4	4	2023	2027	Tbc
RESS 5 (possible)	2.5	2025	2030	Tbc

Source: DCCAE

The government plans to set a maximum price per technology by auction; an Administrative Strike Price (ASP). Successful bidders whose bid price is greater than the ASP would receive the ASP level. This tool is intended as a budget control mechanism.

The RESS auctions are for volume, rather than installed capacity. Therefore, it will be necessary when setting ASPs to have the latest view on likely load factors and the levelised cost of electricity (LCOE)[11]. The HLD gives an illustrative load factor of 45% for offshore wind, meaning 254MW of installed capacity is required to deliver 1TWh (compared to 356MW for onshore wind, 1,000MW for solar PV and 134MW for biomass).

At the heart of RESS is a two-way contract for difference (CfD), where a generator receives a strike price per MWh of output. If the market reference price in a trading period is below the strike price, the generator is topped up to that strike price by revenue collected from consumers via the Public Service Obligation (PSO) levy. If the market reference price is above that strike price, the generator pays back to the scheme. This structure is very similar to the CfD low-carbon support programme in the GB market.

The reference price for RESS is the I-SEM Day-ahead Market (DAM). The generator will retain full responsibility for balancing under RESS and be exposed to imbalance pricing. With no reference price link to the 'spill' price of power through imbalance pricing, generators under RESS will be heavily incentivised to ensure outturn volumes match DAM traded volumes as closely as possible. These elements will be reflected in the PPA terms.

While the HLD sets out parameters, the specific volumes, rules and support duration for each auction will be set closer to the time.

The HLD explicitly recognises a target of encouraging technology diversity on the Irish system. To do so, RESS will include (from the second auction, RESS 2, onwards) a single technology cap. In effect, this measure could limit the volumes within an auction that come from a single technology, creating space in the budget for other technologies, so long as their price is within a certain (to be determined) range of the auction clearing price. This approach may create room for offshore wind in Ireland.

11. A 'levelised cost' is the average cost of the lifetime of the plant per MWh of electricity generated. They reflect the cost of building, operating and decommissioning a generic plant for each technology

4.4 Consideration of overall scale for offshore wind in Ireland

The RESS HLD provides a starting point from which to consider the likely scale of the offshore wind sector in Ireland, at least until the end of the next decade. Under RESS 1, the government plan is to make it a requirement that the project must be completed by the end of 2020. If the auction occurs in 2019, it means that only projects deployable in relatively short periods of time (i.e. 'shovel ready') would be eligible. This requirement could facilitate the participation of solar on the system, but is unlikely to pull through offshore wind. In any event, no offshore wind project has secured a connection, a prerequisite eligibility requirement, so there will be no offshore wind taking part in RESS 1.

The RESS 2 auction is planned for 2020 with successful generators expected to commission by the end of 2022. This too will likely prevent offshore wind from successfully participating, even if the technology has an allowance within one of the proposed technology caps. The exception may be the Arklow Bank extension or the Oriel Wind Farm which may be commissioned by this time (see Figure 7, Offshore wind capacity pipeline table), but for the purposes of this illustration we have assumed commissioning by the end of 2022 does not occur.

On this basis, offshore wind is only realistically likely to participate in RESS 3 onwards, where the period between auctions for support and delivery are at least four years. This suggests an absolute maximum of 9.5TWh/yr, and only if no other technology participates in auctions beyond RESS 2 and RESS 5 takes place (for 2.5TWh/yr).

Using the indicative load factor of 45% for offshore wind, as given in the RESS HLD document, these assumptions place a ceiling of 2,410MW of installed offshore wind capacity by 2030 (Figure 6). Importantly, this is underpinned by the assumption in RESS HLD that Ireland will set a target of 55% renewable electricity in 2030, but this target is still not fixed and the first formal attempt to set one will be via the 'National Energy and Climate Plan' being prepared by DCCAE for the EU at present. The first draft is due by the end of 2018 and importantly, some studies by EirGrid and IWEA[12] have shown that higher renewable electricity targets of 70-75% are feasible by 2030, so the volumes here could potentially grow if a higher target is set for 2030.

Figure 6: Maximum offshore wind capacity deployed under RESS

RESS auction (year)	Auction requirement (TWh/yr)	Maximum installed capacity (MW)	Delivery year
3 (2021)	3	761	2025
4 (2023)	4	1,015	2027
5 (2025)	2.5	634	2030
Total	9.5	2,410	

Source: Cornwall Insight analysis

12. https://www.cru.ie/document_group/electricity-connection-policy-2/

The potential scale of the offshore wind sector in Ireland is an important factor when considering the level of competition that can be expected from developers, many of whom will be active in other jurisdictions. Figure 7 shows the indicative pipeline for offshore wind developments in Ireland. In total the existing projects being developed could potentially deliver over 5.3GW of new offshore capacity, against an indicative ceiling for support under RESS of just over 2.4GW by 2030.

Figure 7: Offshore wind capacity pipeline

Project	Capacity	Status	Notes
Arklow Bank 2	494.8MW	Consent authorised. No connection agreement.	Survey works results to be completed in early 2019. SSE is moving forward with plans to fully develop the wind farm and invest over €1bn in the project.
Codling Bank	1,100MW	Consent authorised. No connection agreement.	Joint venture between Hazel Shore and Fred Olsen Renewables.
1,594.8MW		**Consent authorised**	
Codling Bank Extension	1,000MW	Consent application submitted. No connection agreement	Joint venture between Treasury Holdings and Fred Olsen Renewables.
Dublin Array	600MW	Consent application submitted. No connection agreement	In development. Joint venture between Innogy and Saorgus Energy.
Oriel Wind Farm	330MW	Consent application submitted. 210MW connection (Gate 3) signed March 2015.	Oriel Wind Farm Limited and Parkview (Belgium) partnership. Originally planned to be developed in parallel to NISA (see below)
Skerd Rocks	100MW	Consent application submitted. No connection agreement.	Being developed by Fuinneamh Sceirde Teoranta. First proposed west coast offshore wind farm.
2,030MW		**Consent application submitted**	
Clogher Head	Up to 500MW	Concept phase	Hibernian Wind Power (ESB subsidiary). Application for Foreshore Licences to undertake surveys and investigations have been made.
Kilmichael Point	Up to 500MW	Concept phase	Hibernian Wind Power (ESB subsidiary). Application for Foreshore Licences to undertake surveys and investigations have been made.
North Irish Sea Array	750MW	Concept phase	Element Power purchased project from Gaelectric in April 2018.
Up to 1,750MW		**Concept phase**	
TOTAL	**Up to 5,374.8MW in development pipeline**		

Source: Cornwall Insight Ireland, data from EirGrid, company statements and other public data.

The available data suggests that projects with consent or that have applied for consents could easily soak up all support available under RESS. The scale of viable offshore wind projects being developed in Ireland and potential for support under the new support scheme highlights that much of the proposed capacity will not come to fruition unless RESS auction requirements are increased, the value of support is higher than other markets, or projects can be developed without support. The development pipeline also highlights that there is likely to be sufficient competition within RESS auctions as the potential capacity is well in excess of twice that which could be supported by RESS.

4.5 Connection policy

The process by which generators are provided network connection offers in Ireland is changing. The implementation of the group processing approach (GPA), also known as ‘gate’ system, saw connection agreements offered in lots for large-scale generation. The last of the ‘gates’ occurred in 2009. The non-GPA scheme commenced in 2009 and was designed to enable small-scale technologies to connect outside of the GPA. Many prospective connections were preapproved for non-GPA, which is one of reasons why over 36GW worth of connection applications were made, far above what is required to meet emissions and renewables targets and electricity demand.

An Enduring Connection Policy[13] (ECP) has been introduced, with a view to managing that queue. The first phase of that policy (ECP-1) is dealing with the legacy connection queue and is focused on providing connection capacity to DS3 service providers and generators that are close to construction. EirGrid issued on 31 August 2018 the final list of applicants that met the criteria to be processed as part of the ECP-1, known as the ‘2018 batch’. No offshore wind projects were included in the batch, although six projects with a cumulative capacity of 1,247MW applied. As RESS-1 should only provide support to generators with an ECP-1 connection this rules out offshore wind projects from the initial auction.

Subsequent phases of the ECP are subject to development. The expectation is that new ‘batches’ of connection capacity will commence in 2020, although at this stage the CRU is considering factors that should be prioritised, e.g. a first come first served approach, evidence of project readiness (such as having planning permission), whether connections can provide DS3 services, a technology quota, merit or price. The CRU has indicated that it is particularly interested in examining the benefits of a price-based approach, which it states could result in a more efficient allocation of capacity, be a fairer approach, could facilitate wider policy goals and deliver a more enduring solution.

“The available data suggests that projects with consent or that have applied for consents could easily soak up all support available under RESS

13. https://www.cru.ie/document_group/electricity-connection-policy-2/

4.5.1 Other market approaches to offshore wind connections

Offshore wind network connections are significantly more complex than for technologies such as onshore wind or solar. Investors will require clarity on how the connections are built, funded and regulated.

Different approaches are taken in other Europeans markets, with the responsibility for activities either more or less centralised. Three markets are compared in Figure 8.

Figure 8: European market approaches to offshore wind connection activity

	Offshore zone identification	Site selection and investigation	Permits and consents	Network connection application	Network connection construction
Germany	Government (Federal Maritime and Hydrographic Agency)	Government (Federal Maritime and Hydrographic Agency)	Developer via Federal Maritime and Hydrographic Agency	TSO	TSO/ developer
Netherlands	Government (Enterprise Agency)	Government (Enterprise Agency)	Government (Enterprise Agency)	Government (Enterprise Agency)	TSO/ developer
UK	Government (Crown Estate)	Developer	Developer	Developer (Offshore Transmission Owner)	TSO/ developer (Offshore Transmission Owner)

The approaches adopted result in either the government (or a regulated authority) or the developer taking on much of the up-front financial risk. Where the developer has less of a role to play, it de-risks much of the activity, but reduces the control over the site selection and process.

For example, the GB approach is decentralised where the developer takes the lead in undertaking site surveys, acquiring network permits and consent, and designing and constructing the necessary infrastructure. This involves lower risk and up-front cost for government, but can be reflected in auction prices once contracts are awarded. The scale of the offshore wind industry in GB lends itself to this approach, as multiple developers have shown willingness to compete to build offshore farms, with over 30 now operational.

One possible arrangement worth considering could be a split between the TSO and project developer comparable to the Offshore Transmission Owners (OFTO) regime in GB. Under this scheme the regulator operates tenders where an OFTO designs, builds, operates and maintains the transmission assets associated, but separate from, the offshore wind generation assets in return for a fixed revenue stream. The separation of offshore transmission from offshore generation also ensures that European unbundling requirements are met as the same entity is prohibited from holding generation and network licences. Revenues are collected by the TSO and passed back to the OFTOs.

A key element of the OFTO scheme is the coordination of the offshore and onshore networks and drawing in investment, which Ofgem state[14] is £5bn for 4.6GW of offshore transmission assets to date.

14. https://www.ofgem.gov.uk/publications-and-updates/infographic-promoting-sustainable-energy-future

4.6 Comparison of potential offshore wind industry scale

Expectations of the overall scale of the offshore wind sector in any market will also feature in the decision on which elements of the connection process are best undertaken centrally and which are the responsibility of the developer. As shown previously, the current policy direction indicates that a maximum of 2.4GW of offshore wind capacity could be developed with support by 2030. Given the long lead times to plan and develop projects, and the uncertainty that support will be secured in auctions that take place every two years, non-incumbent developers and international investors will need to assess their willingness to invest in Ireland compared to neighbouring markets where the scale of the market potential is greater.

Figure 9: Indicative pipeline for offshore wind capacity in European markets

Country	Installed capacity (MW) (end of 2017)	Cumulative capacity to 2030 (Central scenario)	Pipeline of new capacity to 2030
Belgium	877	4,000	3,123
Denmark	1,266	4,300	3,034
France	2	7,000	6,998
Germany	5,355	15,000	9,645
Ireland*	25	-	2,410 (maximum)
Netherlands	1,118	11,500	10,382
Sweden	202	300	98
UK	6,835	22,500	15,665

** Ireland data uses Cornwall Insight's own analysis. Other data is from Wind Europe*

Source: Wind Europe, Offshore Wind in Europe, Key trends and statistics 2017. February 2018

Do they devote time and resource to understanding I-SEM competitions and the new RESS scheme? In reality, unless there is significant premiums available, it is likely markets with greater potential could be prioritised.

Figure 9 highlights the scale of opportunity across European markets for offshore wind. This uses Wind Europe's[15] latest annual key trends and statistics to show their central scenario for new capacity to be deployed by 2030 across a selection of markets.

On current assessments the potential market for offshore wind developers in Ireland represents a small fraction of the wider European opportunity, although the opportunity is comparable to those in Belgium and Denmark: importantly Denmark is aiming for 100% renewable electricity by 2030 whereas the RESS HLD suggests a target of 55% but this could increase if more ambition is demonstrated in the National Energy and Climate Plan currently being prepared. The pipeline for offshore wind developments indicates that between two and five projects could deliver 2.4GW, with a good mix of parties ranging from large pan-European utilities, Irish incumbents and specialist offshore wind developers seeking to invest.

15. https://windeurope.org/about-wind/statistics/european/wind-in-power-2017/

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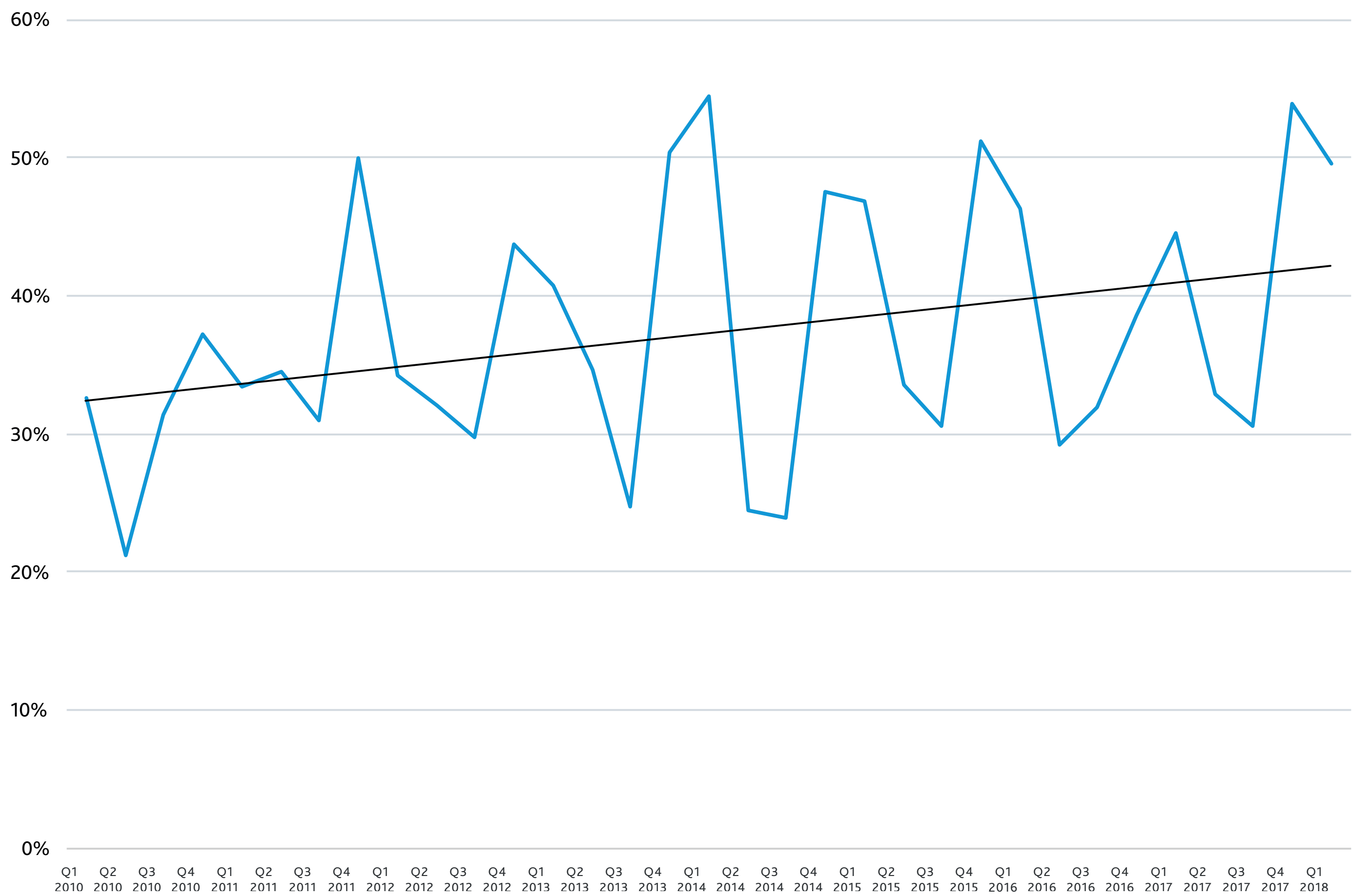
5. Technical considerations

5.1 Aggressive cost reduction

The global offshore wind industry has drastically reduced the LCOE in the last decade.

Cost reductions have been realised through a wide array of factors. However, the single largest influence has been the steady increase in turbine rated capacity. As well as changing the economics of turbine supply this also has an effect on whole projects, as significantly reduced number of supporting structures and array cables are required for the same rated capacity of windfarm.

Offshore wind load factors (UK)



Over the past 10 years offshore wind projects have transitioned gradually from 2–4MW rated turbines to around 8MW today with a clear pipeline indicating a further evolution to 10MW plus machines within the next five years.

This effect is so significant that in recent years some projects, including those developed by large and traditionally risk averse utilities have deployed previously untested technologies. For example, committing to use new turbine models ahead of prototype testing or type certification of the machine.

Turbine capacity is one of the factors that can increase offshore wind load factors, but other important contributors include the amount of production lost to planned and unplanned maintenance, and siting wind farms in higher wind resource areas.

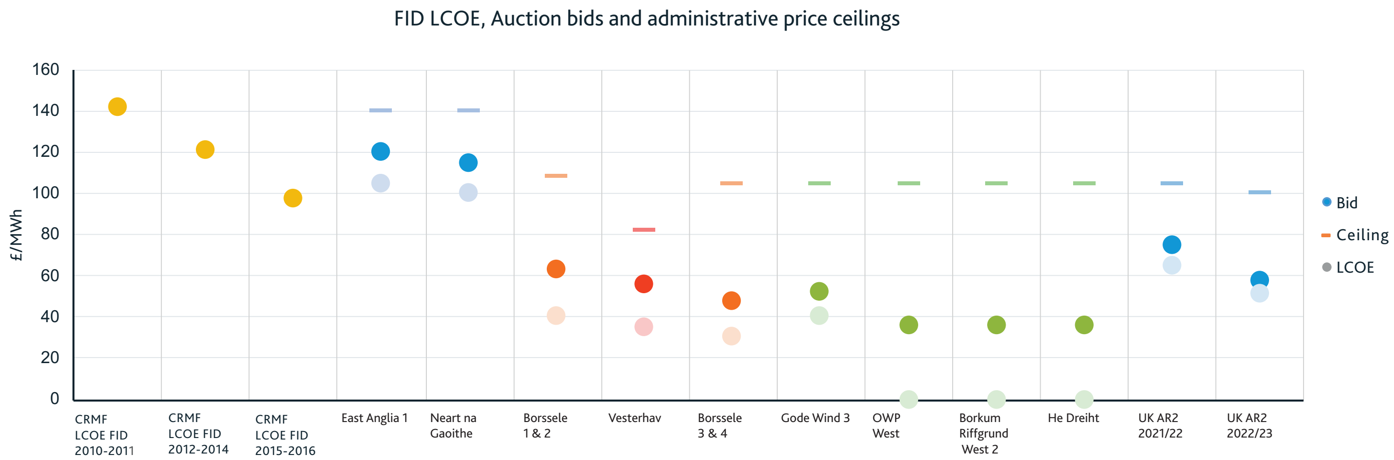
Figure 10 shows the increase in load factors for offshore wind in the UK since the beginning of the decade, where turbine size increased from the 2–4MW range in the 2000s, to 6-8MW turbine size being the norm for projects commissioned in recent years. More recent projects have also been sited further from shore to capitalise on higher wind resources.

Other significant influences contributing to this cost reduction have come from a maturing market, where a reducing risk profile and cost of capital have contributed to dramatically lower finance costs on contemporary projects compared to earlier projects. Installation contractors have continually strived to refine and learn from previous projects and as a result much work that would previously have taken place offshore is now either redundant or completed onshore.

A selection of LCOE data, at the time of the final investment decision (FID) stage, is provided at Figure 11 alongside auction ceilings across GB, Germany and Denmark.

As the offshore wind industry has matured, the provision of what were relatively recently specialist services have become commoditised themselves, with several providers competing to keep their assets and teams busy.

Figure 11: FID, LCOE, Auction bids and administrative price ceilings



Source: ORE CATAPULT

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5.2 Challenges to deliver at these prices

The rapid fall in the LCOE, as observed through recent auctions, should be viewed with some caution as many projects are not yet commissioned. As well as being some years away, auction systems variously place limited, if any, liability on bidders subsequently not able to deliver projects at the prices promised. There may be something of a calculated risk exhibited by bidders who have won auctions with some of the lowest prices seen to date.

Much work will still be required to deliver projects at some of the headline low LCOE figures, with innovation, especially in the area of operations and maintenance (O&M) being required to contribute significant cost savings, much of which at present remains conceptual or unproven.

It is therefore essential to ensure that work to develop, demonstrate and test new solutions for both initial capital expenditure and subsequent operational cost reductions and health and safety improvements continue. The nascent Irish offshore industry should be well placed to benefit from continued development towards lower costs. In some cases, formal opportunities to grow capability by developing demonstration scale projects comprising a small number of turbines initially may prove beneficial. Relatively mature markets such as Denmark and the UK continue to construct demonstration sites (Nissum Bredning and Aberdeen bay) which can be commercially viable in their own right, but also invaluable for developers and the supply chain alike.

While there has been convergence on some general principles and common practices in offshore wind farm design, specification, construction and operations there are not yet 'off the shelf' technology options in all areas. It is likely that developers will continue to seek to balance the tension between new, improved but untried technology and their own risk appetite for the foreseeable future. Delivering a track record built upon some early successful Irish offshore wind projects will be key to building sufficient confidence to support the future growth of the industry.

5.3 Supply chain considerations

Supply chain companies are vocal in expressing a requirement for there to be certainty of future pipeline. In particular those with facilities, teams or technology developments which require long term investment are in a challenging position when they only have a few years visibility of likely deployment. Many other European markets are now providing visibility and commitments to the offshore wind industry that predictable volumes of new sites will receive support.

Economics of offshore wind supply chains are influenced by wider macroeconomic conditions. Commodity prices are reflected in the procurement of materials and manufacturing costs, vessel and offshore construction and logistics costs will be influenced by the wider marine and particularly oil and gas markets, with which there is considerable crossover. Many of these wider economic influences have for the past five years or so been favourable for offshore wind, and have all contributed considerably to the downwards trajectory of costs and also the overall attractiveness of large scale deployment of capacity.

5.4 Infrastructure considerations

Ireland can look to a number of other EU countries to gain experience of how to construct and operate the offshore grid infrastructure necessary for offshore wind.

Ports may stand to benefit from the development of an offshore wind industry. The type of port required will vary depending on the lifecycle stage and location of an individual project. During construction ports with significant laydown area and quayside capacities may be used as local marshalling points. For instance, a marshalling port may be used to collect major components in a single location when supplied from other countries or to improve the logistics and utilisation of expensive jack up turbine installation vessels. The port of Belfast has served in this role during the construction of several UK Irish sea offshore wind projects and would perhaps be a natural marshalling port for the Irish market. Facilities in Dublin may also have some role to play in supporting construction activities.

Once operational an offshore wind farm will also require an O&M port and onshore base. In most instances the optimal location for such will be the one which offers the shortest transit time for Crew Transfer Vessels (CTV). Smaller existing harbours may be well positioned, with potential clustering available where several wind farms are within convenient reach of a single port.

In other countries there has recently been an increase in the reliance of permanently stationed Service Operations Vessels (SOV) which has influenced the choice of O&M port. Since there is a relatively short distance from shore it is likely that the first generation of Irish offshore wind farms will be serviced from CTVs. There may be a requirement and opportunity related to the investment in onshore facilities and O&M ports in particular which can play a role in wider redevelopment of coastal regions.

5.5 What is the wind farm of the future?

Offshore wind farms constructed between now and 2030 are unlikely to be radically different to those which are under construction or operational in other European markets. Turbine rated capacities look likely to continue upwards with at least 15MW machines expected by the start of the next decade. There is also a general trend for increasing the capacity of windfarms, with several projects globally under construction or proposed that exceed 1GW.

In future the type of foundations deployed are still likely to be predominantly monopiles followed by a significant minority of projects using jackets. As with other European markets, Ireland is expected to see mainly monopile foundations used on projects, at least initially. Where there is a sufficiently strong appetite for local construction it may be that gravity base foundations find some application to Irish projects, although the requirement for this will be driven as much by the incentive regime as the potential technical advantages.

Floating turbine substructures are at present a relatively immature technology. The precise deployment pipeline for floating wind is less certain and contains much lower volumes than fixed foundations at present, but once matured, floating wind offers the potential to unlock sites with higher wind resource on the Atlantic coast.

In order to mitigate the 'commuting time' associated with trips to and from shore each day, and also to enable the use of 'walk to work' access systems which remove the requirement to climb ladders, there has recently been a tendency for new offshore wind farms to embrace the use of an SOV. Such vessels are much larger in size, offer overnight accommodation for several weeks of endurance and will include a gangway or other motion compensating system to enable access to the turbine in higher sea states, perhaps as much as 3m significant wave height.

Major component exchange or other maintenance which requires offshore heavy lifting capability is an area where some evolution is likely to emerge in the next few years. Alongside adoption of previous generation installation vessels to maintenance tasks, there is also a significant appetite for alternative methods to conduct maintenance lifting operations. It is possible that new vessels and or lifting equipment will be developed and come to market in time to be relevant to the maintenance of future Irish offshore wind projects. Operators are keen to find alternative means to complete lifting of gearboxes, generators or turbine blades where required for maintenance.

At present offshore wind maintenance activity is largely reactive. Considerable effort is being put into finding ways to shift maintenance activity to be mostly proactive with only a small reactive element. One area which is of particular relevance to this area is a trend for increasing reliance on data and analytics. Technology and skills in this area are evolving rapidly, and as with other industries the impact on offshore wind maintenance is already significant. It looks likely that developments in this area will continue apace, and that the depth of understanding of asset condition and performance will be significantly greater for future offshore wind projects than for those already in operation today. Irish offshore sites are likely to be no different in this respect.

The application of robotics or autonomous solutions is another cross industry trend which has significant relevance to offshore wind. It is likely that future projects will rely heavily on non-human methods of access, particularly to the most challenging environments. Unmanned aerial inspection, particularly of blade surfaces is also likely to be commonplace. More development will be required to develop robotic solutions capable of undertaking actual maintenance tasks, but it is possible technology will begin to displace physical human activity offshore.

> As with other European markets, Ireland is expected to see mainly monopile foundations used on projects, at least initially.

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6. Conclusions and recommendations

Offshore wind has the potential to play a successful role in delivering Irish renewables, carbon emission reduction and security of supply targets. Lessons learnt from similar markets allow for the Irish offshore wind sector to benefit from cost reductions, robust supply chains and effective policy and regulatory frameworks.

The evolution of renewables policy, electricity market design and network connections policy all point towards the emergence of coherent arrangements that will attract investment in offshore wind. However, given the scale of offshore wind projects and the challenges associated with putting in place necessary onshore and offshore infrastructure for deployment and ongoing maintenance, it is desirable for the sector and the Irish energy sector in general to have clarity on the frameworks to allow for offshore wind capacity to grow.

Importantly, whilst the potential for offshore developments in Ireland may be significant relative to overall generation capacity, the indicative absolute scale of the sector is relatively small in comparison to other nearby markets. This suggests that Ireland needs to develop an easily navigable low risk and therefore financially attractive regime in order for international investors in offshore wind to invest in this sector.

Our recommendations are framed to help unlock the offshore wind sector potential in Ireland and ensure investors actively seek to compete and invest in Ireland.

6.1 Recommendations

Issue	Recommendation
Simplifying the consenting and permitting regime	The Maritime and Foreshore (Amendment) Bill should be enacted into law at the earliest opportunity
Process to gain network connection agreement is uncertain for offshore wind	How the longer-term Enduring Connections Policy will manage offshore wind should be resolved as rapidly as possible, as a connection offer is necessary to obtain investor confidence and support under RESS
Final details on the levels of support, auction qualification and participation rules for offshore wind in RESS are not yet known	Details on the RESS auction rules should be forthcoming as soon as possible. The scale of offshore wind projects means that they require longer lead times to put in place finance and obtain the necessary consents and permits than most onshore developments
The potential size of the Irish offshore sector is presently too wide-ranging for international investors to take a view on whether to invest	The approach for introducing auction technology caps within RESS will determine the scale of the offshore wind sector in Ireland. The most up to date data on technology costs should be used to underpin the setting of caps, as well as consideration of how technology developments across Europe have significantly increased turbine capacities and load factors
It is not known if RESS support will take account of possible price cannibalisation impacts and system management costs.	The impact of increased volumes of variable generation on the Irish system and wholesale prices in the new I-SEM should be considered when appraising support costs and DS3 values so that whole-system impacts are adequately considered and planned for now
Industry has had a limited formal role to play in developing policy and supply chains	Efforts for collaboration between government, regulatory authorities and the offshore wind industry should be accelerated

The changes proposed by the Maritime and Foreshore (Amendment) Bill are positive for an emerging market and can be expected to achieve greater certainty and speed in the consenting regime. Whilst considerable work has been undertaken to advance the drafting of the Bill, it needs to be enacted into law as a matter of urgency to pave the way for a simpler consenting and planning regime for offshore wind in Ireland.

The passing of this legislation should enable development of further detailed guidance and, where necessary secondary regulations, that recognise the benefits of putting in place processes that are compatible and streamlined with other necessary permitting and consenting processes, including subsidy support schemes. Consideration should also be given to allowing sufficient flexibility within the consenting and permitting processes for developers to alter plans, within reason, where there is an economic case to do so. For example, this could be circumstances where more efficient and larger turbines mean fewer installations are necessary to deliver the same overall capacity and potentially higher load factors.

The development of the Enduring Connections Policy (ECP) is laying the baseline for how all generation can access network infrastructure. The nature of offshore wind requires special consideration due to the likely scale of developments and the requirement for investors to have certainty regarding how connections are sought, granted and which entity (if not the developer) is responsible for building out onshore and offshore infrastructure. Defence and radar objections must be considered too.

The intended direction of travel, or at the least closing out options, on the enduring approach for offshore wind connections (and connection policy in the round) is needed. CRU have indicated that price based releases of capacity batches, possibly by locational auctions, will be considered. If the intent is to release the next batch of capacity in 2020, then clarity is required rapidly for offshore wind investments to have a realistic chance to obtain connection offers as these are a prerequisite for RESS support.

The enduring connection frameworks for offshore wind should not be developed in isolation from policy and other regulatory considerations. Consideration should be given to the potential number of projects that are likely to come forward by 2030. Current scenarios suggest that offshore wind deployment could range anywhere between 250MW and 4.5GW by the end of the next decade. The RESS HLD suggests a ceiling of 2.4GW. Even at the larger end of this range, it may only be necessary to connect a small number of very large wind farms which in turn would have a bearing on the pros and cons of putting in place complex connection processes and how network access is allocated where constraints already exist.

The publication of the High Level Design for the RESS is welcome insofar as it clarifies the approach for supporting renewables over the coming decade. Specifically, for offshore wind there are a series of recommendations that will assist with the development of the details for the scheme. These are:

- Auction rules – the desire for a level-playing field for all technologies should be sought, although the likely scale of offshore wind projects and time taken to commission will be significantly different from other competing technologies such as onshore wind and solar PV. Therefore, developers will need certainty on the activity they should complete at pre-qualification, point of auction and the timeframes allowed from being granted support and commissioning. Within this clear guidance on aspects of supply chain evidence, provision of bonds and penalties for commissioning deadline slippage must be understood.
- Auction technology caps – it is very unlikely that RESS 1 will call forward any offshore wind projects due to the short timescales for delivery, and the absence of ECP-1 connections awards to offshore wind. It is imperative that work commences immediately on the allocation of single technology caps to be introduced for RESS 2. At the heart of this is the need to ensure that the latest evidence on the LCOE for all viable technologies is gathered and used in the Irish context (e.g. taking account of network connection and reinforcement timings and costs, ancillary infrastructure requirements for offshore wind including ports and local supply chains). This exercise should also consider the effect on caps of a number of relatively small (by current standards) offshore stations or one or two large stations. The RESS HLD has suggested that administered strike prices should be derived from a backward looking three-year LCOE analysis. This analysis must take into account that the offshore wind industry in Europe is rapidly changing in terms of deployment activity. Data from Wind Europe[16] shows that almost half of all of Europe's offshore wind capacity was installed in the three year period 2015-2017. It took over 20 years to commission the same capacity prior to this period.

16. https://windeurope.org/about-wind/statistics/european/wind-in-power-2017/

Policy development should also be cognisant of the impacts of price cannibalisation that are likely to be exacerbated by the increasing deployment of variable generation. As observed in other markets the increasing penetration of the low/ zero cost marginal plant leads to increased short-term wholesale price volatility and increasing number of trading periods where prices are low or even negative. In turn this will increase the amount of subsidy to be collected from consumers where generators are topped up against short term market reference prices. Assumptions related to future support levels should model these impacts, and how the timing of the commissioning of a number of relatively small stations compares with one or two very large stations.

Finally, the recommendations from the OREDP interim report should be seen through in the timescale indicated. The recommendations to 'identify suitable means of increasing the involvement of industry and stakeholder groups' and 'explore the potential for collaboration on ORE projects through bilateral agreements to learn from other countries' should be actioned as a matter of urgency. This should go further by setting out how government and regulatory authorities will work with the offshore wind sector during the completion of support policy, connection arrangements, and how developments can benefit Irish supply chains and the wider economy. Supply chain companies are vocal in expressing a requirement for certainty of future pipeline. In particular those with facilities, teams or technology developments which require long term investment are in a challenging position when they only have a few years visibility of likely deployment. Many other European markets are now providing visibility and commitments to the offshore wind industry that predictable volumes of new sites will receive support.

Actively integrating industry representatives into the decision-making process could drive development in the sector at a much greater pace, as has been demonstrated in the UK.

> Supply chain companies are vocal in expressing a requirement for certainty of future pipeline

7. Annex

7.1 - Differences between current and proposed consent regime

The schematics below show the key processes that offshore wind generators have to currently follow, as determined by the Foreshore Act, and the proposed process to be implemented by the Maritime and Foreshore (Amendment) Bill.

Current arrangements are complex and require the developer to interact with numerous entities to gain the necessary permits, consents and licences. The outcome of each of these can have a bearing on other elements of the process, which results in additional risk for the developer and lengthy timescales. The proposed future regime is more streamlined and involves fewer parties, which it is hoped will reduce the timescales and complexity for developers.

Figure 12: Foreshore Act

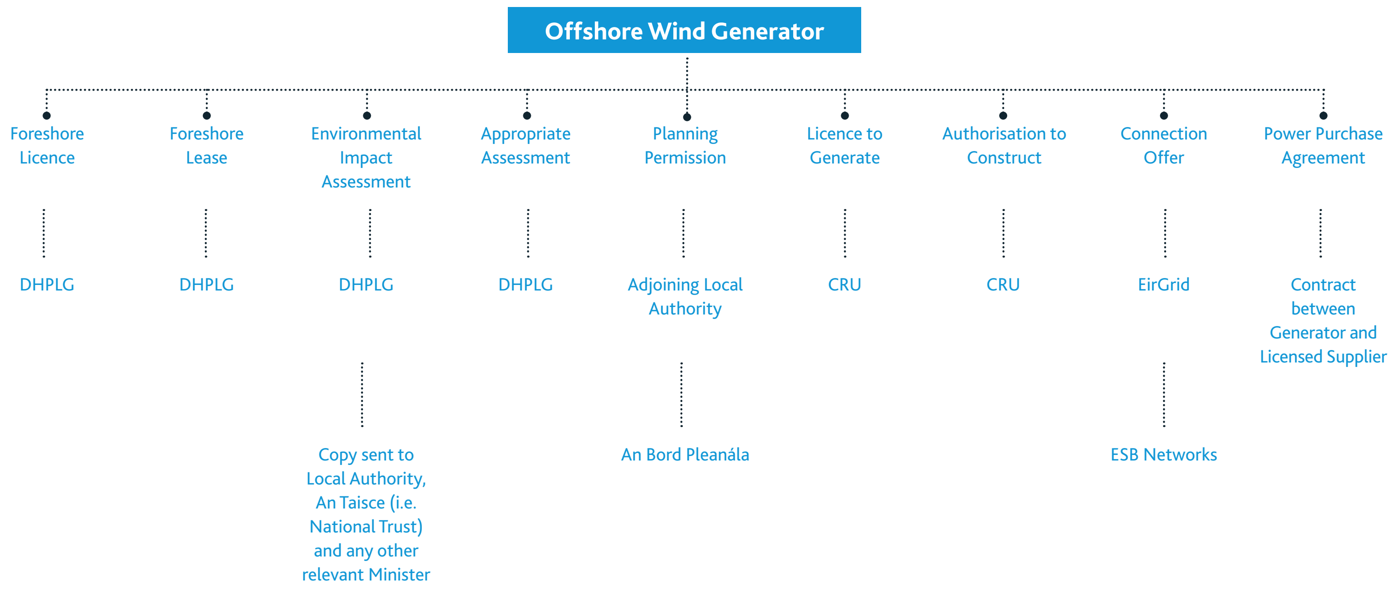
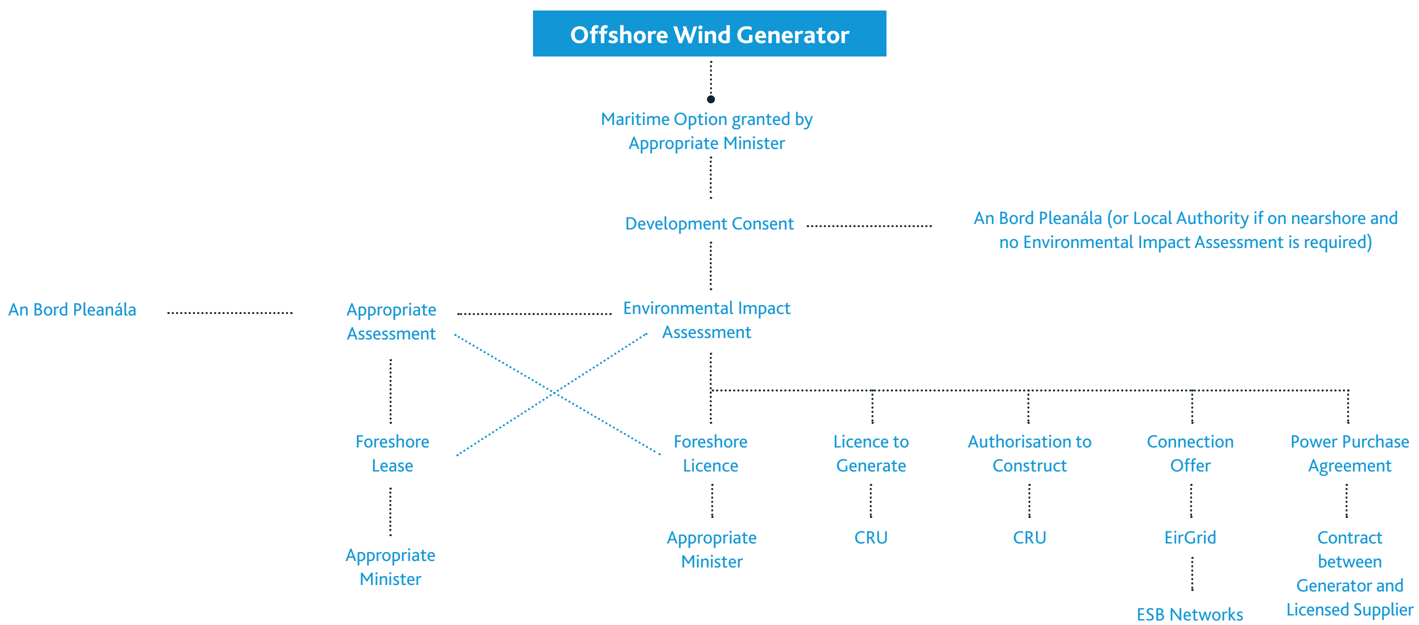


Figure 13: Maritime and Foreshore Bill



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7.2 - Examples of offshore wind sector collaboration in the UK

Figure 14 below summarises the extent to which collaboration is occurring in the UK market between industry, government and academia and the achievements highlighted demonstrate how these joint working/leadership bodies and initiatives can drive the emerging offshore wind market.

Figure 14: UK offshore wind collaboration

Joint working group	Role	Achievements
Offshore Renewable Energy Catapult **(ORE CATAPULT)** **Research/Innovation**	ORE CATAPULT is an independent partner and the UK's leading technology innovation and research centre for offshore renewable energies (offshore wind, wave and tidal) with the aim of supporting UK companies to de-risk and reduce the costs of offshore energy projects.	The ORE CATAPULT's latest Impact Report (2016/2017)[17] highlights their progress to date, which includes: 257 industry collaborations, involved in 35 projects globally, supported 51 companies in product testing and validation, launched the Offshore Wind Innovation Hub jointly with the Knowledge Transfer Network (KTN) to coordinate innovation across industry, government and academia and for every £1 of core grant invested, ORE CATAPULT has leveraged £3 of additional research funding. ORE CATAPULT have also produced a number of relevant reports[18] for various aspects of offshore wind from broad economics and operational reports to more specific turbine analysis.
Offshore Wind Industry Council **(OWIC)** **Gov/Industry Collab**	OWIC is a senior government and industry forum. OWIC facilitates the delivery of the government's ambitious plans for offshore wind and to bring together industry and government to overcome challenges and maximise benefits to the economy	Helped to facilitate the Wind Industry's response to the UK Government's 2017 Industrial Strategy - with the outcome that the wind industry is 'committed to collectively work with government to secure a transformative sector deal by the middle of 2018 - the deal will focus on reducing costs, increasing productivity, decarbonising the UK economy, growing a skilled workforce to deliver exports and transforming economically challenged regions of the country'[19].
Offshore Wind Programme Board **(OWPB)**	The OWPB is sponsored by the OWIC and brings together senior representatives across industry and government with responsibility for lowering the cost of offshore wind.	The OWPB commission various reports and pieces of research to support the development of the offshore wind sector.
The Offshore Wind Innovation Hub **(OWIH)**	Launched jointly by the ORE CATAPULT and KTN and funded by BEIS the Hub's aim is to coordinate across the offshore wind innovation landscape in the UK, to present innovation priorities, supply chain growth and funding opportunities.	OWIH in collaboration with industry and academia have built offshore wind technology roadmaps[20] to register industry challenges and ways to solve them. Four individual roadmaps have been produced which cover the following topics: turbines, sub-structures, electrical infrastructure and O&M windfarm lifecycle

17. https://ore.catapult.org.uk/app/uploads/2017/11/IMPACT-REPORT-2016-17-FINAL.pdf
18. Offshore Renewable Energy Catapult, Industry Report Database
19. https://ore.catapult.org.uk/work-with-us/industry/offshore-wind-industry-council/
20. OWIH Technology Roadmap home page, whereby each of the four roadmaps can be accessed

7.3 - Excerpts from OREDPs recommendations

The table at Figure 15 contains a sample of the recommendations from the OREDP interim review recommendations. The list contains those recommendations that are particularly pertinent to ensure industry collaboration in creating a vibrant offshore wind sector in Ireland.

Figure 15: OREDP – Interim Review Recommendations

Recommendation	Responsibility	Delivery timeline
2: Identify suitable means of Increasing the involvement of industry and stakeholder groups in the governance structure of the OREDP	DCCAE ORESG	End 2018
7. Continue the ongoing review of Ireland's offshore renewable energy test site requirements.	DCCAE SEAI	2019-20
8. Consider what further technical supports from MaREI or Enterprise Ireland could be provided to help early-stage technology companies with a focus on the indigenous ORE industry.	SEAI	2018
9. Review the ORE technologies (including emerging technologies) to be supported with additional consideration of a project's potential to reduce levelised cost of energy, reassess the structure and procedures of the Prototype Development Fund to ensure that it is fit for purpose. Consider providing additional funding for the Prototype Development Fund to enable grants up to 80% of the development and testing costs. Funding levels will be subject to State Aid Guidelines and consideration should be given as to whether qualifying projects must involve collaboration within projects and dissemination and access to data.	SEAI	2019
10. Consider larger scale funding supports such as a Pre-Commercial Technology Fund to bridge the gap experienced by technology developers as they progress up the Technology Readiness Levels (TRLs) to larger and more expensive device testing.	SEAI	2018-19
16. Support early mover projects to stimulate the supply chain and act as clear signals that Ireland is open for business leveraging support from the Marine Development Team (MDT).	DCCAE ORESG	2018-19
18. Communicate that Ireland is open for business, engage the public in an informed discussion on the opportunities associated with ORE and explore the potential costs and benefits to society.	ORESG SEAI DBEI	Ongoing
20. Identify priority issues and explore the potential for collaboration on ORE projects through bilateral agreements to learn from other countries that are taking a lead role.	DCCAE ORESG	Ongoing
21. Elevate the status of the Maritime Area and Foreshore (Amendment) Bill to national priority legislation and accelerate the efforts to publish in 2018 and enact it by an early date.	DHPLG DCCAE	Ongoing
22. Consider the identification of initial development zones, in association with the introduction of the Marine Spatial Planning process and the prioritisation of ORE as one of the marine sectoral activities. Ensure supporting infrastructure such as ports, roads and grid connections are considered when allocating these zones.	ORESG DCCAE DHPLG	Post enactment of Maritime Area and Foreshore (Amendment) Bill
25. Provide greater strategic support for the development of the mature offshore wind sector, including the establishment of a dedicated offshore wind working group	ORESG	2018-20

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