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OFFSHORE WIND: DELIVERING RENEWABLE ENERGY FOR IRELAND

MARCH 2022



OFFSHORE WIND GLOSSARY

KEY WORDS AND ACRONYMS

CLO = Community Liaison Officer.

The individual appointed by a developer (ESB) to liaise and confer with the local community and the general public about a proposed ORE development.

DMAP = Designated Maritime Area Plan

The MAP Act enables spatial designations for specified marine areas and uses, called Designated Maritime Area Plans (DMAP). The DMAPs can be regional, local or sectoral including ORE marine plans.

EirGrid = EirGrid is the national Transmission System Operator; it develops and operates the national electricity (higher-voltage) grid.

FLOW = Floating Offshore Wind

Technology for floating offshore wind farms is being rapidly developed which will enable wind farms in much deeper waters than is currently possible with fixed-bottom offshore wind farms.

Green Hydrogen = Hydrogen generated from renewable sources can be produced by electrolyzers consuming electricity during periods when renewable power available exceeds electricity demand. It will be used to decarbonise sectors that are not suitable for direct electrification e.g. some industrial heat processes and heavy road transport.

HOW = Hybrid Offshore Wind connections

A “hybrid” connection is the connection of an additional, different type of generator to an existing generator’s electricity grid connection and in that way sharing the grid capacity. The sharing by an existing thermal power station of its grid connection with a new offshore wind farm is a HOW and is a more efficient use of an existing grid connection, avoiding the significant cost and disruption of building a new connection.

MAC = Maritime Area Consent

The MAC is the state consent required to enable occupation of a Maritime Area, the legal basis for which is in the MAP Act.

MAP Act 2021 = Maritime Area Planning Act 2021

The MAP Act is the State’s fundamental reform of marine governance. The Act provides the legal underpinning to an entirely new marine planning system, which will balance harnessing our huge offshore wind potential with protecting our rich and unique marine environment.

MARA = Maritime Area Regulatory Authority

Mara will be responsible for the granting of MACs, licences and the enforcement of the new regulatory regime.

MaREI = the Research Centre for Energy, Climate and Marine, at University College Cork.

About MaREI - Research Centre for Energy, Climate and Marine [<https://www.marei.ie/about-us/>]

MPA = Marine Protected Area

MPAs are geographically defined maritime areas that provide levels of protection to achieve conservation objectives. The government is developing legislation on the identification, designation and management of MPAs.

NMPF = National Marine Planning Framework

The NMPF was approved by the Dáil in May 2021. The National Marine Planning Framework (NMPF) brings together all marine-based human activities for the first time, outlining the government’s vision, objectives and marine planning policies for each marine activity.

[gov.ie](http://www.gov.ie) - [National Marine Planning Framework \(www.gov.ie\)](http://www.gov.ie)

ORE = Offshore Renewable Energy

This term usually refers to offshore wind generated electricity but can also refer to wave and tidal power or other types of energy generated offshore such as “green” hydrogen.

OREDP = Offshore Renewable Energy Development Plan

This government plan establishes a framework for the sustainable development of Ireland’s offshore renewable energy (ORE) potential and identifies opportunities. The first OREDP was published in 2014. A revision, OREDP2 is expected in 2023.

ORESS = Offshore Renewable Electricity Support Scheme

The Irish State purchases long-term renewable offshore electricity contracts via competitive auction among offshore wind farm developers. These contracts provide certainty of income, needed to financially underpin the investment wind farm developers are required to make.

WEI = Wind Energy Ireland

The Irish industry body to promote wind energy including Offshore Wind in Ireland, of which ESB is an active member.

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INTRODUCTION

Offshore wind generated energy will play a major role globally in mankind's fight against climate change and our transition to a zero carbon economy by replacing energy generated by burning fossil fuels with clean renewable electricity. The Irish government, in the Programme for Government (2020) has committed to developing a plan setting out how Ireland will take advantage of the massive potential of offshore energy. The government target now in the Climate Action Plan 2021 is to achieve 5GW (5,000MW) capacity of installed offshore wind by 2030.

Ireland's geographic position is particularly good for generating electricity from wind. Power from onshore wind farms currently provides over one third of Ireland's electricity needs. The "real" map of Ireland shows that Ireland has jurisdiction over a marine area that is many times the size of our landmass yet there is just one offshore wind farm on the East Coast (the Arklow Bank, 25MW). Otherwise Irish offshore wind energy is a totally untapped resource. There are a number of countries in Europe that have far shorter coastlines, that have already developed significant offshore wind electricity generation (e.g. while the Irish coastline stretches to 3,000 kms, Belgium with a coastline of 63kms, has developed more than 2GW of offshore wind). Our nearest neighbour, the UK has already developed over 10GW of offshore wind electricity generation.

The purpose of this ESB Leading Lights paper on Offshore Wind is twofold:

- Firstly it is to explain the "jargon", share the facts and describe the current state of play with regard to offshore wind Energy in Ireland.
- Secondly, it is to inform about ESB's plans and share our perspectives on the development of Offshore Wind in Ireland.

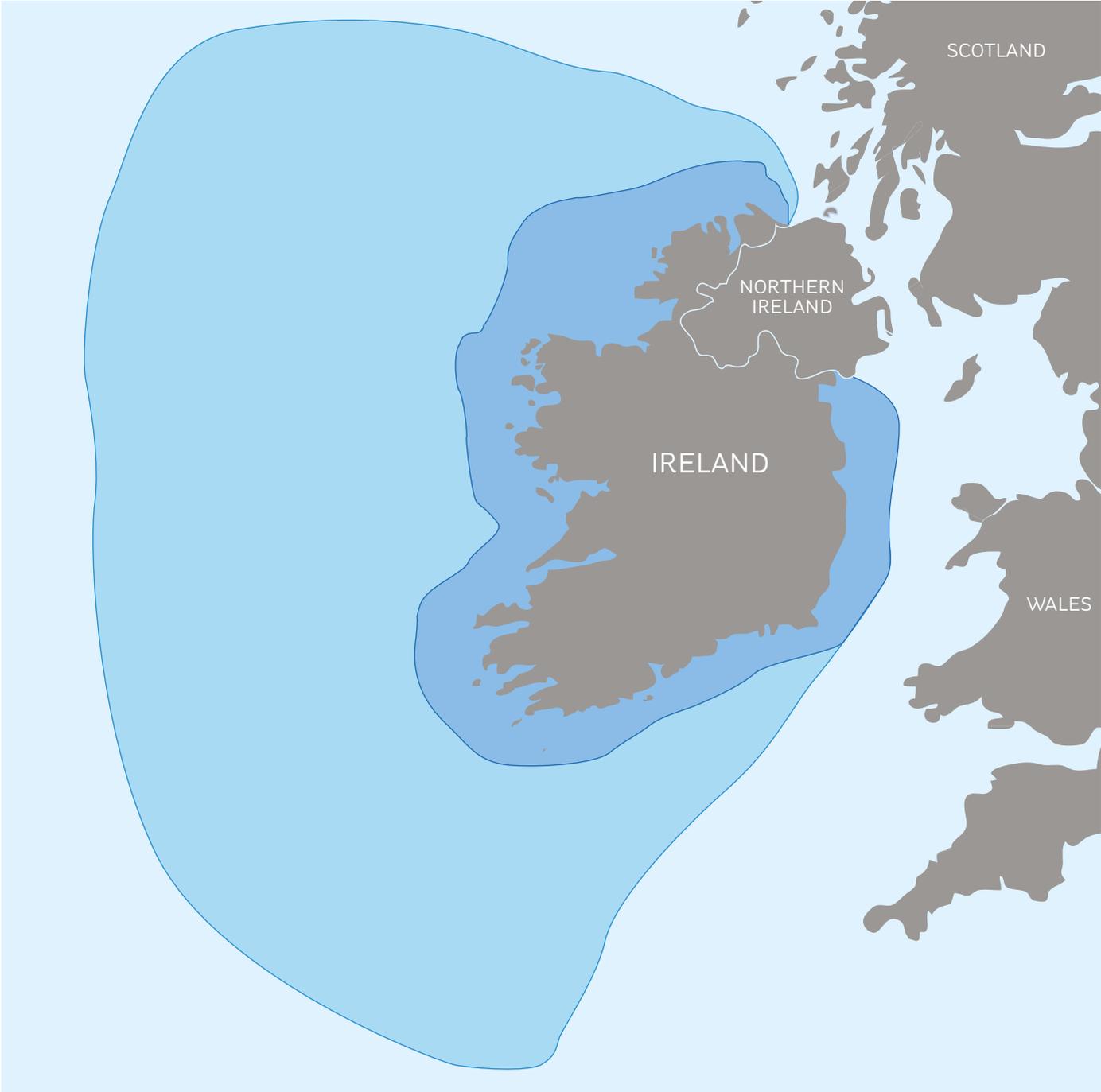
ESB has and will continue to play a leading role in Ireland's transition to a low-carbon energy future, powered by clean electricity. We have developed almost 1GW of clean renewable energy both at home and abroad and we have ambitious plans to build on this over the coming years.

"ESB has been involved in offshore wind generation since 2017. Our strategy, Driven to Make a Difference; Net Zero by 2040, calls out the importance of developing and connecting more renewable generation. We aim to play a positive role in developing Ireland's Offshore Wind for the benefit of the people of Ireland, with care for the marine environment and in consultation with marine users and local communities."

Paddy Hayes, Chief Executive ESB.



IRELAND'S MARINE TERRITORY



Ireland's large marine territory and long coastline indicate our offshore wind energy potential.

-  Approximation of Ireland's marine territory
-  Indicative viable marine area for offshore wind development (to 2030)

FACTS & FIGURES

- The Climate Action and Low Carbon Development Act 2021 commits Ireland to achieving a carbon neutral economy by no later than the end of 2050.¹
- The Climate Action Act 2021 also commits Ireland to a net 51% carbon reduction 2021-2030, relative to a 2018 baseline. Ireland also supports the EU target of a 55% reduction in carbon emissions by 2030 compared to 1990 levels.¹
- Ireland's electricity will be powered by 80% renewables by 2030 (from 40% national target in 2020).²
- 5GW of offshore wind will be operational by 2030 (only one 25MW wind farm currently).³
- Offshore wind farms in Ireland on the east coast can achieve capacity factors of approx. 45% (Depending on the technology employed), meaning that a 1GW wind farm will generate approximately 4TWH (4,000,000MWh) / year and on the west coast they will have capacity factors of approx. 50%.
- There is potential to develop between 9.2GW and 12GW from fixed wind and at least 27GW from floating wind in the Irish Marine area, within 100 km of Ireland's coast.⁴
- The EU target is 300GW of installed offshore wind capacity by 2050. By 2030, the EU strategy aims for 60GW of offshore wind installed in the waters off the coastal Member States (EU).⁵
- ESB plans that our generation portfolio will have the capability of ensuring over 60% of the electricity we generate is from renewable or zero-carbon sources by 2030. We will also invest in assets that support a high level of renewables on the system such as energy storage, flexible generation, synchronous condensers, and power-to-gas⁶.

Proposed Emissions Reductions by Sector

Sector	2018 emissions (MtCO ₂ eq.)	2030 target emissions (MtCO ₂ eq.)	% reduction relative to 2018
Electricity	10.5	2-4	62-81%
Transport	12	6-7	42-50%
Buildings	9	4-5	44-56%
Industry	8.5	5-6	29-41%
Agriculture	23	16-18	22-30%
LULUCF	4.8	2-3	37-58%
Unallocated Savings	N/A	4	N/A

(Taken from Climate Action Plan 2021)

¹ Climate Action and Low Carbon Development (Amendment) Act 2021 <https://www.gov.ie/en/publication/984d2-climate-action-and-low-carbon-development-amendment-bill-2020/>

² Climate Action Plan 2021 <https://www.gov.ie/en/publication/6223e-climate-action-plan-2021/>

³ Programme for Government: Our Shared Future <https://www.gov.ie/en/publication/7e05d-programme-for-government-our-shared-future/>

⁴ Strategic Environmental Assessment Statement of Ireland's Offshore Renewable Energy Development Plan, (2010, SEAI) <https://www.seai.ie/publications/ORED-SEA-ER-Volume-1-Non-Technical-Summary.pdf>

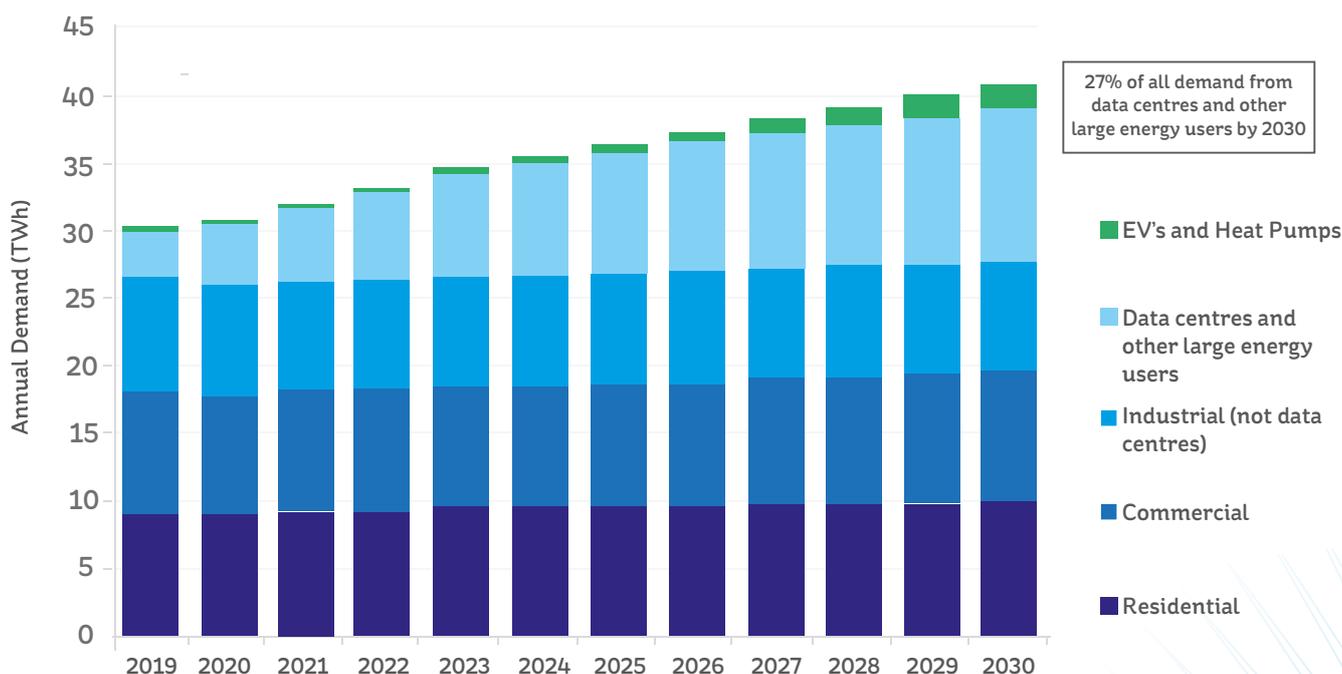
⁵ EU Offshore Renewable Strategy (Nov 2020) https://ec.europa.eu/energy/topics/renewable-energy/eu-strategy-offshore-renewable-energy_en

⁶ ESB Group Strategy <https://esb.ie/who-we-are/our-strategy> Our Strategy (esb.ie)

ELECTRICITY DEMAND IN IRELAND

Electricity Demand is forecast by Eirgrid to rise by about 33% between 2021 and 2030⁷. A key driver for electricity demand in Ireland for the next number of years is the connection of new large energy users, such as data centres. Another driver in electricity demand is the transition to electricity for transport (electric vehicles) and heating of buildings (electric heat pumps), replacing fossil fuel usage. This growth in demand is partly being contained through the roll out of Smart Meters to all households and through other demand reduction and energy efficient technologies.

Eirgrid's Median Demand Forecast for Ireland to 2030 with approximate split into different sectors



Eirgrid's Median Demand scenario for Ireland.

⁷ Eirgrid/SONI All-Ireland Generation Capacity Statement 2021-2030: 208281-All-Island-Generation-Capacity-Statement-LR13A.pdf (eirgridgroup.com)

ESB'S OFFSHORE WIND PLANS & COMMITMENT

ESB is developing the Oriel Wind farm Project and the nearby Clogherhead project off the coast of Co. Louth with Parkwind NV, a Belgian-based offshore wind farm developer. Oriel is a government designated 'relevant project' which means that it is in the first batch of projects with a right to be processed for a Maritime Area Consent (MAC) and therefore likely to compete in Ireland's first ORESS auction, planned for 2022. ESB is also progressing plans for seven different offshore wind farms in Irish waters all around the coast, including floating offshore wind farms off the south and west coasts.

The UK offshore wind industry is the most developed in the world and ESB has invested significantly, working with a variety of partners, on a number of projects, to further develop our involvement and expertise.

In Ireland, while the industry focus now is on fixed-bottom turbines on the East coast, new floating offshore wind technology that can be situated in much deeper waters will be key to realising Ireland's full offshore wind potential. ESB has ambitious plans to develop floating offshore wind for Ireland. Most notable is our Green Atlantic@ Moneypoint project, a visionary project of scale (see page 11).

The Irish government, in its Programme for Government 2020, has committed to producing a longer-term plan setting out how, as a country, we will take advantage of the massive potential of offshore energy on the Atlantic Coast. This plan will set out how Ireland can become a major contributor to a pan-European renewable energy generation and transmission system, including the development of "green hydrogen" infrastructure (where at times of excess wind energy availability, electrical energy can be converted and stored as hydrogen via electrolysis), taking advantage of a potential of at least 30GW of offshore floating wind power in our deeper waters in the Atlantic. ESB stands ready to play a full role in making that vision a reality.



ESB Offshore Investments to date, Secured & Concept Stage (March 2022):

Project Name	Planned (approx.)	ESB Partner	Location	Status
Ireland				
Oriel	370MW	Parkwind	Off Louth coast	Auction ready
Clogherhead	800MW	Parkwind	Off Louth coast	Potential Project In development
Sea Stacks	800MW		Dublin/Wicklow coast	Potential Project In development
Loch Garman	800MW		Wexford coast	Potential Project In development
Helvick Head	800MW		Waterford coast	Potential Project In development
Celtic	1,000MW		Cork and Waterford	Potential Project In development
Moneypoint	1,500MW		Clare & Kerry coast	Potential Project In development
Great Britain				
Galloper	353MW	RWE, Siemens, Macquarie, Spring I.C.	Suffolk coast, UK	Operational
Five Estuaries Offshore Wind farm (Galloper Ext.)	353MW	RWE, Siemens, Macquarie, Spring I.C.	Suffolk coast, UK	In development
Neart na Gaoithe	448MW	EDF	Fife coast, Scotland	In construction
Inch Cape	1,080MW	Red Rock Power	Angus coast, Scotland	Auction ready



ESB's Wind farm locations - both operational and in development

Ireland

- 1. Oriel
- 2. Clogherhead
- 3. Sea Stacks
- 4. Loch Garman

- 5. Helvick Head
- 6. Celtic
- 7. Green Atlantic @ Moneypoint

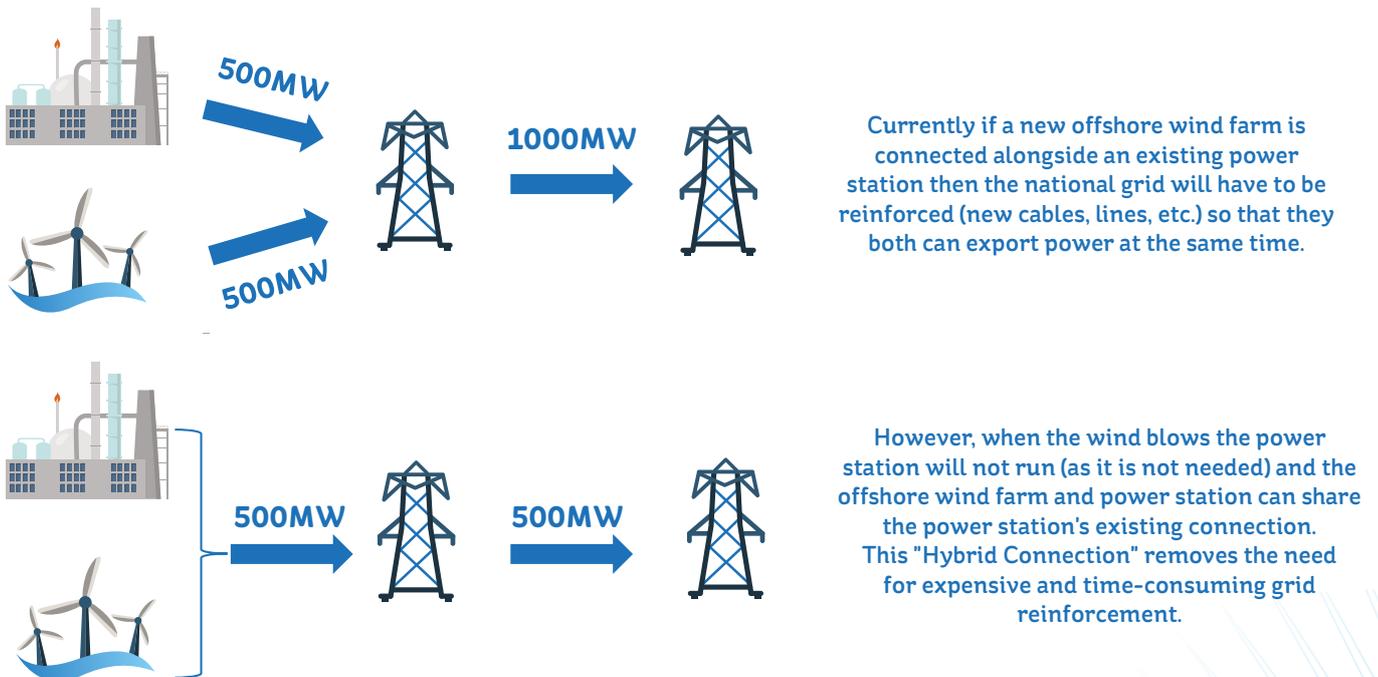
UK

- 1. Inch Cape
- 2. Neart na Gaoithe
- 3. Gallopier
- 4. Five Estuaries

HYBRID OFFSHORE CONNECTIONS - THE KEY TO ACHIEVING OUR 2030 TARGETS

Eirgrid's "Shaping our Electricity Future" roadmap, following a comprehensive public consultation sets out the vision for how the electricity grid will develop in terms of grid capacity, the operation of the grid and electricity market design. However there is detail that yet needs to be worked out; for example where the different offshore wind projects in development can be connected to inject energy into the grid. This detail is needed urgently and the workplans to deliver the required grid capacity need to be implemented urgently if Ireland is to meet the 5GW ambition in the Programme for Government. ESB believes that to deliver on the 5GW target by 2030, "hybrid connections", that is single grid connections shared between two or more technologies as is planned for in the Climate Action Plan 2021 are needed. (Currently the available injection capacity available to 2030 is much less than 5GW).

HYBRID CONNECTIONS



Hybrid connections allow an existing generation station to share its connection with another generation technology. This is currently being implemented for onshore wind connections and should be immediately extended to offshore.

This will have multiple benefits for Ireland.

- shared use of the existing grid capacity optimises the use of existing connections and eliminates the need to build more expensive transmission lines across the country
- the existing station can provide back-up when the wind isn't strong enough
- bringing electricity ashore at existing generation sites facilitates the production of carbon free electricity from green hydrogen produced from offshore wind electricity which is stored on-site, increasing security of supply
- it increases competition in the early ORESS auctions resulting in lower cost offshore electricity
- it speeds up the connection of offshore wind in Ireland, facilitating Ireland in meeting its 2030 target

There are at least 8 power station sites in Ireland that could immediately be utilised for hybrid connections, three of which are ESB sites, Moneypoint (see page 11), Poolbeg and Aghada power stations. ESB could bring ashore at least 3,200MW of offshore wind at these sites via Hybrid Offshore connections by 2030.

ECONOMIC IMPACT OF OFFSHORE WIND

The development of offshore wind energy will create employment in conducting environmental surveys, community engagement, engineering design and planning services. As a site moves to construction, people with backgrounds in various types of engineering, marine construction and marine transport will be recruited. Once the site is up and running, a project requires a team of turbine technicians, engineers and administrators to ensure the wind farm is fully maintained and properly operated, as well as crew for the vessels and crew for transporting workers from shore to the turbines.

The proportion of Irish and locally based jobs will be dependent on the availability of people with the necessary skillset as well as the suitability of the port and marine infrastructure in Ireland. As the offshore employment sector is relatively new in Ireland there is an acceptance that there will be a requirement for training, development and upskilling if we are to maximise the level of employment opportunities particularly at a local level. Skillnet Ireland is a business support agency of the Government of Ireland. In its "Zero by 50" report (March 2021)¹ sponsored by Wind Energy Ireland, a centre of excellence is called for to train people in both onshore and offshore wind energy development.

A report by the Carbon Trust (UK)² on behalf of the Irish Wind Energy Association³ forecast that the installation of just 3.5GW of offshore wind energy would create 2,500 local jobs in planning, development and construction and provide 700 local, long-term jobs, as well as 20,000 wider employment opportunities during the lifecycle of these projects and that there would also be indirect jobs relating to materials and services consumed, logistics, support services and other onshore activities. The government's current target of 5GW of offshore wind electrical capacity by 2030 would create even more employment⁴.

MaREI, in its EirWind socio-economic study⁵ indicates that in 2030, 6.3GW of installed capacity could support 12,000 direct and indirect jobs in the domestic supply chain, with a total Gross Value Added (GVA) impact of circa €2bn for the period 2020-2029.

Coastal communities could be transformed by new employment opportunities, however the development of the supply chain needs to be undertaken in such a way that as much local content as possible can be secured. This study recommends at least three port clusters as catalysts for jobs and enterprise in the Irish Sea (e.g. Rosslare), the Celtic Sea (e.g. Cork Harbour) and the Atlantic coast (e.g. Shannon Foynes and Killybegs).

¹ Zero-by-50-Our-Climate-Neutral-Future-Green-Tech-Skillnet.pdf (skillnetireland.ie)

² final-harnessing-our-potential-report-may-2020, Carbon Trust.pdf

³ The 2020 Programme for Government subsequently increased the Irish target from 3.5GW to 5.0GW by 2030

⁴ Offshore wind is a "Game Changer" for Ireland. EirWind release 30-year strategy for offshore wind in Ireland - MaREI (2020)

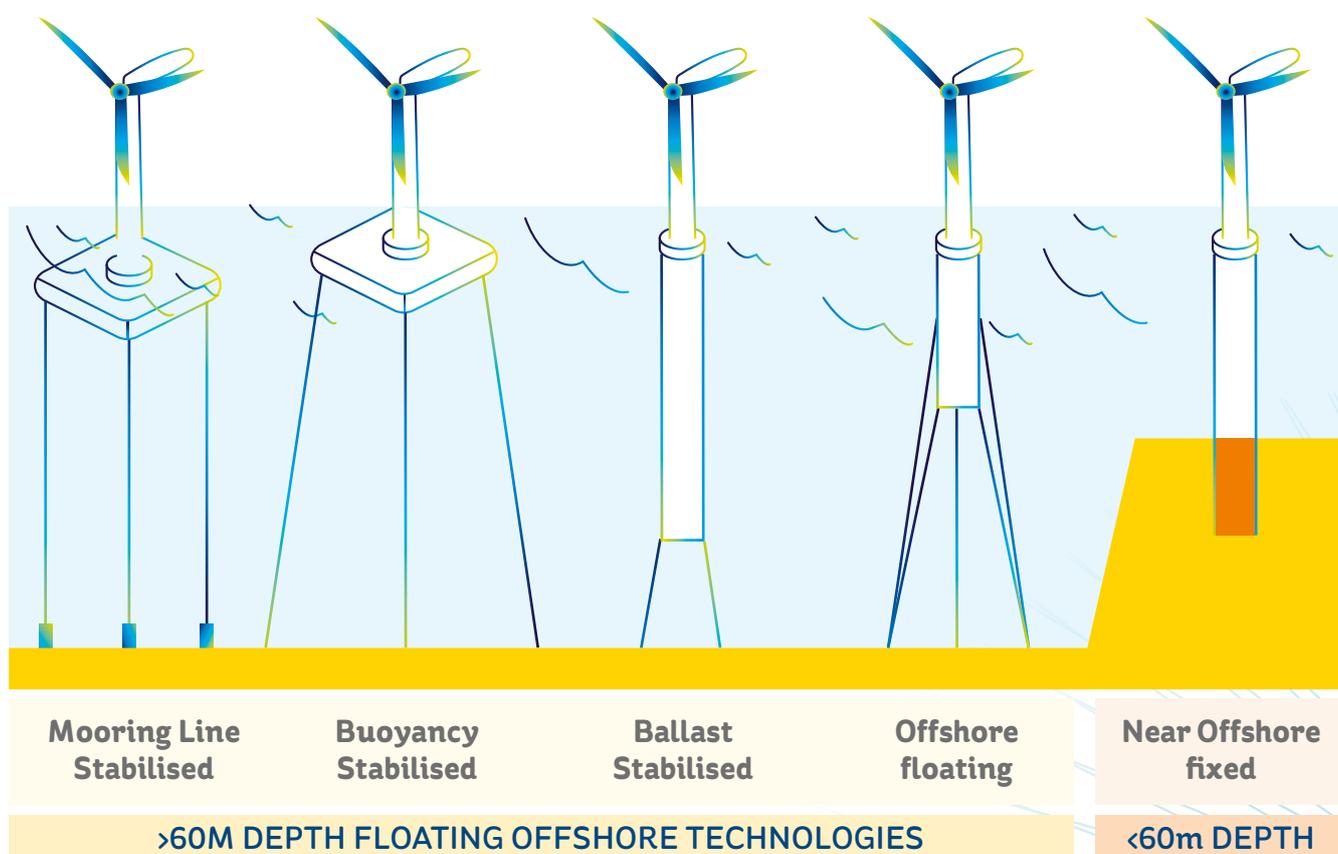
⁵ Moneypoint: a socioeconomic impact report - A report for ESB by BVG Associates (July 2021).

FLOATING OFFSHORE WIND

In its “Revolution” report (2021)⁶, Wind Energy Ireland sets out its view as follows: “FLOW has quickly progressed from demonstration to early-stage commercial projects. It can no longer be dismissed as an emerging technology. Taking measures to support FLOW now will also help to ensure that the supply chain we urgently need to build for offshore wind can support the development of FLOW towards the end of the decade. This will enable the industrialisation of this whole new sector for Ireland in the 2030s.”

The commissioning of the 48MW Kincardine Phase 2 project⁷ off the east coast of Scotland in 2021 brought Europe’s installed capacity of floating wind to over 100MW. By 2030, Europe could have as much as 7GW Floating wind capacity is ready to start delivering commercially this decade.

The UK, France and Norway have so far shown the greatest ambition. The UK has set a 2030 target of 1GW of FLOW and announced plans to design new leasing opportunities for early commercial-scale projects in the Celtic Sea; France has launched its first commercial-scale tender for a floating wind project of between 230 and 270MW to begin operation this decade and Norway has recently opened three areas of up to 500MW each for FLOW. In January 2022, Crown Estate Scotland announced the outcome of its application process for ScotWind Leasing, the first Scottish offshore wind leasing round in over a decade. 17 projects were selected out of a total of 74 applications and have been offered option agreements which reserve the rights to specific areas of seabed. 11 of the 17 successful projects were floating offshore wind projects. ESB is ready to progress with FLOW projects at our Moneypoint and Celtic Sea offshore wind farms, subject to appropriate regulation and government policy.



⁶ revolution-final-report-july-2021-revised.pdf (Wind Energy Ireland)

⁷ The Kincardine project has been developed by Principle Power.

GREEN ATLANTIC @ MONEYPPOINT

ESB plans to transform its facility at Moneypoint in Co. Clare, where there is currently a 915MW coal-fired power station, into a Green Energy Hub (Green Atlantic @ Moneypoint) with an ambitious investment plan to deliver huge benefits to the region.

- A floating offshore wind farm of up to 1.5GW will be developed off the Clare / Kerry coast. Subject to the appropriate consents being granted. Phase 1 of the wind farm (400MW) is expected to be in production by 2028.
- Moneypoint will become a centre for the construction and assembly of floating wind turbines. A deep-water port already exists at the site, making it an ideal staging ground for the construction of the wind farm. The development of Moneypoint will support the wider plans of Shannon-Foynes port and help make the Shannon Estuary a focal point for the offshore wind industry in Europe.
- ESB's plans include investment in green hydrogen production and storage, and an electricity generation facility at Moneypoint, fueled by green hydrogen, towards the end of the decade.

ESB has commissioned research⁹ into the economic impacts of the planned development and the creation of job opportunities by the offshore wind farm. While there are specific factors relating to Moneypoint as an existing generating station, it is expected that there are significant local benefits accruing across a range of areas including jobs, businesses, infrastructure and the local community. Jobs within the installation and commissioning, operation and maintenance and decommissioning supply chain areas will be predominantly based in the vicinity of the host port. Therefore, these opportunities directly impact and benefit the local area.

MODEL OF ESB'S PROPOSED GREEN ATLANTIC @ MONEYPPOINT



CONSENTING PROCESS FOR ORE

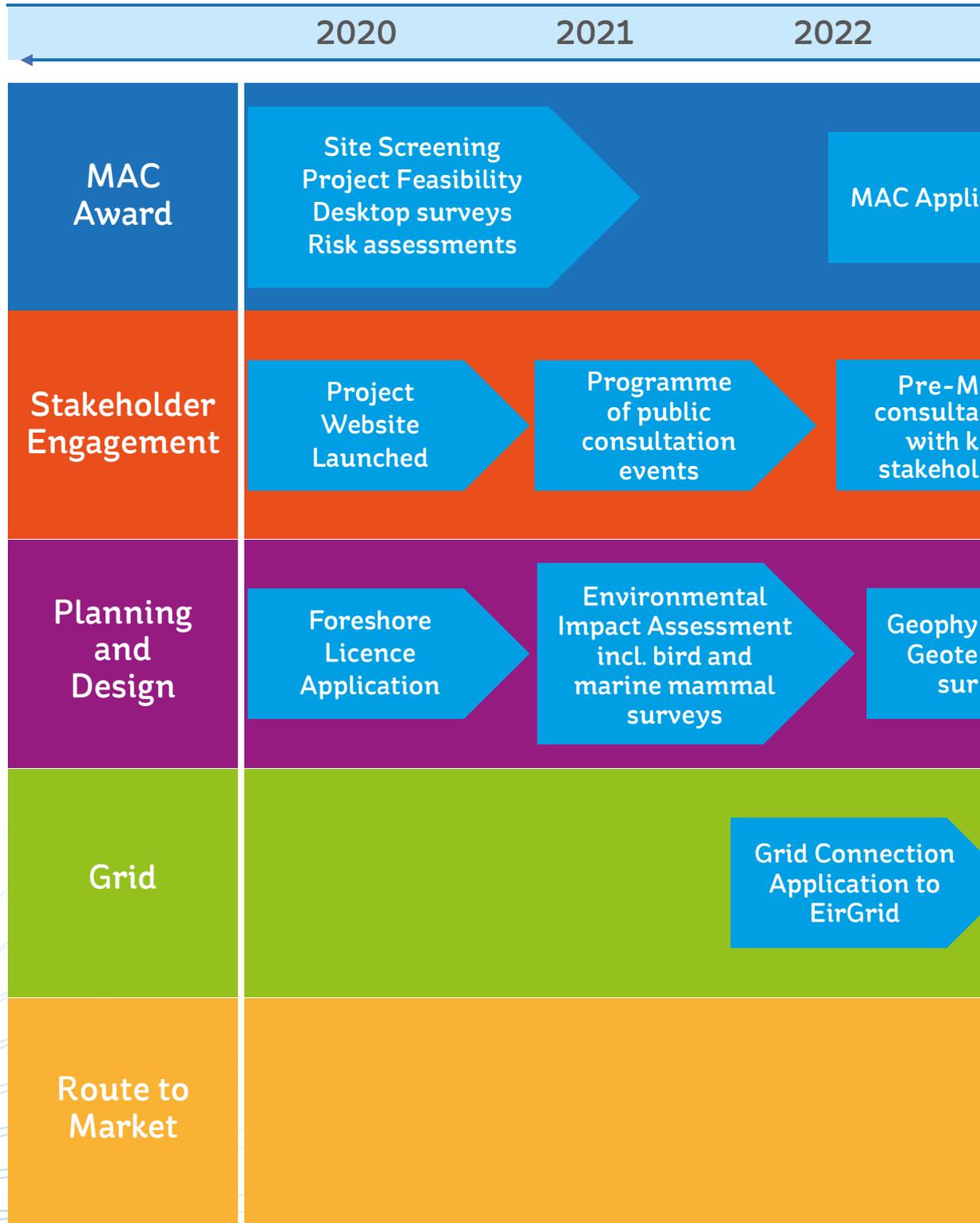
The Maritime Area Planning Act provides the legal basis for an entirely new marine planning system, underpinned by the National Marine Planning Framework (NMPF). The NMPF provides the spatial and policy context for decisions about Ireland's sea area.

The MAP Act streamlines arrangements for offshore developments on the basis of a single consent principle. i.e. one Irish state consent, Maritime Area Consent (MAC), to enable occupation of the maritime area and one development consent (planning permission), with a single environmental assessment. The award of a MAC is effectively the gateway to the planning process.

The Act also establishes a new agency, the Maritime Area Regulatory Authority (MARA) to undertake certain consenting and enforcement functions such as granting MACs, licencing specified maritime usages and ensuring compliance and enforcement of MACs, licences and offshore development consents.

Transitional arrangements for the new "MAC" consenting process are being put in place. A number of ORE development projects that meet certain criteria have been given "relevant" project status which meant that their MAC applications could be progressed once the MAP Bill 2021 was enacted. That will mean that they can compete for long term electricity support contracts in the first ORESS auction planned for 2022. The Oriel wind farm development which is part-owned by ESB has a 'relevant project' status and will compete for a longterm renewable electricity provision contract in the first ORESS auction. ORESS 2, the second offshore renewable energy support scheme auction is expected to take place in 2025.

PROJECT CONSENTING STEPS (INDICATIVE TIMELINES)*



*Construction Phase inductive timeline is mid-2027 to mid-2030.



COMMUNITY ENGAGEMENT & PARTNERSHIP

ESB believes that it has a unique responsibility by virtue of its heritage and values to support government policy to fight climate change by leading the low carbon transition in Ireland.

We commit to playing a strong role in developing Ireland's offshore wind for the benefit of the Irish people and with due care for the environment. ESB commits to proactively engaging with the public and particularly communities affected by ESB's offshore developments. We will do this in at least five ways:

- (1) ESB will share all relevant information about ESB Offshore projects in a comprehensive and timely fashion. ESB will listen to community concerns and will work in partnership with the communities to resolve any issues that might arise.
- (2) ESB supports the concept of a fair transition where all members of society benefit and will support government initiatives in this area.
- (3) ESB will contribute to community funds for offshore wind developments as it has done for Onshore Wind developments so that local communities benefit directly from the projects.
- (4) ESB will show due respect for our Irish marine environment at all times and will work to the highest environmental and ethical standards only.
- (5) ESB is supportive of formal co-ordinated dialogue with the fishing industry and other marine users.

Examples of some of the Community Engagement actions ESB commits to:

- ESB will create a publically accessible project website at an early stage of the project development. This webpage will include project milestones and timelines, as they become known.
- ESB will appoint a Community Liaison Officer (CLO) for the project and provide contact details to the community. The CLO will be the point of contact for the community and all requests / concerns will be acknowledged and resolved, within one week, where possible.
- ESB will provide information on the construction schedule to all stakeholders identified in the preplanning process and on the project website.
- ESB will facilitate public meetings, as necessary, to inform the public about the project and its status.
- ESB will produce an annual report detailing events / issues that arose and how they were dealt with. This report to be submitted to the local authority.
- ESB will maintain the project website with updated information about the project post construction.
- ESB will compile a report measuring the local and national economic impacts of the offshore wind project as well as the environmental benefits.





Cuan an Daingin, Co. Chiarraí

ESB OFFSHORE PROJECT WEBSITE LINKS

More information on ESB's Irish wind farm projects is available at:

Celtic Offshore Wind - www.celticoneoffshorewind.ie
Clogherhead Offshore Wind - www.clogherheadwind.ie
Helvick Head Offshore Wind - www.helvickheadoffshorewind.ie
Loch Garman Offshore Wind - www.lochgarmanoffshorewind.ie
Moneypoint Offshore Wind - www.moneypointoffshorewind.ie
Oriel Offshore Wind - www.orielwindfarm.ie
Sea Stacks Offshore Wind - www.seastackoffshorewind.ie

More information on ESB's GB wind farm projects is available at:

Galloper Offshore Wind - <http://www.galloperwindfarm.com/>
Inch Cape Offshore Wind - <https://www.inchcapewind.com/>
Neart na Gaoithe Offshore Wind - <https://nngoffshorewind.com/>

