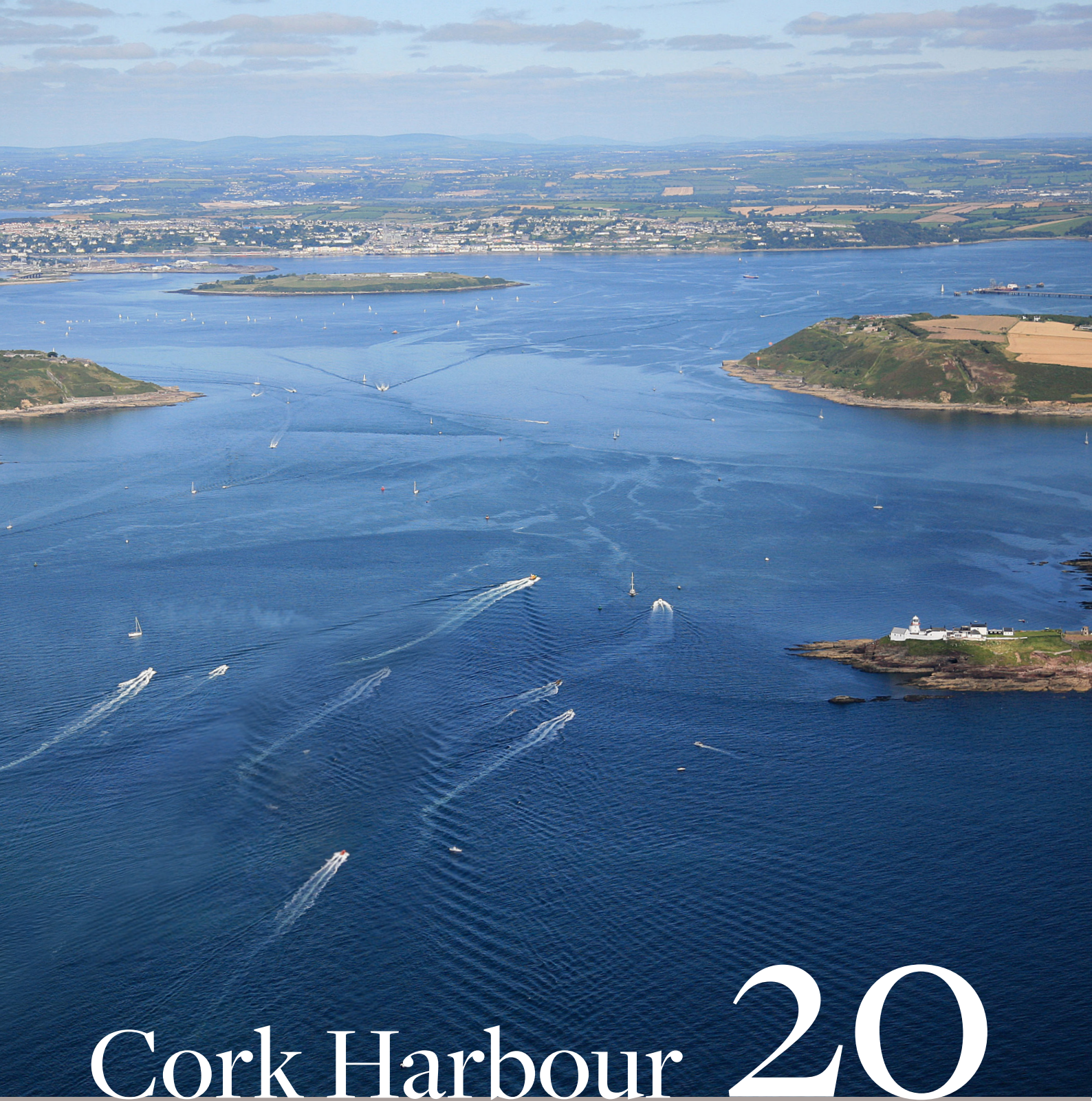

Cork Harbour 2025

Ready to Float – Offshore Wind

Contents

Executive Summary

Offshore wind is leading the transformation of the global energy system, with a staggering growth rate of 19% - faster than any other industry. Rapid developments in floating foundation technology are opening new markets, where floating foundations can be deployed in waters from circa 60m to 1000m depth. Floating wind has many benefits over the traditional bottom-fixed technology, such as higher capacity factors, being less visually impactful and less environmentally intrusive.

Ireland is committed to developing offshore wind to address climate change and meet critical decarbonization targets from renewable energy. The initial focus has been on bottom-fixed offshore wind projects in the Irish Sea and the Celtic Sea off the South Coast. The deep waters and excellent wind capacity factors in the Celtic Sea and off the West Coast of Ireland, endow these areas with unequivocal strategic advantages for further floating offshore wind developments.

The geostrategic advantages of Cork Harbour, the second largest natural harbour in the world, means it is ideally placed to seize the benefits of new floating and bottom-fixed offshore wind projects. Cork Harbour is in the process of being transformed into an offshore renewables hub by the private sector, with circa €200m of investments and plans already underway by companies such as Green Rebel Marine, Irish Mainport Holdings, Doyle Shipping Group (DSG), Simply Blue Group, DP Energy, and Port of Cork. The Cork Harbour supply chain is getting 'Ready to Float' for Offshore Wind by 2025.

As the maritime capital of Ireland, Cork can build on the maritime and energy infrastructure and capability that already exists, thereby positioning Cork Harbour as the *de facto* -floating offshore wind hub in the Celtic Sea. Cork benefits from its location, existing port capacity, maritime track record, the industrial and energy profile of Cork Harbour, strategic port designations, the local supply chain readiness, regional infrastructure, human capital, skills and training, and the Cork 'can do' attitude.

Decisions by government in the next couple of months are required to ensure that projects from the Celtic Sea, including floating wind projects, will be prioritised within the measures needed to meet the target of 5GW of offshore wind to be developed in Ireland by 2030. This means expanding the envelope of opportunity from the limitations of bottom-fixed projects in the Irish Sea and facilitating Cork's prospects to become as a major offshore wind centre, delivering jobs and economic value.

Cork Harbour is perfectly positioned right now to support the development of offshore wind. Gearing-up for large-scale assembly and installation of offshore wind farms can be achieved via DSG's plans to redevelop Cork Dockyard. The redevelopment of Cork Dockyard as a clean, green facility, servicing the offshore wind sector, is a progressive plan for Cork Harbour, potentially creating up to 200 direct long-term jobs alone.

It is an imperative that the Dockyard be open to service the pipeline of projects emanating from the Celtic Sea by 2025. The alternative is that port-related business will be forced to go elsewhere. Plans for the extension of the deep-water berth in Ringaskiddy could add significant capacity to the capabilities on offer in Cork Harbour in support of the nascent floating wind boom in the Celtic Sea.

An enormous opportunity exists for a whole new industrial sector to emerge in Cork Harbour, not seen since the IDA designated the Ringaksiddy area as a cluster for pharmaceuticals in the 1970s. Policy action is needed now. This includes the designation of Cork Harbour as a strategic hub for offshore wind in the new National Development Plan (Ireland 2040); County Development Plan provisions for land-use activities in support of offshore wind; and a government decision to ensure that floating wind projects in the Celtic Sea are included in the Climate Action target of 5GW of offshore wind by 2030. This is key to unleashing the potential for floating wind and the opportunity for Cork Harbour.

Floating offshore wind is the economic opportunity of our generation.

1.0 Introduction

Offshore wind is a clean, renewable energy that can help to decarbonise our total energy requirement in the long-term and help to achieve targets to address climate change. The offshore environment provides an opportunity to tap into a more powerful and consistent wind resource, with the potential to generate more electricity at a steadier rate than onshore wind.

As suitable land becomes scarcer for onshore wind, Ireland's vast marine environment, (ten times our landmass)[1], provides an alternative space for the construction of wind turbines. Traditional bottom-fixed offshore wind technology is typically in the form of a monopile or jacket/tripod, which can be deployed in water depths of up to approximately 50m. Rapid developments in floating foundation technology are opening new markets, where floating foundations can be deployed in waters from circa 60m to 1000m depth (Figure 1.1).

Ireland is committed to developing offshore wind to meet critical decarbonization targets from renewable energy. The initial focus has been on bottom-fixed offshore wind projects in the Irish and Celtic Seas. In the meantime, floating offshore wind technology has emerged as one of the biggest growth areas in renewables globally (Figure 1.2). The deep waters and excellent wind capacity factors in the Celtic Sea and off the west coast of Ireland, endow these areas with unequivocal strategic advantages for further floating offshore wind developments.

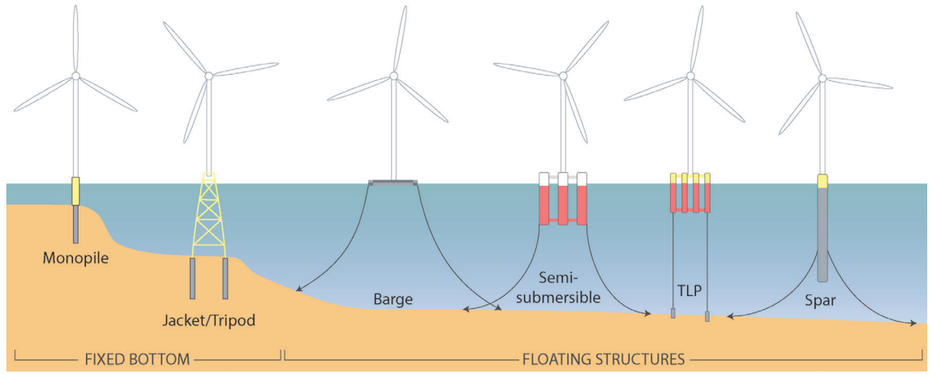

Figure 1.1. Types and benefits of Floating Wind. *Floating wind foundations are moored and anchored to the seabed. Foundation designs fall into four main categories (Barge; Semi-submersible; Tension Leg Platform; and Spar). Benefits include: i). Stronger and more consistent winds in deeper waters means that capacity factors of over 60% can be achieved; ii). Less environmental impact; iii). Visual impact over the horizon and noise issues are minimised; iv). More efficient installation and maintenance; and v). Lesser reliance on large and expensive installation vessels.* **Image source: Eirwind[2].**

1. Marine Institute – Real Map of Ireland: https://www.marine.ie/Home/site-area/irelands-marine-resource/real-map-ireland
2. Cummins V., and McKeogh, E. (2020). EirWind: Blueprint for Offshore Wind in Ireland

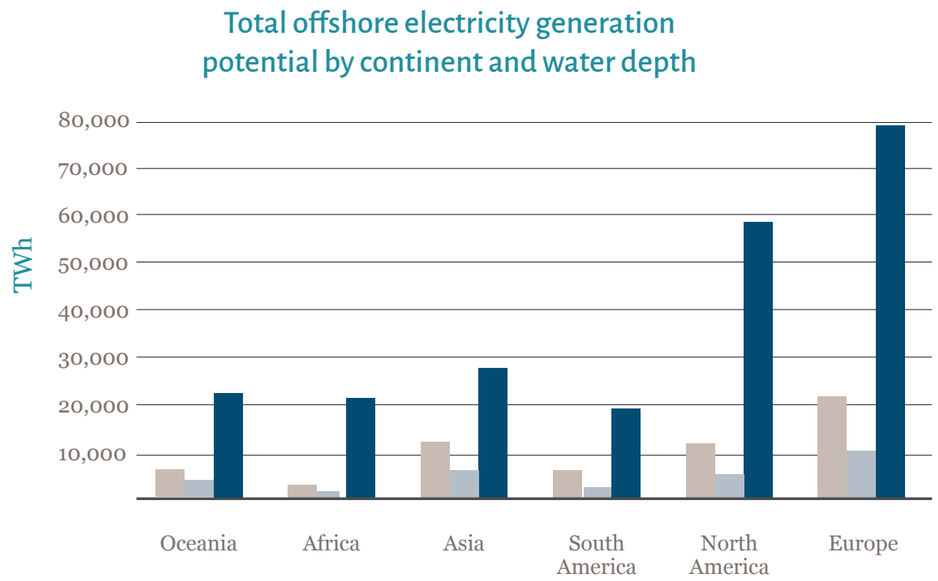

Figure 1.2. *Technology improvements have enabled the rapid maturing of the floating wind market. European installed capacity of offshore floating wind stood at 65MW in Dec 2020. There are currently 25GW of capacity under development worldwide[3]. 10GW to 30GW are likely to be installed by 2030, with 50-70GW by 2040. Early commercial-scale projects in the early 2020s will develop supply chains and pave the way for large-scale industrialisation of floating wind and cost competitiveness with bottom-fixed wind, later this decade[4].* **Image source: Adapted from Bosch et al., (2013)[5]**

The Government's ambition for the development of 30GW[6] of floating wind provides Ireland with the opportunity to meet net zero emissions by 2050 across electricity, heat and transport. It also provides an opportunity for Ireland to become a net energy exporter[7]. This is a radical point of departure from our traditional reliance on imported fossil fuels, and sees Ireland vastly accelerating and amplifying its part in Europe's energy transition. Paving the way for development of floating wind will also dramatically enhance Ireland's reputation as a location for investment that is truly green, ethical, and proactive. Economically, floating wind is potentially to Ireland what North Sea oil was to Norway, with added environmental and reputational benefits. Cork Harbour is uniquely placed to be the gateway to this transformative development.

3. Carbon Trust, (2020). Floating Wind Joint Industry Report – Phase II Summary Report.
4. DNV GL, (2020). Floating Wind: The Power to Commercialise: Insights and Reasons for Confidence.
5. Bosch, J., Staffell, I., and Hawkes, A.D. (2018). Temporally explicit and spatially resolved global offshore wind energy potentials. Energy Vol. 163, pp. 766-78.
6. 30GW is equivalent to 30,000MW
7. Government of Ireland, (2020). Programme for Government – our Shared Future.

Figure 1.3. *Thousands of square miles of ocean and coast are due to undergo ecological assessment as part of the planning process for offshore wind farms.The Roman Rebel, pictured, was purchased by Green Rebel Marine to conduct surveys off the coast. Crosshaven boatyard on the right of the image, was also bought by Green Rebel Marine in 2020. The nine-acre site in Cork Harbour will serve as a world class base for Green Rebel Marine to survey, equip and service a network of planned wind farms along the Irish coast, including the Celtic Sea. It will support 80 new jobs.* **Image source: Green Rebel Marine.**

Only a few European seaports are currently suitable for floating wind manufacturing, assembly, and servicing. Engineers Ireland recommend the urgent identification of a seaport to support offshore development with sufficient depth, quay length and storage space[8]. The geostrategic advantages of Cork Harbour, the second largest natural harbour in the world, means it is ideally placed to seize the benefits of new floating offshore wind projects, while also supporting bottom-fixed projects. Offshore wind development requires ports with the right mix of water depths, quayside bearing capacity, landbanks, cranage, vessels, berthage, and transport links.

The private sector has already begun to embrace the energy transition, (with the decommissioning of the Kinsale Gas Fields as a milestone), by transforming Cork Harbour into an offshore wind energy hub. For example, investments of €16.5m were made in Q4 of 2020 by Green Rebel Marine (Figure 1.3) and Mainport Shipping (Figure 1.4), to gear-up for offshore surveys. Plans for a further circa €200m of inward investment are well progressed by companies such as Doyle Shipping Group and Simply Blue Energy. In January, Simply Blue Energy announced a Joint Venture partnership with Shell to develop the Emerald project off Cork. Shell's entry into floating wind in Ireland is evidence of the opportunities in the Irish market. In February DP Energy announced a strategic partnership with Iberdrola. There are further investments planned for the Celtic Sea by companies such as SSE, Energia, ESB and Equinor, that will galvanise Cork's position. This new floating wind industry opportunity for Ireland has already established its roots in Cork, from where it will flourish, given the right supports.

8. Engineers Ireland (2020). The State of Ireland 2020: Engineering a Green and Digital Recovery.

Figure 1.4. *The Mainport Geo, a 50m DP2 survey vessel was purchased by Irish Mainport Holdings in 2020 to service the offshore wind sector, at the same time as buying a share of Wicklow based offshore services company, Alpha Marine. Alpha Marine has a long track record in the offshore wind sector through the provision of tug and workboat charters, crew transfer vessels (CTVs), hydrographic survey, environmental and geophysical work. Mainport Holdings, headquartered in Cork, are set to become significant players in Ireland's offshore wind market.* **Image source: Irish Mainport Holdings.**

The aim of this document is to introduce a plan for Cork, as 'Ready to Float' for Offshore Wind by 2025. Section 2 outlines how Cork Harbour has the ingredients to be the de facto floating offshore wind hub in the Celtic Sea, with the potential to support developments off the east, south and west coasts, as well as projects from the UK and France.

As the maritime capital of Ireland, Cork can build on the maritime and energy infrastructure and capability that already exists, to accelerate towards a vision for 2025. Sections 3 and 4 provide further context on the Celtic Sea and port requirements for floating wind. Section 5 presents conclusions and recommendations to realise the 2025 ambition.

2.0 Cork Harbour - Unique Selling Points

Cork Harbour stakeholders across industry, government and civil society have a unique opportunity to contribute to the rapid development of offshore wind plans in the seas around Ireland, with positive implications for infrastructure, jobs, environment, and economy.

This section summarises the parameters that position Cork Harbour as the de facto -floating offshore wind hub in the Celtic Sea. These are:

Cork's Harbour's geostrategic location

- One of the largest natural harbours in the world, Cork Harbour features a deep, extensive and sheltered waterbody.
- Proximity to the Celtic Sea, Irish Sea and Atlantic pipeline of offshore wind projects, with the potential to support developments off the east, south and west coasts, as well as projects from the UK and France.
- Perfectly positioned on the doorstep of ~ 50GW of floating wind resources in the Celtic Sea, with a pipeline of floating wind projects[9] creating demand for high impact port assembly and installation facilities from 2025, and long-term operations and maintenance bases.

Existing port capacity

- The Port of Cork, a Tier 1 port of national significance, hosts excellent modern deep-water facilities in Lower Cork Harbour, ideal to support offshore wind development.
- The privately owned DSG vision for Cork Dockyard as a strategic hub for offshore wind is an unprecedented opportunity for the region (Figure 2.1a and 2.1b).
- The dry-dock in Cork Dockyard, the only large dry-dock in the Republic, located in Cork Harbour, is an important support facility for the offshore sector. (Max length overall 165m; max beam 21.3m; max draft 7.5m).
- The deep, sheltered waters of Cork Harbour and nearby Bantry Bay provide ideal wet storage options.

Ireland's maritime capital

- As the maritime capital of Ireland with centuries of maritime heritage, Cork Harbour is perfectly poised to build on the maritime and energy capability that already exists, to accelerate towards a vision for 2025.
- Cork Harbour has been used for decades as the primary servicing base for offshore oil and gas exploration off the south and west coast of Ireland.
- Marine operators have a track record in offshore support activities, including towage and service vessels for the Kinsale gas field, (which is currently being decommissioned).
- In recent years, the port has increasingly been used as a landing location for wind turbines and other components of onshore wind farms.
- The Dockyard has a proven track record in assembly and deployment of major structures. Figure 2.2 shows a shipment of Liebherr cranes at the Dockyard in December 2021. These had been assembled at the yard for shipment to Somalia.

9. ITP Energised (2019). Assessment of the Floating Offshore Wind Potential in the Irish Sea and UK Waters of the Celtic Sea.

Figure 2.1a *DSG Cork Dockyard owned by Doyle Shipping Group, pictured 2020.* **Image source: DSG.**

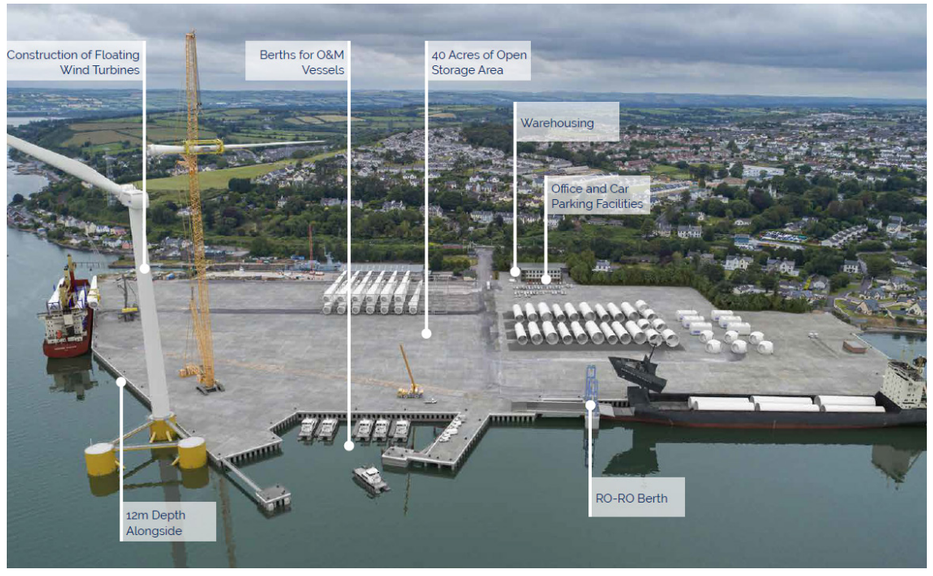

Figure 2.1b *DSG Cork Dockyard – Artists Impression - Renewable Energy Vision.* **Image source: DSG.**

Figure 2.2 *A shipment of Liebherr cranes at the Dockyard in December 2021, following assembly at the yard for shipment to Somalia.* **Image source: DSG.**

Industry and energy profile of Cork Harbour

- A concentration of large energy users exists in and around the port, including Ireland's only oil refinery, two Combined Cycle Gas Turbine plants at Whitegate and Aghada, and the pharmaceutical clusters in Ringaskiddy and Little Island.
- The harbour can be a nerve centre for scaling-up green hydrogen production powered by floating offshore wind.

Strategic designations

- The Port of Cork is a 'core' port under the Trans-European Transport Network (Ten-T). This enables the Port to meet future connectivity needs and to support the wider regional and national economy.
- An area of 776 acres at Ringaskiddy is designated as Ireland's only Marine Freeport. The land which is fully serviced and zoned for Industrial development by Cork County Council is owned by IDA Ireland and Port of Cork. Advantages include VAT exemptions on imports within the zone, certain import duty exemptions for non-EU goods and operational advantages such as simplified customs procedures.
- The National Planning Framework[10] envisages that Cork will become the fastest-growing city region in Ireland with a projected 50% to 60% increase of its population in the period up to 2040. With the National Planning Framework and the National Development Plan committing to Cork as Ireland's fastest growing city region, - it is essential that all government policy aligns with the objectives of Ireland 2040 and the position of City Regions as economic drivers.

10 National Planning Framework (NPF) (2040). National Planning Framework 2040. Government of Ireland.

Supply chain development

- Facilities and berths are available to support deployment of survey vessels for geophysical, geotechnical and marine biology surveys (e.g. Cork City, Ringaskiddy, Cork Dockyard, Crosshaven).
- The availability of local survey vessels (e.g. Green Rebel Marine, Irish Mainport Holdings) provides advantages to developers by potentially being more competitive in mobilisation and demobilisation costs.
- Cork-based marine contractors own and operate vessel fleets capable of servicing offshore platforms and subsystems.
- Cork is being primed as a key location for aerial surveys, with recent investments by Companies such as Green Rebel Marine and APEM Ltd.
- A number of important large and small consultancies provide engineering, marine, financial, and other support services (e.g. Arup, RPS, Exceedence, MMCC Marine etc.).

Regional infrastructure

- In addition to maritime transport, Cork Harbour is well connected by multiple other modes.
- Cork airport is the second largest of the three principal international airports in the Republic, after Dublin and ahead of Shannon, providing excellent access for international business.
- The M28 motorway project from Cork to Ringaskiddy is planned to improve access for port related traffic.
- Cork Dockyard is strategically connected to the Cobh to Midleton railway line.

Skills and training

- The world-class navigational and simulation facilities in the NMCI provide excellent opportunities for simulating deployment scenarios for different offshore wind developments (Figure 2.3).
- New training courses and training facilities dedicated to offshore wind, are planned by the National Maritime College of Ireland.
- Green Rebel Marine plans for a world class offshore wind training hub in Crosshaven will utilize state-of-the-art commercial facilities.

Figure 2.3. *The National Maritime College of Ireland (NMCI). World class maritime training, education, and research facilities (NMCI and MaREI) are co-located with the Naval Base on Haulbowline Island.* **Image source NMCI.**

Human capital

- University College Cork (UCC), the Munster Technological University, and the National Maritime College of Ireland (NMCI), provide undergraduate and post graduate talent in key areas such as engineering, environmental studies, marine science, supply chain management, nautical science, marine engineering, and marine electro-technology.
- Cork hosts world class research infrastructure, including the LIR National Ocean Energy Test Tank Facility in UCC's Beaufort Building in Ringaskiddy.
- An opportunity exists to further develop the innovation ecosystem established by the IMERC project in Ringaskiddy, including co-location with the naval service, headquartered on Haulbowline Island in Lower Cork Harbour (Figure 2.4).
- The IT@Cork Cluster provides the knowledge-base for the type of high-tech automation systems and controls required for the operation of offshore wind farms.
- Cork Chamber of Commerce and Cobh and Harbour Chamber of Commerce, facilitate business representation, networking and services in the region (e.g. Cork Chamber represents 1,200 members employing over 100,000 people).
- Home of Ireland's unique energy industry cluster, Energy Cork. Energy Cork strengthens enterprise and employment within the energy sector supported by Cork City Council and Cork County Council through their respective Economic Development Funds. Energy Cork was conceived by Cork Chamber to build on the unique opportunities for the region to secure competitive advantage in the energy sector.

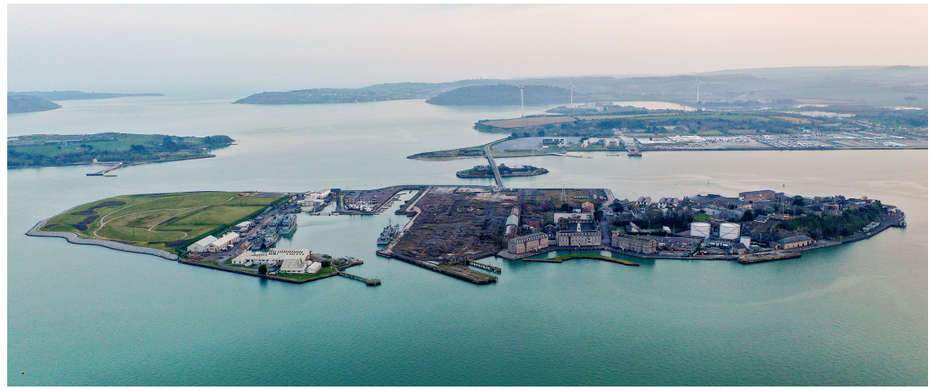

Figure 2.4. *Cork Harbour hosts the national headquarters of the Irish Naval Service, pictured above, on Haulbowline Island in the Lower Harbour. The end user knowledge of naval service personnel provides a unique source of maritime domain awareness and knowledge. Clustered with the National Maritime College of Ireland and the Beaufort Building in Ringaskiddy, the cluster provides an innovation ecosystem to underpin offshore development. The remediation of Haulbowline Island paves the way for further development of this innovation hub, as per the potential outlined in the Haulbowline Master Plan[13].*
Image source: Irish Naval Service

11 BDP (2015). Haulbowline Master Plan.

Pure Cork and We Are Cork

- The Pure Cork brand promotes the attributes that make Cork a wonderful place to visit, live and work.
- The We Are Cork place brand has been developed to allow and encourage Corks public sector, business, education and visitor stakeholders to use the brand when promoting Cork to their respective audiences'
- Development agencies such as Enterprise Ireland and IDA help to nurture and attract indigenous talent and FDI investment to the region.

Cork Chamber Sustainable Cork Programme

- The Cork Chamber Sustainable Cork Programme commenced with an in depth consultation of almost 1,000 businesses and citizens to define a vision for the recovery and resilience of Cork as we emerge from the pandemic. The outlook was framed in the United Nations Sustainable Development Goals, and a headline was the relentless focus on quality of life and a more sustainable economic model.
- The Building Economic Resilience report, and ongoing Programme, robustly supports the delivery of renewable energy as a key component of the Cork economy.[12]

IDA Strategic Plan Driving Recovery and Sustainable Growth 2021- 2024

- IDA are placing sustainable growth at the centre of the 2021 to 2024 strategy, in line with Government policy, international consensus, the vision of IDA clients, and the demands of citizens.
- IDA will will seek growth that meets the needs of the present without compromising the ability of future generations to meet their own needs, while fostering an inclusive, sustainable, and resilient economy and society.[13]
- The national context for IDA's approach to winning investment for the regions is set by Project Ireland 2040 and the associated National Planning Framework (NPF), National Development Plan and Regional Spatial and Economic Strategies and the objectives of the Programme for Government in relation to regional development.
- Two key sustainability objectives of the IDA are to support de-carbonisation and responsible production across the IDA client base and crucially to win sustainability investments to drive a green recovery.

12 https://www.corkchamber.ie/wp-content/uploads/2020/07/Sustainable-Cork-Programme-Building-Economic-Resilience.pdf
13 https://www.idaireland.com/about-ida/driving-recovery-and-sustainable-growth-2021-2024

3.0 The Celtic Sea floating wind opportunity and project pipeline

A resource assessment study of the Celtic Sea[14] showed the potential for the development of up to 50GW of floating offshore wind capacity. This is enormous. To put it in context, the European Commission estimates that Europe will need 450GW of offshore wind energy by 2050 to decarbonise our energy systems.

WindEurope have forecast that 85GW of this will be required in the Atlantic Ocean. More than half of this could come from the Celtic Sea alone. A study of the job creation potential arising from floating wind in the UK part of the Celtic Sea, indicates that circa 900MW of installed capacity by 2030 would yield 3,200 jobs and £682m (€765m) spend in the local supply chain[15] . While the figures are not directly transferable to an Irish scenario, not least because the UK has a 20-year head start in the offshore wind industry compared to Ireland, it is clear from the numbers that regional job and economic benefits from floating wind are not insignificant.

The UK aims to deliver 1GW of floating wind by 2030. With the right policy priorities, Ireland could readily achieve the same target. This would take a burgeoning floating wind supply chain to a new level, with major opportunities for Cork Harbour (Figure 3.1). Government policy is critical

Figure 3.1. *Delivering 1GW of floating offshore wind equates to the assembly and deployment of 67 * 15MW turbines between 2027 and 2030. The logistics around the assembly and deployment of this volume of components coming in by sea would require facilities in DSG's Cork Dockyard, and the Ringaskiddy terminal (pictured above), which is operated by Port of Cork.* **Image source: Port of Cork Company.**

14. ITP Energised (2019). Assessment of the Floating Offshore Wind Potential in the Irish Sea and UK Waters of the Celtic Sea.
15. ORE Catapult (2020). Floating Offshore Wind Constraint Mapping in the Celtic Sea.

to unlocking this potential. Decisions pending in Q1 of 2021 will determine if projects from the Celtic Sea, including floating wind projects, will be prioritised within the measures needed to meet the target of 5GW of offshore wind to be developed in Ireland by 2030. This means expanding the envelope of opportunity from the limitations of bottom-fixed projects in the Irish Sea and facilitating Cork's prospects as a major offshore wind hub.

There are currently five floating wind projects (3.1GW) proposed for the Irish and UK parts of the Celtic Sea (Figure 3.2). The development of these or other future projects in the Irish part of the Celtic Sea will be determined by the market opportunity, initially by the domestic market, and subsequently by the export market. Accessing the domestic electricity market requires an urgent review of requirements for grid upgrades and reinforcement along the south coast by Eirgrid to ensure that investors in the Cork Harbour supply chain can bank on a secure project pipeline for the region. It also requires government support for floating wind projects in the Celtic Sea to enter an auction system for renewable generators via the Renewable Energy Support Scheme (RESS), from 2025. This will provide the pathway for floating offshore wind developers, in relation to when they need to have their projects auction ready, as well as a timeline that port operators and other service providers can plan towards.

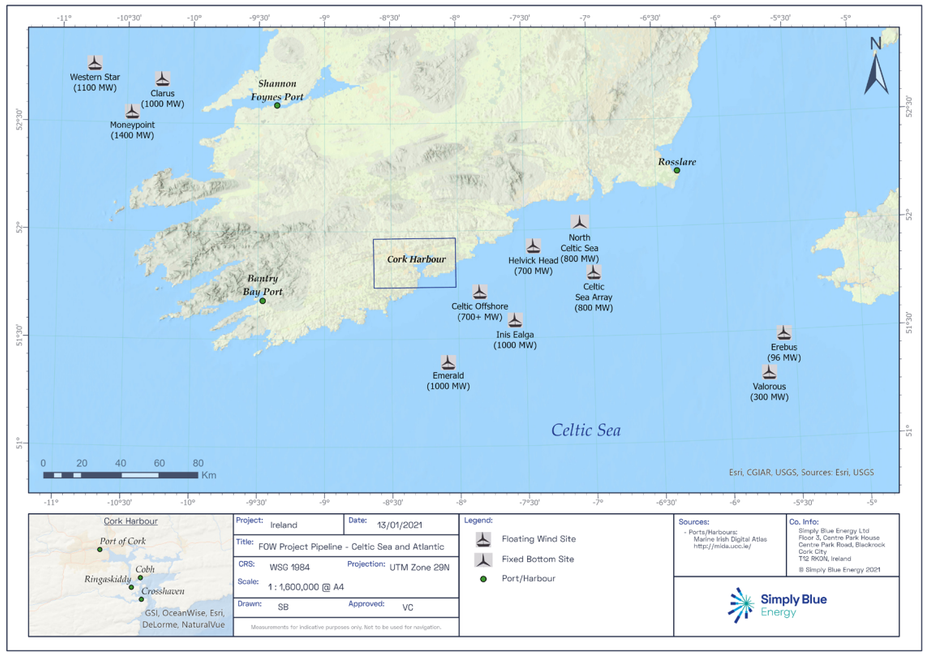

Figure 3.2 Floating Project Pipeline Celtic Sea and Atlantic- *There are currently circa 5.3GW of floating offshore wind projects in the pipeline in the Celtic Sea. There is an additional 3.5GW of floating wind proposed for the Atlantic. These are additional to fixed-bottom projects in the pipeline for the Irish and Celtic Seas.* **Image source: Simply Blue Group.**

While RESS schemes are likely to be the dominant route to market in the coming decade, Corporate Power Purchase Agreements (CPPAs) also offer potential. Large energy users such as data centres drive the current demand for CPPAs. An opportunity exists for Cork Harbour to become an attractive alternative location outside of Dublin and Meath, with access to clean energy from the Celtic Sea.

Deployment of floating wind at scale will drive the cost of electricity down, facilitating competitive pricing in both domestic and European electricity markets. Figure 3.3 presents the expected Levelised Cost of Energy (LCoE) trajectory for floating offshore wind based on estimated installed capacity over the next 10 years. Industry expects the costs to be circa €50/MWh by 2030 which is competitive against bottom-fixed offshore wind.

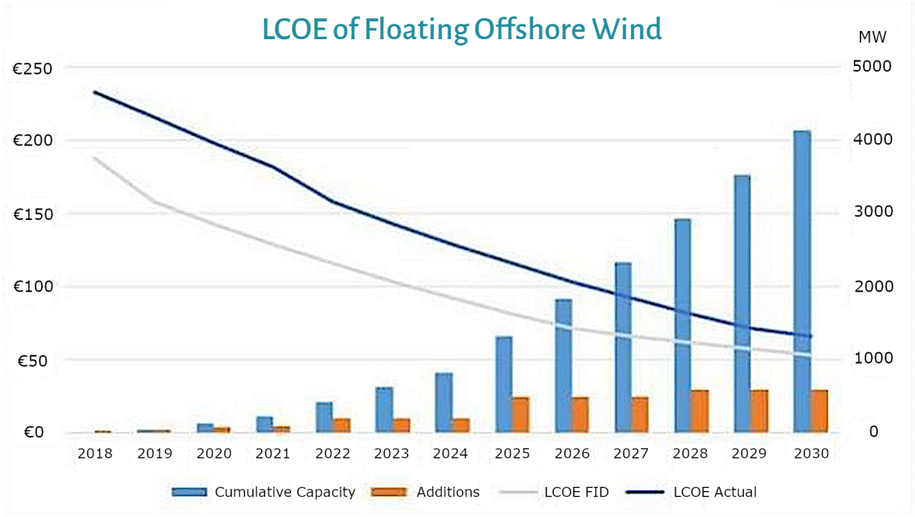

Figure 3.3 The Levelised Cost of Energy of Floating Offshore Wind *is expected to reach €80-€100/MWh for the first commercial scale projects reaching FID between 2023-2025. Assuming gross cumulative installations in the region of 4GWs, the LCoE is expected to be circa €50/MWh by 2030.* **Adapted from: WindEurope**[16]

Existing, proposed, or future interconnectors, (such as the €1 billion Celtic Sea interconnector to France, which will connect into Carrigtwohill in Cork and come onstream in 2026), can facilitate the export of electricity into European markets. However, for large-scale growth in offshore wind development in the Celtic Sea it will also be necessary to explore new markets in other energy areas such as transport and heat and bulk energy export for example using the vector of hydrogen.

16 WindEurope, (2018). Floating Offshore Wind Energy: A Policy Blueprint for Europe.

Figure 3.4. *View looking east from Cork's 'Energy Quarter' in Lower Cork Harbour, including the oil refinery and the Bord Gáis Closed Circuit Gas Turbine (CCGT) Plant at Whitegate. Hydrogen from natural gas is consumed at scale in this industrial cluster. Green Hydrogen generated from electricity produced from floating wind, has the potential to support the decarbonisation of such industries, for example by providing dispatchable power through CCGTs.* **Image source: Port of Cork Company.**

Expansion of the energy market for floating wind in the Celtic Sea can be achieved by gaining access to the heat and transport markets in Ireland which are four times the size of the electricity market. Green hydrogen is produced using water electrolysis to create hydrogen and oxygen using sustainable electricity from renewable sources. This can be an alternative to fossil fuels for use in electricity, heat and transport, as well as in power generation and heavy industry, such as the industries in Cork Harbour (Figure 3.4). Advances in electrolyser technology efficiency and major cost reductions combined with the environmental and financial incentives associated with decarbonising society in general have made the concept of a hydrogen economy a reality[17]. Figure 3.5 presents a vision of how this may translate into a new green hydrogen economy for Cork Harbour, driven by electricity generated from floating offshore wind in the Celtic Sea. Such a concept could be extended to novel applications such as district heating for Cork Docklands.

17 European Commission, 2020. Communication from the commission to the European parliament, the council, the European economic and social committee and the committee of the regions. A hydrogen strategy for a climate-neutral Europe. COM (2020). 301 final. Brussels

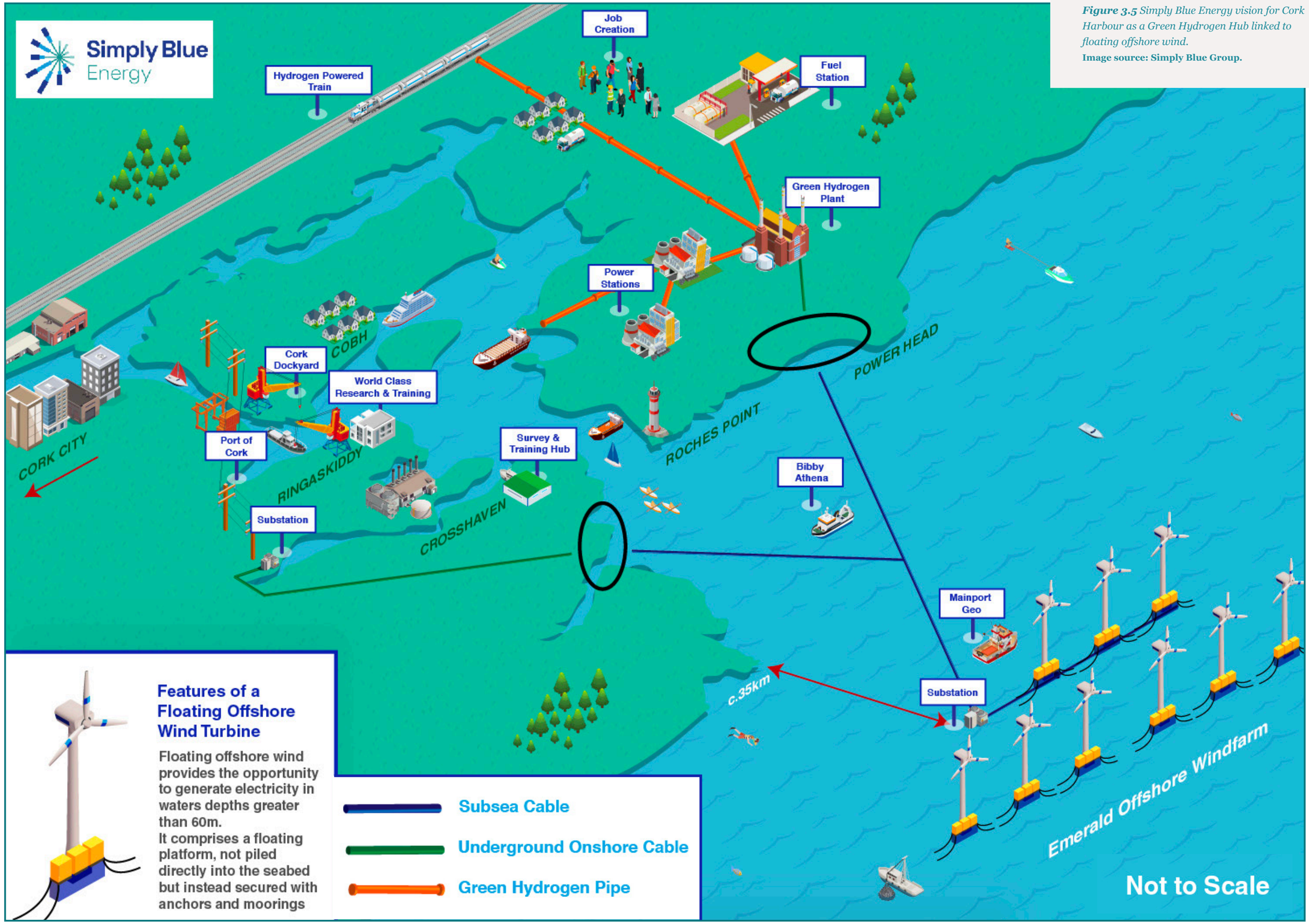

Figure 3.5 *Simply Blue Energy vision for Cork Harbour as a Green Hydrogen Hub linked to floating offshore wind.*
Image source: Simply Blue Group.

4.0 Offshore wind and port capacity

The Programme for Government aims to have 5GW of offshore wind installed by 2030 to meet national climate targets, - which marks a huge increase in the volume of offshore wind nationally, from a standing start of 25MW of current installed capacity at the Arklow Bank.

The target is most likely to be met by the deployment of both bottom-fixed and floating structures, subject to government policy. This presents a major opportunity to develop a local supply chain and the jobs that go with it. For example, in 2030 6.3GW of domestic offshore wind would support approximately 12,000 direct and indirect jobs in the domestic supply chain with a Gross Value Add (GVA) impact of circa €2billion for the period 2020-2029[18]. The development of port infrastructure for the assembly and deployment of turbines and foundations is a critical enabling factor to driving the sector forward in Ireland.

Port infrastructure and services required by the offshore wind sector span a range of activities that occur at a number of scales depending on the stage of project development.

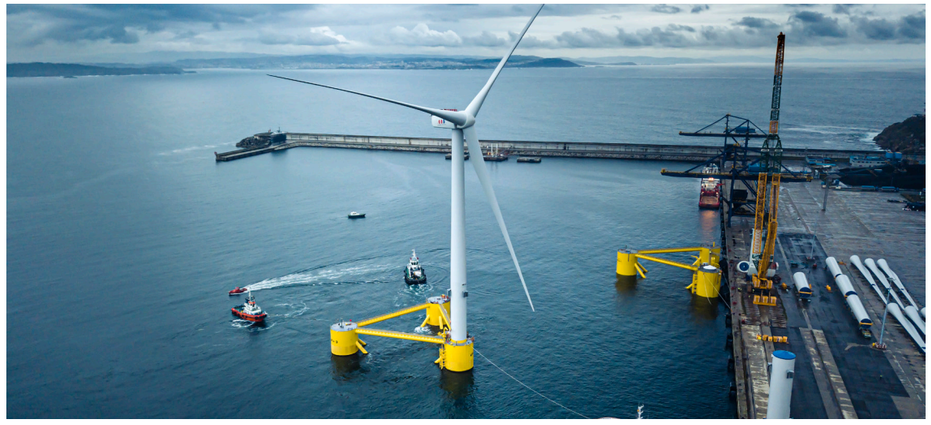

Figure 4.1. The WindFloat Atlantic assembly and installation process *undertaken in the outer Harbour of Ferrol in Portugal in 2018. The foundations were moored to the quayside in Ferrol where the installation of the 8.4MW wind turbines was undertaken, prior to the floating structures departing for their final destination 20km off the coast of Viana do Castelo (Portugal). This technology can be towed with the standard of towing craft currently available in Cork Harbour and also has the advantage of not having to rely on complex offshore operations associated with the installation of traditional bottom-fixed structures.*
Image source: photo courtesy of Principle Power. Artist: DOCK90

18 Kandrot, S., Cummins, V., Jordan, D. and Murphy, J. (2020). Economic and employment impacts of offshore wind for Ireland: A value chain analysis. International Journal of Green Energy 17:11, pp687-696.

These range from: - i). large, strategic ports designated as manufacturing hubs (such as Green Port, Hull, UK); ii). ports for assembly and installation (Figure 4.1) (such as Belfast and Cork.; iii) small ports and harbours for operations and maintenance (such as Crosshaven, Kinsale or other such harbours along the Cork coast). (Few ports are capable of providing the level of quayside space required for manufacturing of the blades, turbines or foundations).

Table 4.1 describes the port capacity required for different stages of offshore wind development. Cork Harbour is perfectly positioned right now to support Phases 1 and 4. By 2025, Cork Harbour will be ready to support Phase 3, on time to meet the demands of offshore wind developers, currently progressing projects through the early feasibility and planning stages. Gearing-up for Phase 3, which requires investment in Cork Dockyard and the Port of Cork, is vital to capture as much local content in the supply chain as possible, to ensure economic value and jobs for the Cork region.

Table 4.1. Port development opportunities for offshore wind support.

Phase	Supply chain segment/ Stage of floating offshore wind development	Port requirements
Phase 1. Yrs 0-6	Project development and design – includes site identification and feasibility; consenting and environmental impact assessments and engineering design. Project development covers all early spend in a project, making up around 5% of capital spend.	Facilities to support deployment of survey vessels for geophysical, geotechnical and marine biology surveys.
Phase 2. Yrs 7-8	Manufacturing	The manufacturing of turbines, blades or foundations are influenced by the capacity of the major shipyards outside of Ireland (such as Cherbourg in France and Navantia in Spain) or strategic decisions of international OEMs.
Phase 3. Yrs 7-10	Assembly and installation	Key minimum requirements: • Draft from 11m; • Quayside LOA from 300m; • Beam from 90m; • Storage from 100,000m²; • Lift capacity from 700 tonnes. Requires marine contractors to operate vessel fleets capable of installing FW, anchor drilling and ship maintenance.
Phase 4. Yrs 10-35	Operations and Maintenance	Requires marine contractors to operate vessel fleets capable of servicing offshore platforms and subsystems. High-tech automation for systems control requires IT cluster. Skills exportable.

Belfast port is currently best placed on the island of Ireland with capacity to support plans for new bottom-fixed offshore wind projects in the Irish Sea in the decade ahead (Figure 4.2). However, existing capacity in Belfast will not be sufficient to meet demand for port facilities, from the volume of offshore wind projects coming onstream in Ireland and the UK. Proposals for new ports on the east coast (e.g. Braemore and Rosslare) are limited by factors such as water depth with regards to servicing the floating sector. In due course, Shannon Foynes has an important role to play for floating projects on the west coast with deep water attributes[19], however, it will require considerably more investment than Cork Harbour, which already has a shipyard ready to be adapted, independent of exchequer funding.

The demand for assembly and installation port facilities for floating wind projects in the Celtic Sea will kick-off from 2025. The first floating wind farm in the Celtic Sea, the 96MW Erebus project, is currently being developed by Total and Simply Blue Energy, - the latter an Irish company headquartered in Cork. This will be followed by the 300MW Valorous project, both off the coast of Pembroke[20].

Figure 4.2. *The development of a substantial number of offshore wind farms in the UK part of the Irish Sea, enabled Belfast Harbour to develop the first purpose-built installation and pre-assembly harbor in the UK and Ireland, at an investment of £50m in 2013. Initial turbine sizes were 2.3MW. The port remains an unrivalled facility in the Irish Sea with 480m of quay, 9.3m channel depth, and 50 acres of storage area. It was developed under a long-term agreement due to visibility of a large project pipeline (West of Duddon Sands 389MW; Burbo Bank Extension 232MW; Walney Extension 660MW). Belfast Harbour serves as a role-model for what can readily be achieved in Cork Harbour in support of offshore wind. Companies such as the Doyle Shipping Group are uniquely placed to transfer stevedoring expertise and offshore wind know-how from Belfast to Cork.* **Image source: DSG.**

19 Shannon Foynes Port (2020). Shannon Estuary – Offshore Wind Potential Study.
20 Blue Gem Wind. [online] Available at: www.bluegemwind.com

The Erebus project requires port facilities in the Celtic Sea to facilitate assembly and deployment from 2025, with a commencement of generation target for late 2026. An Erebus Port Assessment Study by OWC[21] concluded that no large-scale offshore wind facilities exist in the region to support floating offshore wind projects. Recurring limitations in a systematic review of ports, that extended from Brest to Belfast, were identified as: i). water depth requirements for WindFloat units (the PPI technology being utilized in the Erebus project), to remain afloat at all times; and ii). quay strength and space for quayside assembly.

With respect to water depth requirements, deep-water channels in Cork Harbour provide adequate depths to enable towed access to WindFloat units. Wet storage space is available in the sheltered confines of the Harbour, such as the Curlane Bank anchorage (Figure 4.3a). The deep waters of Bantry Bay provide further prospects for wet storage (Figure 4.3b), with the added advantages of:

- Port of Cork oversight of harbour operations in Bantry Bay
- The track record of dealing with oil storage and maritime traffic in Bantry
- The availability of excellent towage capacity locally and
- The opportunity to extend the benefits of floating wind development in the Celtic Sea to the West Cork region

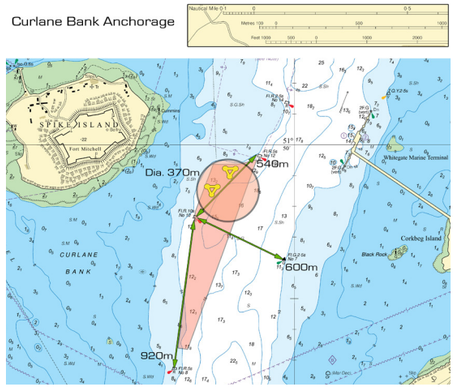

Figure 4.3a. *The Curlane Bank anchorage in Cork Harbour is an excellent example of the space managed by the Port of Cork available for potential wet storage of offshore wind technology.* **Image source: Port of Cork.**

Figure 4.3b. *Bantry Bay in West Cork, also operated by the Port of Cork, is renowned for its sheltered deep waters. The visualization shows an oil tanker at the Single Point Mooring associated with oil storage on Whiddy Island. A windfloat unit in wet storage is superimposed in the background to provide an impression of the activity.* **Image source: Port of Cork.**

21 OWC (2020). Erebus Ports and Harbours Study presented by OWC at the Blue Gem Wind Port Workshop 16th December 2020.

Quayside depth, strength and space is addressed by the DSG plans for Cork Dockyard. Exciting plans for Cork Dockyard by DSG envisage the development of the shipyard as a renewable energy hub[22] (Figures 2.1a and 2.1b). Doyle Shipping Group is the largest independent provider of shipping agency services and logistics in Ireland. The company has a dedicated workforce of over 600 people and has offices and warehouses in all the major Irish ports. It also owns and operates Cork Dockyard as one of its three private port facilities (the others being Passage West in Cork Harbour and Greenore in County Louth).

Cork Dockyard covers an area of c.44 acres. It is a major strategic industrial site/port facility within Cork Harbour and includes a range of uses including manufacturing, workshops, storage, stevedoring and marine / port related facilities. Existing on-site infrastructure include 800m of quay wall with deep water berth, a dry-dock, roll-on roll-off (Ro Ro) options, 15,000 sq metres of covered storage and 180,000 sq metres of open space for storage and lay-down space.

The redevelopment of Cork Dockyard as a clean, green facility, servicing the offshore wind sector, is a progressive plan for Cork Harbour, potentially creating up to 200 direct long-term jobs. The vision includes plans for a new berth with 12m of water depth (currently 7m), additional storage area, and the opportunity to dock the equivalent of two WindFloat units for assembly. The project will be progressed for planning in 2021. From a floating offshore wind developers' perspective, there is an imperative that the Dockyard be open to service the pipeline of projects emanating from the Celtic Sea by 2025. The alternative is that port related business will be forced to go elsewhere.

The Port of Cork Ringaskiddy Terminal further strengthens the opportunity for Cork Harbour. Ringaskiddy has suitable water depth and infrastructure to support assembly and deployment activities. However, due to high occupancy rates (circa 75%) for receiving regular bulk, container, roll-on roll-off, and project cargo, access to quayside space will be limited to off peak periods. Plans for the extension of the deep-water berth in Ringaskiddy could add significant capacity to the capabilities on offer in Cork Harbour in support of the nascent floating wind boom in the Celtic Sea[23].

22 Doyle Shipping Group (2020). Renewable Energy Vision.
23 MMCC (2020). Port Assessment Report Cork Harbour. Internal Report commissioned by Simply Blue Energy.

5.0 Case Study: Humber Region– A Vision Realised

The UK has marched ahead on offshore wind and expects to have delivered 40GW by 2030. Within this incredible achievement significant investment has occurred catalysing a world leading hub for offshore wind in the Humber region.

In Hull Siemens have invested £160m in an offshore wind facility and at the other side of the river in Grimsby, multiple offshore wind farm operations and maintenance bases stand proudly in a town previously ravaged by the decline in traditional fishing.

By taking advantage of the Port of Hull's prime location in relation to offshore wind projects in the North Sea the region has been perfectly placed to capitalise on the UK's offshore wind industry.

Figure 5.1. *Stakeholders such as Hull City and East Riding Councils, Associated British Ports, the Local Enterprise Partnership, Siemens, Team Humber Marine Alliance and multiple offshore wind developers such as world leading Orsted have together redefined the brand, image and economy of the Humber region.*
Image source: Siemens

Through the Regional Growth Fund significant funding has been secured for skills & employment, business support, and research and development to ensure that local people and business gain maximum benefit from the renewable energy sector. The University of Hull is working to ensure that the knowledge element of the sector establishes itself in Hull.

These attributes are the reason that Siemens chose Hull as the location to build its world-class offshore wind turbine blade manufacturing, assembly and servicing facilities that form the centrepiece of
Green Port Hull:

- Over 500 hectares of employment land, some with direct quayside access
- Strategic location within 12 hours' sailing time from three major Round 3 wind farm zones
- Programme of investment totalling £1billion underway in Hull
- Enterprise Zone incentives
- Designated Centre for Offshore Renewable Engineering
- A portfolio of deliverable sites in the port and its hinterland
- Dedicated investor support
- Extensive infrastructure and logistics capability
- Excellent connectivity by road, rail, sea and air
- A skilled workforce
- An emerging supply chain
- Civic leadership committed to realising these opportunities
- A world-class university
- Competitive employment costs[24]

A formal Humber Freeport Bid to Whitehall was submitted by Humber stakeholders in February 2021 carrying with it hopes of thousands of further jobs and millions of pounds of investment.

24 https://greenporthull.co.uk/about-green-port

6.0 Conclusions and Recommendations

All the key ingredients are already available for Cork Harbour to become an unparalleled hub for floating wind in the Celtic Sea, servicing projects in Ireland and the UK, from 2025.

The journey has commenced with up to €200m of private sector investment already underway, and significantly more planned. An enormous opportunity now exists for a whole new industrial sector to emerge in Cork Harbour, not seen since the IDA designated the Ringaksiddy area as a cluster for pharmaceuticals in the 1970s.

There is a need for i). a joined-up vision, and ii). to act now.

Co-production of a vision for Cork Harbour will require a joined-up approach across government, industry and civil society. **The designation of Cork Harbour as a strategic hub for offshore wind in the new National Development Plan (Ireland 2040)** will help to prioritise investment in enabling infrastructure in the Port of Cork and grid upgrades. **At the County level, the new County Development Plan planned for 2021 provides an opportunity to zone areas in Cork Harbour for landuse activities in support of offshore wind.**

Stakeholders must act now, to pave the way for floating wind projects in the Celtic Sea this decade, for industry to increase levels of investment, and to ensure energy citizens are engaged and informed.

Without policy action, future investment will not be sustained, and may in fact go elsewhere. **As an urgent priority, the government must ensure that floating wind projects in the Celtic Sea are included in the Climate Action target of 5GW of offshore wind by 2030.** This is key to unleashing the potential for floating wind and the opportunity for Cork Harbour.

Floating offshore wind is the economic opportunity of our generation.

Cobh & Harbour Chamber
Advancing business together

Cork Chamber
Advancing business together

DP ENERGY

DSG

ENERGY CORK

GREEN REBEL MARINE

IRISH MAINPORT HOLDINGS
THE MAINPORT GROUP

MTU
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Munster Technological University

NMCI
National Maritime College of Ireland
Coláiste Náisiúnta Mara na hÉireann

PORT of CORK
DEEPWATER MULTI-MODAL PORT

Simply Blue Energy