Irish Maritime Development Office

IPORES 2018

A Review of Irish Ports Offshore Renewable Energy Services

Irish Maritime
Development Office

RSM supported by Pure Marine

Contents

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Foreword

The Offshore Renewable Energy Development Plan (OREDP) identifies the opportunity for the sustainable development of Ireland's offshore renewable energy resources. By increasing indigenous production of renewable electricity, we contribute to reductions in our greenhouse gas emissions, improve the security of our energy supply and create jobs in the green economy. The OREDP sets out key principles and policy actions for the sustainable development of Ireland's offshore renewable energy resources, while recognizing the importance of supporting infrastructure, such as port facilities, in the achievement of this national ambition.

The offshore renewable energy industry will be regionally dispersed because of its reliance on the natural resources that exist around our coast. The industry will be served by ports that have the necessary infrastructure to support its development, including, but not limited to adequate water depth, quayside capacity, cranage, proximity to energy sites, and well-developed supply chains. The offshore renewable energy industry represents an opportunity for Irish ports to develop a new, and in many cases, complementary source of revenue, which can contribute significantly to regional development and local employment.

This report identifies the facilities and other criteria that will be considered by offshore renewable energy developers and comments on the preparedness of Irish ports to meet the needs of this emerging sector. The report finds that Irish ports are well positioned to provide the services required within the timeframe associated with the roll-out of the industry in Ireland. Irish ports have exhibited a capacity to respond positively to commercial opportunities and will do so again as the offshore renewable energy industry grows. The commercial opportunities that will arise for ports will be in the construction, assembly, servicing and maintenance of devices, and in accommodating other supply chain activities on port estates.

I welcome the clarity that this report brings to the opportunity that exists for Irish ports to contribute to the commercial development of the offshore renewable energy sector and to unlocking the consequential benefits in terms of regional development. I would like to thank the consultancy team in RSM and Pure Marine for their diligent work on this project and the many industry stakeholders who contributed so generously of their time in the compilation of the report. Offshore renewable energy is set to play a greater role in meeting Ireland's sustainable energy targets in the reducing carbon emissions and Irish ports are well positioned to provide the supporting infrastructure.

Liam Lacey
Director
Irish Maritime Development Office

2.0

Executive Summary

Since 2012, the offshore renewable energy (ORE) sector in Europe has tripled in size, primarily through the deployment of offshore wind turbines, with energy companies investing over €22 billion in the construction and operation of over 11GW (2,000 turbines) of capacity. The rapid growth of the offshore wind industry in Europe is projected to continue over the next ten years, where offshore wind is becoming a mainstream supplier of low-carbon electricity due to achieving competitiveness through a continued focus on cost reductions and innovation throughout the supply chain.

Ireland's offshore renewable energy resources are among the largest in Europe; however, these assets remain largely undeveloped. To date, the only offshore wind project deployed in Ireland is the 25MW (7 turbine) offshore wind demonstration project commissioned in 2004. However, recent policy developments in Ireland have stimulated a renewed focus on investment opportunities in Ireland's offshore wind, wave and tidal energy resources. In particular, the new Renewable Energy Support Scheme (RESS) being designed to contribute to Ireland's 2020 renewable electricity targets, and to deliver Ireland's renewable energy ambitions out to 2030, could act as a catalyst for the deployment of ORE projects in Irish waters and create new business opportunities for Ireland's ports.

Consultations with the ORE sector undertaken in this study indicated that between 1,500MW and 5,200MW could be deployed in Ireland by 2030. The majority of this would be offshore wind, though expansion of demonstration projects for wave energy converters and tidal turbines are expected to follow as the technology emerges from its testing and development stages. Energy companies have been undertaking development and site investigations on offshore wind sites in the Irish Sea for projects using fixed foundations and over 1,000MW could be deployed over next 3-4 years. Floating offshore wind farms at sites along the south and west coast of Ireland are also predicted to scale up to similar levels.

Ireland's ports gained some experience of the support activities and facilities required for construction and operation of offshore wind farms through the Arklow Bank demonstration project. However, Belfast Harbour has established itself as one of the leading centres in the offshore wind sector due to its proximity to large wind farms in UK waters in the Irish Sea. The UK government's support for offshore wind and a pipeline of projects being developed by energy companies provided the stimulus for an investment of £50m from Belfast Harbour to build a new offshore wind port terminal, which was designed to provide the quay space and capacity to cater for the increasing size of the offshore wind turbines and foundations being deployed. Belfast is ideally located to support the construction of offshore wind projects in the Irish Sea and has the capacity to support the construction and assembly of around 50 turbines and foundations per year. If the ORE sector in Ireland grows rapidly, then similar facilities in other Irish ports are likely to be required to meet demand. There are also opportunities for Irish ports to support the on-going operation and maintenance activities of ORE projects, where proximity to site to support crew transfers is an advantage.

The National Ports Policy (2013) introduced clear categorisation of the ports sector, similar to categories presented in the IPORES 2012 report. This has facilitated investments of over €370 million by Ireland's Tier 1 ports, namely Dublin Port, Port of Cork and Shannon Foynes Port Company. The development of an overall support framework (similar to those which have been successfully implemented elsewhere in Europe) by progressing policy and legislation to facilitate the deployment of ORE projects in Ireland is essential. This will complement the readiness of Irish ports to take advantage of current opportunities. Ireland's ports have the ability to respond to the ORE industry's needs: the port masterplans developed by Ireland's Tier 1 ports have identified ORE as a potential growth area and are well positioned to provide the facilities and infrastructure required.

A modelling exercise undertaken as part of this study identified a baseline scenario for possible deployment levels of ORE projects in Irish waters. This was developed through consultations with the ORE industry and forecast 1,505MW by 2030, consisting of two offshore wind projects and one wave energy demonstration project. The potential for a higher deployment scenario was also identified, where 5,200MW could be deployed from ten offshore wind projects (including floating wind turbines) and two wave energy projects.

The job creation potential from the baseline scenario is 18,000 person years of employment, which comprises 10,000 person years in the construction phase, 2,700 person years for operation and maintenance and 5,300 person years for indirect jobs created. For the higher deployment scenario, the potential job creation is 60,000 person years in total.

Under the higher deployment scenario, the increased levels of activity would also provide a pipeline of projects that could support investment from Ireland's ports in new facilities and infrastructure. These could service the offshore wind sector and also provide additional port capacity for growth in other sectors of the economy.

Scope and Objectives of the study

The study focused on a review and update the report on Irish Ports Offshore Renewable Energy Services (IPORES), originally produced in 2012.

The main objectives of the IPORES 2017 report were:

1. Provide an updated description of current capacities, infrastructure, facilities and services that ports have to offer.
2. Consult with the main offshore renewable energy sector stakeholders to establish the key port infrastructure requirements for the sector over the next 10 years.
3. Consult with Irish ports to assess awareness of opportunities offered by the developing offshore renewable energy industry and determine suitability of Irish ports to meet the requirements of developers in the ORE industry.
4. Assess the potential for job creation, both at specific ports and through the supply chain, arising from offshore renewable energy sector developments, and activities and services provided from Irish ports.

The methodology to deliver the assignment comprised of the following packages or work:

- Consultations with the Offshore Energy Sector: Interviews and meetings with energy key stakeholders for Offshore Renewable Energy projects, complemented with desk-based research, to produce a "Market Intelligence Report' setting out details of the main current and planned offshore renewable energy projects in Ireland across the wave, tidal and offshore wind sectors.
- Consultations with the Port Sector: Interviews and meetings with Irish ports, along with a review of masterplans and relevant reports, to assess the capabilities to service offshore renewable energy projects as well future potential of ports to develop facilities to meet project requirements in the short and medium term.
- In addition, a benchmarking study was undertaken to analyse international competitors and to examine comparable ports to explore learning that can be used in Ireland.
- Assessment of Job Creation Potential: The market intelligence from the ORE sector and the assessment of the Irish ports informed the development of an economic model to estimate the potential for job creation at specific ports and

through the supply chain. The model was used to translate expenditure on ORE projects into estimates of temporary, direct, indirect, and induced employment across a range of deployment level scenarios.

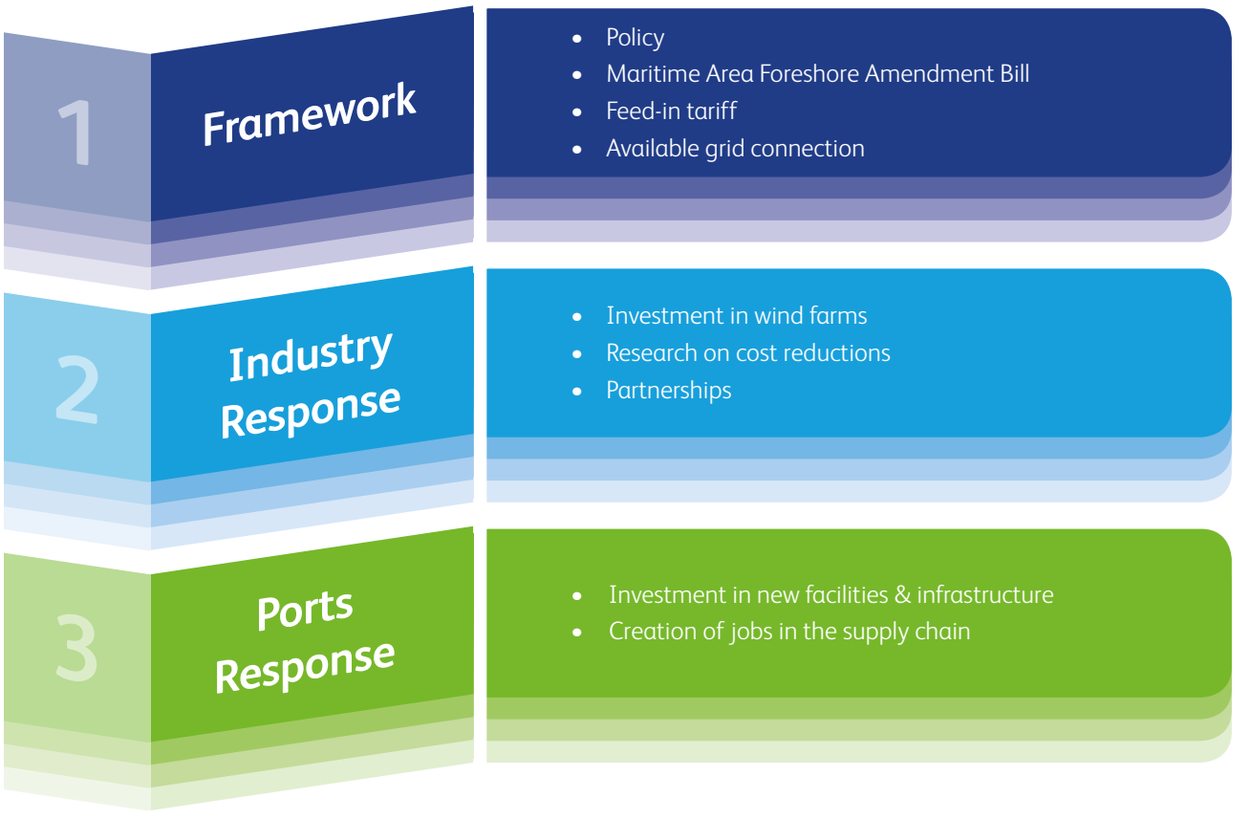
- Technical Assessment of Ports and Harbours: A framework was developed to assess the ports and harbours included in the study. A technical summary for each port was developed that included criteria relating to current suitability and future potential to meet the requirements of developers in the ORE sector.

Establishing an ambitious, inter-departmental, long-term plan for the generation of electricity from offshore resources, similar to successful frameworks established elsewhere in Europe, will stimulate international investors to develop and construct ORE projects in Irish waters, generate new business opportunities for Ireland's ports and the supply chain, resulting in the creation of between 18,000 person years and 60,000 person years of employment over the next 10 years.

When the investment in the development of ORE projects in Irish waters is committed, recommendations to maximise the potential of the ORE sector and the benefits to Ireland include:

Recommendations

A clear and coherent framework around existing policy and legislation, that includes feed-in tariffs and foreshore licencing legislation to support the ORE sector, is needed to attract the investment from industry that will result in job creation and the construction of new facilities and port infrastructure, as shown in the chart below.



- Promote the economic case for the ORE sector in Ireland – highlighting the cross-cutting economic benefits for the energy and maritime sectors.
- Engagement and cooperation – the ORE industry and ports have a joint responsibility to provide leadership in the development of the sector; this should be facilitated wherever possible by development agencies.
- Increased marketing activities by Irish Ports – in particular at an international level to promote the opportunities for investment in Ireland's maritime sector.
- Promote supply chain opportunities – where Irish companies innovate and international companies can expand into the Irish market.
- Arrange fact-finding visits to other EU ports – facilitating knowledge exchange and creating opportunities for future collaboration.

Irish ports could play a leading role alongside Irish and international energy companies to establish a sustainable offshore renewable energy sector in Ireland. Appropriate policy and legislative frameworks and the support of development agencies will be required to facilitate the growth of the ORE sector. In turn, this has the potential to provide significant economic benefits by creating new business opportunities for Irish ports and providing the impetus for investment and development of port infrastructure which will result in job creation across the maritime, construction and energy supply chains.

3.0

Introduction

3.1 Terms of Reference

RSM PACEC Ltd, in association with Pure Marine Gen, were commissioned by the Irish Maritime Development Office to undertake a review and update of the Irish Ports Offshore Renewable Energy Services (IPORES) report.

The main objectives of the study were to:

1. Provide an updated and more comprehensive description of current capacities, infrastructure, facilities and services that ports must offer the developing offshore renewable energy sector, to include wind, wave and tidal energy resources;
2. Establish the key port infrastructure requirements for the sector over the next 10 years; through a review of published documents and a focused consultation with the main offshore renewable energy sector stakeholders,
3. Determine the level of awareness, strategic planning and marketing by ports in relation to addressing opportunities offered by the developing offshore renewable energy industry.
4. Provide an assessment of the track record of ports in terms of experience with the renewable energy industry;
5. Categorise and determine the suitability of Irish ports to meet the requirements of developers in the offshore renewable energy industry based on current infrastructure, facilities and strategic plans;
6. Estimate the potential for job creation, both at specific ports and through the supply chain, arising from offshore renewable energy sector developments, and activities and services provided from Irish ports
7. Note any significant changes / developments since the 2012 report

Further to the Terms of Reference, within the 2012 IPORES report, a benchmarking exercise was completed: this examined six ports and harbours in the UK and Germany. As part of this updated report, it was agreed to complete a benchmarking exercise: revisiting some of the benchmarks from 2012 and also including some others. The purpose of the benchmarking was to examine the lessons that could be learned in relation to the development of the ORE sector and the conditions which provided the catalyst for the investment.

3.2 Methodology

This review has been guided by a Steering Group led by Liam Lacey, Irish Maritime Development Office (IMDO) and including Mary Lally, Department of Transport, Tourism and Sport (DTTAS), Patricia Comiskey, Sustainable Energy Authority Ireland (SEAI) and Des Cox, EirGrid.

The approach was initially presented to the Steering Group for review and agreement. The figure below sets out a high-level overview of the methodology to deliver the assignment.

Figure 3:1: Methodology

3.3 Rationale for updating the IPORES Report 2012

3.3.1 The IPORES Report 2012

The report on "Irish Ports Offshore Renewable Energy Services (IPORES) - A Review of Irish Ports Offshore Capability in Relation to Requirements for the Marine Renewable Energy Industry" was originally produced in 2012 by the Irish Maritime Development Office in support of the Offshore Renewable Energy Development Plan (OREDP). It provided information on Irish port infrastructure, facilities and management plans in relation to meeting requirements of marine renewable energy developers.

The development of the offshore renewable energy (ORE) sector has been slower than anticipated in the 2012 report. The development activities that had been underway for offshore wind projects in the Irish Sea were delayed due to uncertainties around foreshore licensing issues and feed-in tariffs to support the financing of projects. Wave and tidal energy technologies had been the focus of R&D activities; however, technological challenges remain to be addressed before large scale wave and tidal projects can be realised. These delays to ORE projects in Ireland limited the extent to which recommendations in the 2012 report were implemented.

3.3.2 Current Context

The context and environment for the development of the ORE sector has now evolved with a range of enabling factors in place including:

- Offshore wind energy has been deployed in large arrays in the UK and Europe, including in the Irish Sea. As a result, costs have reduced to become more competitive compared to other renewable energy sources and fossil fuel generation.
- New floating wind turbine systems have been deployed in demonstration projects in Europe and are reaching a stage of readiness to be deployed in large offshore arrays.
- Wave and tidal energy technologies continue to mature, with testing and piloting of projects on the west coast of Ireland.
- Belfast Port has led the way on the island for port involvement in the ORE sector with the construction of a new wind turbine assembly facility located at D1.
- There are ORE projects at an advanced stage of development in Irish waters, with investment lined up to begin construction activities as soon as appropriate policy and support mechanisms are in place.
- The emphasis on the need for higher levels of energy from renewable sources has increased with the revised EU agreements setting targets for 2050 and key international legislation such as the Paris Climate Agreement.

Given the upward shift in the development opportunities of the sector in Ireland, the increased number of potential investors and the emergence of new technology (and therefore new port requirements), the opportunity to revisit the 2012 IPORES report to review and update the findings is timely. Thus, this updated report will provide a clear picture of the capability and capacity of ports and harbours across the Island of Ireland to respond to opportunities within the ORE sector.

This report has considered and is cognisant of key policies and legislation which guide and direct the development of the ORE sector in Ireland. They include many issues which impact on the development of an ORE sector in Ireland and the ports' ability to respond. The assessment undertaken assumes that an appropriate policy and legislation framework is in place to support the development of the ORE sector in Ireland.

3.3.3 Relevance of this Report to the ORE Sector

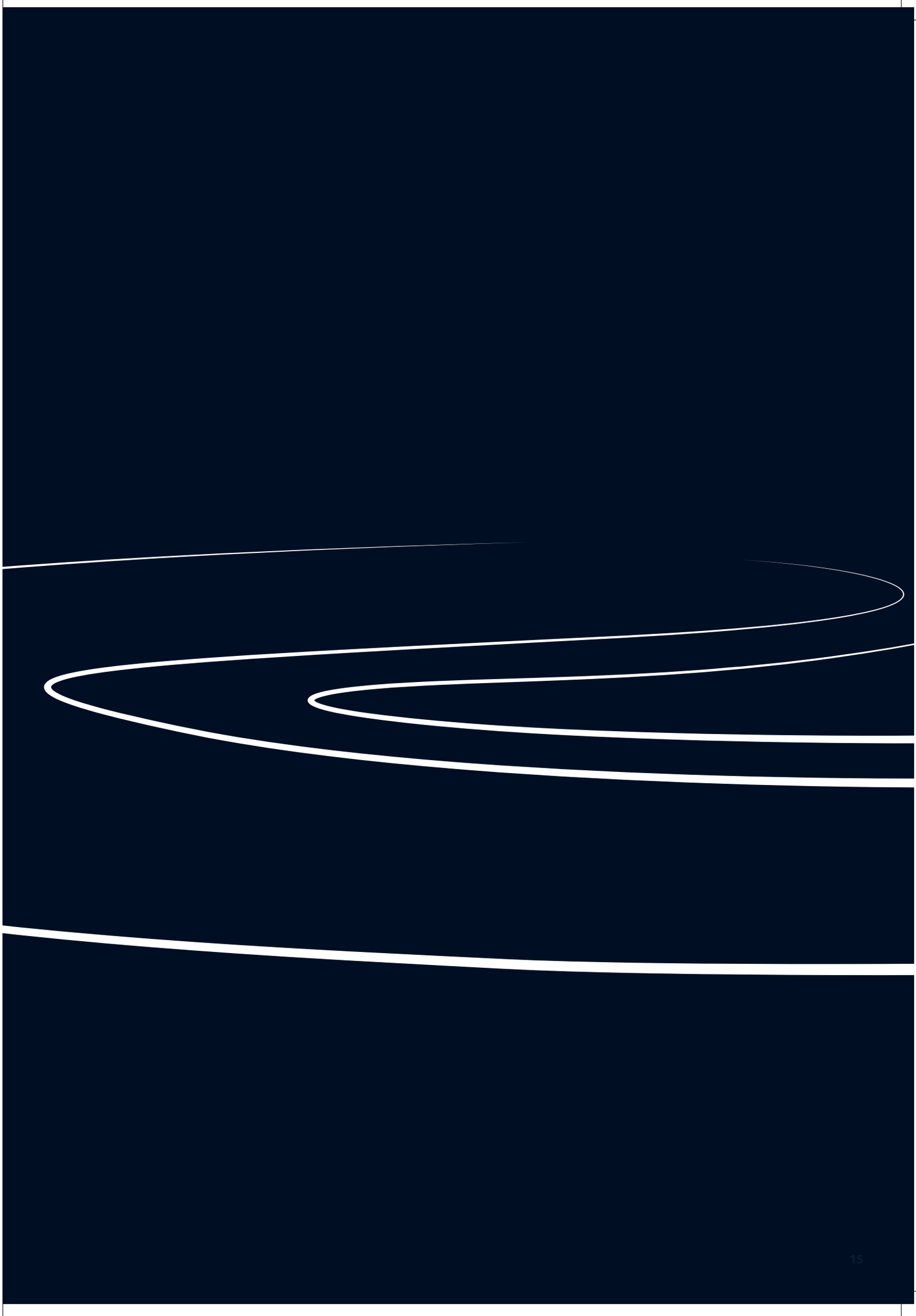
The findings of this report are important to the development of the ORE sector in Ireland. There are significant opportunities to develop large-scale ORE projects along the coast of Ireland. This report will demonstrate that realising these projects will generate new business opportunities for Ireland's ports and harbours. This has the potential to attract private sector investment for the development of new port infrastructure and create additional economic benefits in the form of jobs and supply chain impacts.

The key findings and recommendations of this report aim to ensure that Ireland (and in particular its ports and harbours) is ready to take full advantage of the available opportunities to develop its Offshore Renewable Energy sector.

3.4 Structure of the Report

The remainder of the report is structured as follows:

- **Section 4:** Overview of the 2012 IPORES Report;
- **Section 5:** Offshore Renewable Energy Sector – Ireland;
- **Section 6:** Review of Irish Ports and Harbours;
- **Section 7:** Review of Benchmarked Ports and Harbours;
- **Section 8:** Estimating Potential Job Creation from ORE Developments;
- **Section 9:** Conclusions; and
- **Section 10:** Recommendations.



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Overview of 2012 IPORES Report

A brief review of the previous report in 2012 is taken as a starting point for addressing the terms of reference for the IPORES 2017 report. Therefore, this section presents:

- a brief overview of the report content and methodology;
- recommendations from the 2012 IPORES Report and progress against these;
- the context that surrounded the report as well as the changes which have occurred in the economy, industry and policy landscape since the report was published;
- gaps and opportunities for ports / harbours arising from the offshore renewable energy sector
- a summary of key findings arising from the review of the 2012 report.

4.1 The IPORES Report 2012

The IPORES Report 2012 was produced by the Irish Maritime Development Office in support of the OREDP. In setting the context for its findings, the report acknowledged that:

- Ireland's offshore renewable energy resources are amongst the highest in the world (with a potential of between 63,000 and 73,000 MW of power available from wind, wave and tidal resources);
- much of the potential business in the ORE sector would arise from installation, operations, maintenance and servicing of offshore wind farms in the Irish Sea;
- ports could play a key role in facilitating future large-scale developments and operations of ocean energy devices, and that significant benefits could accrue from this (evident in increased revenues and employment in UK ports, for example).

The 2012 IPORES Report provides information on Irish port infrastructure, facilities and management plans in relation to meeting requirements of marine renewable energy developers. The study involved consulting with 14 ports around the island of Ireland and analysis of information gathered, including a comparison with some key renewable energy services ports in the UK and Germany. Irish ports were categorised using criteria that would meet requirements to service the ORE sector. These included port infrastructure, available quay space and hinterland, depth of water, experience with the sector, proximity to markets, potential for job creation and availability of skills and maritime services.

A database was developed that provided information on the port facilities, infrastructure and hinterland that could support the development of the offshore renewable energy industry. The database was made available through the Ocean Energy Ireland website. However, port stakeholders expressed concern over the lack of coordination between the industry, government agencies and the ports, as well as the absence of strong leadership at national level in driving the marine renewable energy sector forward.

There was a strong consensus amongst stakeholders that a dedicated website on Irish ports should be established, which could provide a database on port infrastructure, facilities, land banks and strategic plans useful to the developers of offshore renewable energy projects. Ports also wanted to be considered as an integral part in the development of a renewable energy policy, with leadership and clear targets provided.

The report identifies a number of areas where, potentially, several thousand new jobs could be created in the short to medium term. The report aimed to send a clear signal to the markets that Ireland and its ports can deliver the requirements needed for the development of the offshore renewable energy industry.

4.2 Recommendations from the 2012 Report

The 2012 IPORES report included the following recommendations:

- Recommendation 1: "The report has designated at least 3 ports which we feel meet the minimum criteria to achieve Category A[1] status for the ORE services. We recommend that such a policy should be endorsed by the various state agencies and stakeholders".
- Recommendation 2: "We recommend that clear targets are established to deliver new ORE projects at Irish ports. We recommend that a high-level Government group oversee a coordinated approach between government agencies, ORE developers, port authorities, shipping companies and the services sector to provide and more effectively deliver and manage an integrated national strategy".
- Recommendation 3: "We recommend that a national website should be developed as part of any future wider marketing strategy for the IPORES that would integrate information and data on Irish ports in terms of what they have to offer the ORE sector".
- Recommendation 4: "A more detailed analysis of the jobs created and employment opportunities offered by the ORE industry in the UK both at specific ports and through the supply chain would be very useful in terms of future planning for the development of the sector in Ireland. The inclusion of state training bodies or 3rd level institutions should also be considered".
- Recommendation 5: "A further assessment of the initiatives introduced by Governments in competing European locations for ORE developments should be undertaken".
- Recommendation 6: "Financial support and co-operation by other regional or state agencies should be considered by the Government to enhance the attractiveness of specific Irish ports to potential foreign investors".
- Recommendation 7: "The foreshore licensing and consent mechanisms needed for upgrading port development, including quay extensions and land reclamation in relation to the facilitation of the offshore renewable energy development, should be streamlined and fast-tracked to address environmental issues to ensure timeframes are met with regard to business development targets".
- Recommendation 8: "On-going evaluation of the suitability of Irish ports in the light of new technological developments in relation to wind, wave and tidal power, should be made to ensure capacity can meet the requirements of the industry. This would be particularly relevant in relation to the commercialisation, deployment and servicing of wave energy converters; the up-scaling of offshore wind turbines; and the development of offshore floating wind farms for extreme environments".

Progress against the 2012 Recommendations

It is positive to note that some of the recommendations within the 2012 report have been actioned and that progress has been made in the following areas:

[1] Category A was a classification used in the 2012 IPORES report. To be classified as Category A, a port was required to meet all the criteria which large foreign investors were likely to seek from a site location. This included: ability to service as regional centres or hubs for ORE; available hinterland that was ready or near to market development; previous experience of the ORE sector; skilled workforce available nearby; short distance from port to potential market; clearly defined strategy for marketing their facilities; ability to make investment in port facilities; presence of transport, logistics and other supply chain sectors; proactive strategy to market port; and proximity to centres of excellence in research and development.

- The Offshore Renewable Energy Development Plan (OREDP) was developed and has been in place since 2014. The Irish Maritime Development Office (IMDO) and the Department of Transport, Tourism and Sport (DTTAS) were involved in the development of this plan.
- A Marine Renewable Energy Portal has been developed by the Sustainable Energy Authority of Ireland (SEAI) and the Marine Institute, which includes a section on port infrastructure and the services available.
- Legislation has been brought forward, although not yet enacted, by the Department of Housing, Planning and Local Government (DHPLC) to improve processes and ease some of the challenges in relation to foreshore licensing issues.

The 2012 IPORES report set out recommendations at a time of limited growth and poor economic performance. This is reflected in recommendations which focus on national policy and government actions rather than recommendations in relation to the ORE sector or the ports and harbours in Ireland. For many of the recommendations in the 2012 IPORES report, the prevailing market context at that time made implementation challenging and in some cases not feasible. The implementation of the recommendations was also adversely impacted because the expected growth in the ORE sector was slower to develop in Ireland post-2012. In particular, ORE activity was hampered by delays to foreshore legislation and the absence of feed-in tariffs for offshore wind projects. The wave and tidal energy sectors have remained as "emerging technologies", where technical challenges need to be addressed through R&D and prototype deployments on test sites before commercial scale projects can be realised.

4.3 Changes in Economic Circumstances, Industry and Landscape

Between 2008 and 2010, Ireland experienced the worst economic downturn in its history with an associated downturn in trade though ports and harbours. By 2012, the economy had started to recover; however, there were still extreme limits on levels of public expenditure in relation to major capital development such as infrastructure. The ports and harbours in Ireland had also suffered as part of the recession with significant downturn in profits and job losses across the sector. By 2012, they too had recovered to an extent. As a result, Irish ports and harbours were open to new opportunities for growth and development outside their traditional businesses sectors involving the transport of freight, cargo and passengers.

At the same time, European legislation was coming into effect; this set ambitious targets for Member States with regard to the proportion of energy to come from renewable sources. The renewable energy resources in Ireland's oceans had been identified and an Ocean Energy Development Unit was established in Ireland (with representation from the Marine Institute and Sustainable Energy Authority Ireland) to support the development of the ORE sector for Ireland.

As the economy recovered and growth returned, new start-ups emerged and established companies began to invest in the ORE sector. At the time of writing the 2012 IPORES Report, the ORE sector was buoyant and seeking to expand, whilst ports were seeking opportunities to develop outside of their mainstream activities. However, barriers to development were identified in the 2012 IPORES Report[2] that included:

- uncertainties around lead times for the determination of planning applications and foreshore licensing for harbour developments and infrastructure; and
- the absence of any clear policy framework at a national level for the development of an ocean energy industry with the necessary political will to invest in the business.

As noted in the 2012 IPORES Report, these barriers were identified from consultations which were undertaken before the

[2] See Page 82 of the 2012 IPORES Report under headings: Port Development Barriers and Co-ordinated Policy Support

Government integrated marine plan, "Harnessing Our Ocean Wealth", was published. That identified the potential of the offshore ocean energy sector and presented an action plan for implementation of a number of high level strategic targets. The consultations did identify that the port stakeholders were keen to engage with the government and its agencies in order to pursue more focused strategic planning in relation to the sector.

Since 2012, the ORE sector has grown dramatically elsewhere in Europe, with over 15 GW of total capacity (94 grid-connected wind farms and 4,149 turbines) – with €54 billion of investment in new offshore wind farms since 2013.

In Ireland, the launch of the Government's integrated marine plan, "Harnessing Our Ocean Wealth", and the implementation of the recommendations from its "Development Task Force"[3] has provided additional "specialist marine resources", through the Marine Development Team, and facilitated coordination between government agencies on marine sectors. This coordinated effort is targeting the untapped potential of the ocean energy sector to contribute to Ireland's targets for a two-fold increase in its Ocean Economy by 2030.

The National Ports Policy (2013) introduced clear categorisation of the ports sector, similar to categories presented in the IPORES 2012 report. The Ports of National Significance (Tier 1) - namely Dublin Port Company, the Port of Cork Company and Shannon Foynes Port Company - lead the response of the State commercial ports sector to future national port capacity requirements to achieve optimum efficiencies of scale. Large-scale infrastructure developments are underway at these ports, signifying the capability and intent of Ireland's ports to meet the continuing demands from its growing economy.

The government has also set out plans for a renewable electricity auction in Ireland through a new Renewable Energy Support Scheme that will underpin Ireland's energy policy ambitions to transition to a low carbon energy future and will be the first step for Ireland in delivering its contribution towards the EU's 2030 targets.

The continued growth in demand for renewable energy, the emergence of a coordinated effort from government agencies on offshore energy projects and increased investment by Ireland's ports in their infrastructure in response to recent growth in the economy provide the background for the review and update of the IPORES study.

4.4 Gaps and Opportunities for Ports/Harbours arising from ORE

Looking ahead, there are reasons to be positive about the ORE market:

- Improving policy and legislative context:
  - OREDP is in place: it sets out 10 action areas to progress so that the ORE sector can feasibly develop in Ireland. Appropriate development of ports is included in the plan.
  - Legislation has been brought forward by the Department of Housing, Planning and Local Government (DHPLG) to improve processes and ease some of the challenges in relation to the foreshore licensing issues. The Maritime Area and Foreshore (Amendment) Bill 2013 is currently being considered by the Irish Government.
- Improving electricity infrastructure – one of the gaps in the 2012 IPORES Report was that whilst port and harbour facilities were evaluated, their proximity to key energy grid infrastructure was not assessed. Since the 2012 report, significant improvements have been made to the energy grid and the 2018 IPORES report presents an opportunity to consider: proximity to adequate grid infrastructure and or potential to have access to grid infrastructure.

[3] Our Ocean Wealth Development Task Force Report, July 2015

- The sector is expanding rapidly internationally with the adoption of new technology and new approaches, for example floating wind, to complement the existing technology.
- There is potential for the development of all types of ORE with the results of the Strategic Environmental Assessment reported in the OREDP showing that the development potential without significant adverse effects is ~70,000 Megawatt (MW).

Irish ports and harbours are well placed to take advantage of the opportunities and understand the economic potential of a significant ORE project. With over 80% of the deployment potential on Ireland's west coast, there are competitive advantages for Irish ports and harbours located in this region. However, most of this is in emerging technology areas like floating wind and wave energy. Similar advantages for ports and harbours on Ireland's east coast exist, where development potential of 6,000MW has been identified[4]. This is mostly offshore wind with fixed foundations that is a mature technology and could be deployed within the next 5 years, if suitable market conditions were in place. Offshore wind farms that have undertaken site development and environmental assessments for the consent process include Oriel Windfarm (330MW), Arklow Bank Windfarm (520MW) and Codling Bank (1,100MW).

Underpinning all of this is the strong national policy focus on the development of renewable energy in general and the development of Ireland's ocean economy (Harnessing Our Ocean Wealth). The development of Ireland's ORE resources could help ensure Ireland meets or exceeds the targets set out in the EU 2020 Renewable Energy Directive and the new 2050 Energy Roadmap.

4.5 Summary

The review of the 2012 IPORES report highlights that whilst some of the recommendations have been actioned, for many of the recommendations, the prevailing market conditions in Ireland since 2012 made implementation challenging and in some cases not feasible.

Looking ahead, this updated report provides a timely opportunity to build on a changing and more favourable economic and policy landscape to explore the readiness of ports and harbours in Ireland to service the ORE sector and ultimately to exploit the potential economic impacts.

[4] Offshore Renewable Energy Development Plan

5.0

Offshore Renewable Energy Sector – Ireland

Current information on market conditions and the pipeline of projects for ORE is required to inform the consultations with the ports on requirements for the sector over the next 10 years. A review of relevant policy documents and consultation with the main ORE sector stakeholders provided the evidence base for the potential pipeline of projects that could be deployed over the next 10-year period.

The consultations with companies involved in the development of offshore wind, wave and tidal energy projects in Ireland also provided insights into the port infrastructure and services that would be required to support the sector.

5.1 Policy Context

The policy areas that impact on the development of the ORE sector in Ireland include energy, enterprise, planning, marine and research and innovation. The policy context in relation to the development of the ORE sector in Ireland was established through a review of relevant polices, strategies and papers. The material reviewed included:

- National Ports Policy 2013;
- The Offshore Renewable Energy Development Plan (OREDP);
- The National Planning Framework 2040;
- Action Plan for Jobs 2017;
- The White Paper 'Ireland's Transition to a Low Carbon Energy Future 2015-2030'; and
- Harnessing Our Ocean Wealth (HOOW) (2012).

In addition, legislation which is currently under consideration by the Irish Government also has a bearing on this report, specifically:

- The Maritime Area and Foreshore (Amendment) Bill (which is expected to be enacted in the near future, and will have significant implications for future marine development and management in Ireland); and
- on-going work by the Department of Communications, Climate Action and Environment on a proposed new Renewable Electricity Support Scheme (RESS) for Ireland.

The key findings are set out below.

5.1.1 Strategic Direction

Both at European Union level[5] and at national level[6] there is a very clear strategic direction regarding the development of ORE. The European Commission has set ambitious targets for the proportion of energy consumed by the state which comes from renewable sources at 16% and of this 16%, 40% must come from renewable electricity by 2020. Whilst Ireland is progressing well there is still some way to go to ensure the achievement of the EU targets by 2020.

Ireland's energy policy "Ireland's Transition to a Low Carbon Energy Future 2015-2030" sends a clear message that Ireland is 'open for business' in relation to renewable energy, including the ORE resources in Ireland's oceans – these are among the best wind, wave and tidal energy resources in the world. The ambitions for "Energy from the Ocean" are also set out in the

[5] The Renewable Energy Directive 2009/28/EC – Ireland obliged to reach 16% of all energy consumed coming from renewable sources. 40% of the 16% must come from changes to electricity production. This must be achieved by 2020

[6] Ireland's National Renewable Energy Action Plan (NREAP) – refers to generating electricity from offshore wind and wave and tidal energy resources within the overall objective of objective of Ireland's energy policy to ensure secure and sustainable supplies of competitively priced energy to all consumers.

integrated marine plan for Ireland "Harnessing Our Ocean Wealth" and the associated strategic framework produced by its Development Task Force.

The Offshore Renewable Energy Development Plan (OREDP) is the main policy driver for the ORE sector. It has set out clearly the potential of the sector to produce more energy from renewable sources. It also demonstrates the opportunities for significant growth within the sector in terms of megawatt (MW) output, but also in terms of job creation and gross value added (GVA). It is important to note that the OREDP sits within a wider evolving policy and spatial and economic context to which it will contribute: for example:

- The "National Planning Framework" includes a reference to support the achievement of the objectives and targets set out in the OREDP. Under the OREDP, Ireland has set ambitious plans for renewable energy and ORE resource development. The development of ORE is critically dependent on the development of enabling infrastructure including electrical grid infrastructure to bring the energy ashore and connect to major sources of energy demand. The National Planning Framework aims to support the progressive development of Ireland's ORE potential, including domestic and international grid connectivity enhancements.
- Eirgrid's "GRID 25" plan aims to enable the integration of increasing amounts of instantaneous renewable generation while ensuring the supply of electricity to all consumers in Ireland. This will include bringing new levels of offshore wind generation and an introduction of ocean technology-based generation to Ireland.

The "National Marine Research and Innovation Strategy 2017-2021" highlights that beyond energy creation, greater enterprise and FDI opportunities exist in the knowledge-based, scientific and engineering sectors needed to harness ORE resources. The national enterprise policy "Enterprise 2025: Innovative, Agile, Connected" identifies 'Marine' and 'Green technologies' as sectors that can contribute to job creation and sustainable economic growth targets. The Government's "Action Plan for Jobs 2017" also references the importance of the ORE sector to future job creation.

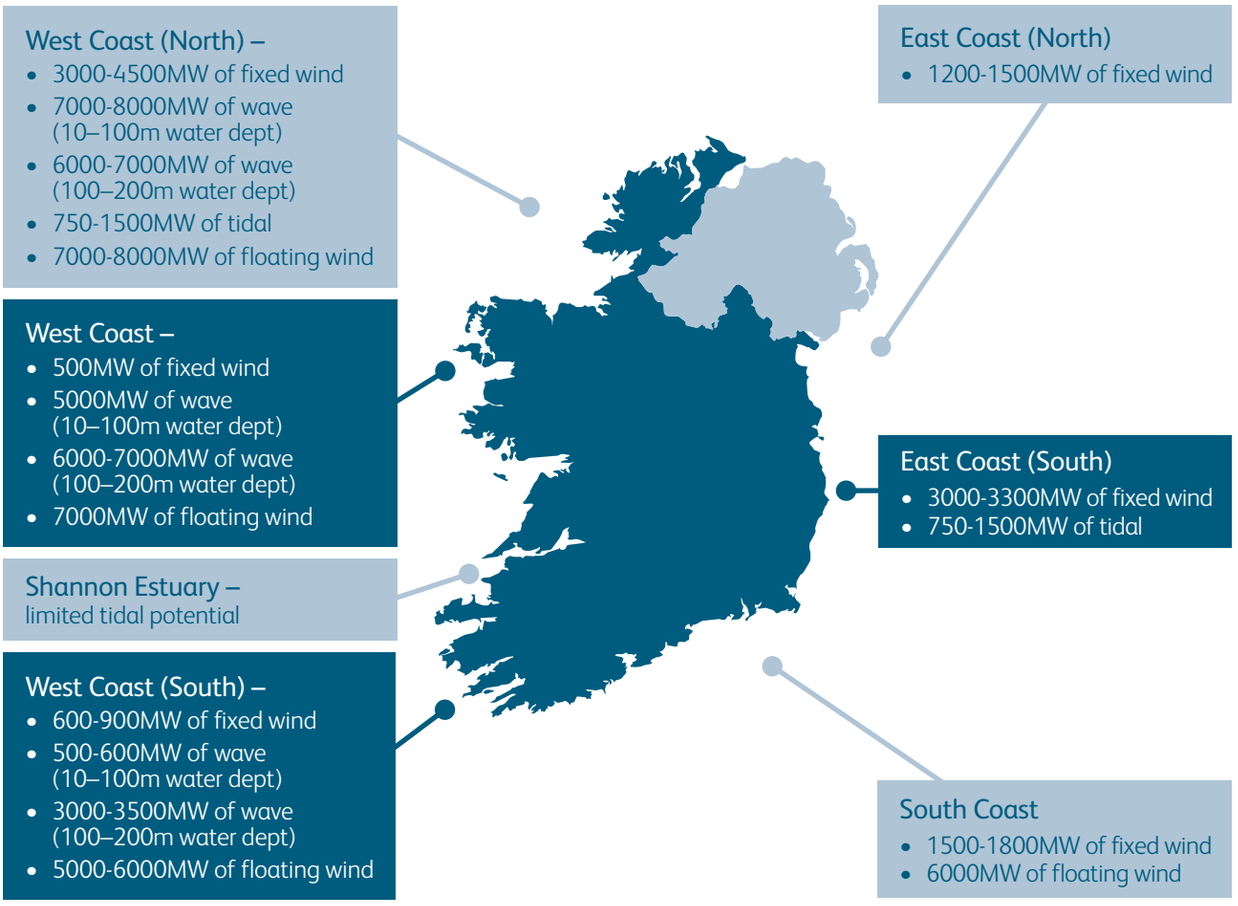
5.1.2 Potential Development of Offshore Renewable Energy

The OREDP presents the findings from the Strategic Environmental Assessment (SEA) and Appropriate Assessment (AA) of Ireland's offshore renewable energy potential. The SEA and AA found that it would be possible to achieve the high scenario of 4,500 MW from offshore wind and 1,500 MW of wave and tidal devices without likely significant adverse effect on the environment. These development levels were not meant to reflect targets and higher levels of deployment could be realised when individual projects come forward that address issues such as the route to available energy markets and the state of readiness of the various technologies.

The assessment of the potential developments in different geographic areas is also presented in the OREDP. This estimated capacity is the maximum which could potentially be added to the Irish network. The key findings are displayed in are displayed in Figure 5.1.

It is noted that there is the potential to develop some 70,000MW of ORE around the coast of Ireland with most of this concentrated along the west coast. In addition, with the range of types of offshore renewable potential, opportunities exist across many sections of the market and there is huge potential. However, the OREDP recognises that that even the scenario for development potential by 2030 of 6,000MW is a challenge given that it represents levels greater than Ireland's current national energy requirement – hence the need for export links to other markets and other member states in Europe.

Figure 5:1: Offshore Renewable Potential Ireland



Source: RSM using data from The Offshore Renewable Energy Development Plan (OREDP)

Table 5:1: Marine Renewable Energy - GVA and Employment 2012, 2014 and 2016

	2012	2014	2016	2014-2016 (% Change)
GVA	8,647.17	15,402.50	38,098.60	147 %
Employment	245	401	454	13 %

Source: SEMRU Ireland's Ocean Economy 2017 (2017)

5.1.3 Job Creation Potential

The 2017 Ireland's Ocean Economy Report developed by the Socio Economic Marine Research Unit (SEMRU) provides a useful baseline for the current levels of employment in the marine renewable energy sector. The table 5.1 notes both sectoral employment levels and GVA for the years 2012, 2014 and 2016. The report "Economic Study for Ocean Energy Development in Ireland", published by the SEAI and Invest Northern Ireland in 2010, estimated that 1,431 additional FTE jobs and a Net Present Value (NPV) of €0.25 billon could be realised when 500MW of wave energy is deployed, with similar rates of job creation expected for offshore wind and tidal energy.

In addition, research conducted by RSM for the Expert Group on Future Skills Needs (EGFSN) projected expansion demand for the Marine Renewable Energy Sector (all offshore energy jobs) for the 2015-2020 period. The report forecasts an expansion demand of 150 jobs and increasing employment from 1,148 in 2014 to 1,298 full-time equivalent jobs by 2020 due to the projected contribution from the MRE sector to meeting the overall targets set out in Harnessing Our Ocean Wealth.

5.1.4 Summary

The cross-cutting policy drivers for the ORE sector present opportunities for growth of the sector and the creation of related business opportunities for Ireland's ports.

Ambitious targets for generating renewable energy are set out in Ireland's new energy policy 'Ireland's Transition to a Low Carbon Energy Future 2015-2030'. The development potential for offshore wind, wave and tidal energy established in the 'Offshore Renewable Energy Development Plan' can meet the significant expansion in renewable energy generation required to realise these ambitions.

Whilst there is a clear impetus and ambition in relation to exploiting the opportunities presented by offshore renewable energy, there is a challenge between these strategic objectives and the planning environment in which developers currently operate.

The provision of a streamlined development consent process through the "Maritime Area and Foreshore (Amendment) Bill" and other legislation in relation to planning (National Planning Framework and the Marine Spatial Plan) will have an important role in making the planning process more efficient. The recommendation from the HOOW Development Task Force for "A Progressive and Responsive Regulatory Environment" highlights the importance of creating an effective and efficient regulatory environment that is attractive to investors in offshore renewable energy projects and enables ports to respond to the new business opportunities that this will generate.

5.2 Key Findings from the ORE Sector Consultations

To create the evidence base on which the report relies, extensive consultations were carried out with representatives from the ORE sector.

5.2.1 Approach and Profile of the Consultees

Consultations with stakeholders in the offshore energy sector were used to gather up-to-date market intelligence and evidence of the job creation potential associated with each project and its development stages. The questions focused on:

- What projects the representatives are currently developing and the timescales for development?
- Ports used and their role in the projects - including infrastructure required/available?
- Employment figures / economic benefits from projects linked to the expenditure levels (including the supply chain) – current and projected?

- Plans for Irish Market – timescales, investment level, challenges faced, constraints etc.

In addition, a smaller group of 4-5 companies active in Ireland were selected for meetings to expand on the key issues emerging from the interviews.

In total, 25 consultations were completed representing government/development agencies and also a broad spread of industry interests including industry bodies, developers (for wind, wave and tidal) and representatives from the supply chain.

5.2.2 Current Project Pipeline and Timescales for Development

Consultees across all sub-sectors of the renewable energy market were positive regarding the opportunities present in the Irish market. In many instances, there was a strong potential pipeline of projects which could be realised in the waters around Ireland, provided the appropriate market conditions existed.

The information contained in this section, provided by industry, has been used to develop the baseline and high and low deployment scenarios for the economic modelling to assess potential job creation.

In the offshore renewable wind sector, consultees identified the following development opportunities:

- Developing a site in the Irish Sea for a demonstration project for new foundations for fixed bottom offshore wind turbines;
- A partnership was announced between a floating wind turbine supplier and an Irish wind energy developer to pursue opportunities for developing floating offshore wind projects in Ireland.
- Consultees estimated that with favourable market conditions, 500 – 1000MW of fixed bottom wind could be deployed on sites in the Irish Sea over the next 5 years.
- Consultees estimated that with favourable market conditions 100MW of floating wind energy could be deployed in the Celtic Sea in the next 5 - 10 years.
- Some consultees who were already active in the North Sea were looking at multiple options in relation to expanding into the Irish market.
- Within the supply chain consultees, there was agreement that the facilities and technology was available to enable offshore wind to be constructed at scale should the market investment be forthcoming.

In the offshore wave sector, consultees identified the following development opportunities:

- It was acknowledged by consultees that the timescales for the development of wave energy projects was dependent on the technology development timescales. There have been multiple attempts to prototype and test new technologies, however, lack of investment required is still making progress slow.
- There are opportunities to increase investment to accelerate the readiness of technology for deployment in wave farm arrays.
- Consultees did indicate that there was strong interest in developing wave energy arrays in Ireland and that the scale of the development in MWs could be substantial in the longer term.

In the offshore tidal energy sector, consultees identified the following development opportunities:

- Consultees indicated that many of the recent / current projects in this area are focused on the testing of single prototypes for example: deploying foundation for tidal turbine prototype in the Orkneys or completing engineering studies for deployment of tidal kite devices in Wales.

- Future developments within this sector will largely depend on the level of government support and the availability of grid connections.
- The development of large tidal arrays is likely to be 5-10 years away as the technology is still under development.

Across all consultees there were opportunities identified for the development of ORE in the Irish market. For all sub-sectors of the offshore energy market there were issues identified in relation to market conditions that impact on the scale and scope of the developments that could be delivered. For the wave and tidal sectors there were additional technological considerations as many of the devices required to deliver array projects in these sub-sectors were still under development or in the testing phase.

Offshore wind energy provided the strongest pipeline of projects with clear scope for the deployment of 500 – 1000MW in fixed bottom wind, >100MW in floating wind energy within the next 5 years, with scope for additional deployments in the 5 -10-year period.

5.2.3 Port and Harbour Requirements

Each sub-sector of the ORE market requires different port and harbour infrastructure to facilitate its development.

Through the review of existing documents and the consultation with the main ORE sector stakeholders, the key port infrastructure requirements for the sector over the next 10 years were identified. The specific port information has been gathered from the experience of two ports involved in the ORE sector - Belfast Harbour and the Port of Cork.

Some of the key issues are detailed below and summarised in Table 5.2:

- Water Depth
  - For fixed base offshore wind, water depth was one of the key requirements for a construction / installation port. Consultees indicated that minimum water depth of 8m was needed to accommodate the large jack-up vessels employed for the load-out of the turbines and foundations for installation at the offshore wind farm site.
  - For wave and tidal devices, the water depth requirements depend on the type and size of the device. For some floating wave and tidal devices less than 8m water depth is satisfactory. Similar water depth requirements to offshore wind (>8m) would become important if the devices required large scale vessels to dock to facilitate transportation to the site.
- Quay Space
  - For all forms of ORE, quay space was a fundamental requirement. All the offshore renewable devices required construction and assembly space near to the quay wall as it would be difficult and expensive to transport the large, heavy structures on land.
  - For offshore wind, each turbine requires approx. 45metre(m)+ to be laid down and to have multiple devices in parallel the space required would significantly increase.
  - For the tidal and wave devices, large platforms and devices would need to be constructed and assembled. The exact space requirements could not be provided as to date only smaller test-scale prototypes had been constructed. However, full scale devices are expected to have similar space requirements to the large offshore wind turbines.

[7]Tonne (t) is a non-SI metric unit of mass equal to 1000 kilograms, the conversion of 1 tonne to 1 ton is 0.98420.

- Quay Strength and Lift Capacity
  - The scale of the devices used for offshore wind is continuously increasing (the average turbine size has increased to 6MW) and therefore requires significant quay strength and craneage capacity to facilitate the construction and assembly of the turbines. Consultees estimate that up to 10 tonne per square metre (t/m2) of bearing capacity was needed for the large turbines, whilst estimates for the craneage required for the large monopole foundations were >500tonne[7] (t) on some projects. For example, the weights of the monopoles for the London Array offshore wind farm were up to 650t. New foundation solutions are emerging; for example the suction bucket caissons which have the advantage of reduced weight and lower craneage requirements.
  - Consultees were less certain regarding the strength and lift capacity needed for tidal and wave energy devices, however it was noted that these would also be large in scale and were likely to have similar bearing capacity and craneage requirements to offshore wind.
- Storage – the storage area available at the port or harbour was another requirement detailed by the consultees. In particular, space to store cabling and other materials was essential. In addition, space to undertake repairs was also considered to be important by some consultees.
- Links to other infrastructure – consultees also noted the importance of having existing links to the onshore electricity transmission grid in the vicinity of the project location or that there were plans in place to have better links to the energy network. This reduced the costs in bringing the energy generated ashore. The grid connection points for projects do not need to be at the ports or harbours servicing the ORE farms.
- Key supply chain services – consultees indicated that the scale of the development in any port or harbour was reliant on the supply chain available within the port and surrounding area. Port services, for example stevedoring, were important for cargo handling whilst there was also a requirement for shipping and logistic support. In addition, manufacturing facilities in both steel and concrete manufacture, (for example used in the construction of foundations or platforms), was also important to the supply chain.
- Access – road infrastructure was also highlighted as an important consideration. This included the ease with which materials could get to the port or harbour but also ensuring the labour force could easily access the port.

However, within the service and maintenance sub-sector the requirements are not as stringent and therefore, many smaller ports and harbours could play an important role in this area. For ports and harbours which service the ORE sector, the key requirements are based on the distance from the farms, the size of boats that could operate from the port or harbour and the facilities at the port or harbour for the teams which support the servicing sector.

Specifically:

- It was noted by consultees that the servicing ports could be smaller and proximity to sites is an advantage. Sailing times to site within 2-4hours would be ideal, however, ports that are 200-300km from an offshore wind farm could be accommodated depending on the size of the array;
- The type of boats used for the servicing and maintenance sector ranges from 100t boats to larger Platform Supply Vessels. Ports and harbours had to have the available water depth and quay space/strength to support the mooring of these vessels.
- Traditionally, teams are brought in to support the servicing and maintenance operations and therefore ensuring that the port or harbour has good transport links and accommodation (hotels) was an important consideration.

Table 5:2: Key Port Infrastructure Requirements

ORE Type	Key Infrastructure Requirements
Fixed Wind	Port facilities for construction: • Heavy lift cranes: - 2x 60t and; - 2x 80t • Large laydown areas (around 20 hectares) for handling and assembling of wind turbines • Deep water for installation vessels, with a range of 8.6m – 10.2m for quay water depths and the size and depth of the channel approach For Operation & Maintenance (O&M) and servicing: • close to deployment site for low transit times and ideally within 2-4 hours sailing time. However, ports that are 200-300km from an offshore an offshore wind farm have been also been used previously; • warehousing and engineering services on-site (around 100,000m2 for handling project cargo and supporting stevedoring operations); • accommodation and transport links for crew transfers
Floating Wind	Turbine and steel tower manufacturing undertaken in Europe or elsewhere Potential manufacturing if concrete platforms and mooring structures are used Port facilities for assembly and installation: • Heavy lift cranes: - 2x 60t and; - 2x 80t • Large laydown areas around (20 hectares) for handling and assembling of wind turbines • Deep water for installation vessels, with a range of 8.6m – 10.2m for quay water depths and the size and depth of the channel approach • Warehousing close to deployment site for servicing opportunities, (around 100,000m2 for handling project cargo and supporting stevedoring operations
Tidal	• Dry-dock for constructions as some floating platforms for tidal turbines are large ship-like structures; • Quay wall with a water depth of >8m • Lower requirements for heavy lift compared to offshore wind, with the ability to lift 40t-60t.
Wave	• A wide range of device types are still being considered during the R&D stages and there has been no convergence of the size of devices or construction facilities required • Dry-dock for constructions may be required for large buoy or ship like structures (indicative facility 150 – 200m long and 20-30m wide); • Quay wall with a water depth of 10m; though innovative ballast systems can reduce this requirement to <5m • Similar heavy lift requirement as offshore wind.

Source: RSM/PureMarineGen

5.2.4 Plans for the Irish Market

It was clear from the consultations that there were significant opportunities in relation to the development of the ORE sector in Ireland. We asked those consulted about their plans for the Irish market over the next 10 years.

In the offshore wind energy sector, the following evidence emerged:

- Site investigations and environmental impact assessments for the development of fixed bottom foundations on shallow water sites on the east coast of Ireland have been undertaken in recent years. The timeline for the deployment of turbines on these sites will depend on the ability of developers to secure the appropriate approvals and consents, grid connections and finance.
- On the west coast, locations for floating wind farms are currently being assessed in relation to options for deeper water sites. One consultee estimated it could be feasible to have an array of projects (30MW – 50MW) (circa 10 turbines) deployed by 2025 following site development, permitting work and construction between 2020 and 2025.

In the offshore renewable wave and tidal sectors, the following was discussed:

- Development of projects in these subsectors largely depends on development of the technology. In many instances, there are testing and piloting activities happening on a smaller scale, for example, at the Galway Bay test site.
- Following the testing phase, it is intended that small arrays of devices will be deployed in demonstration projects that are 5-10MW in capacity. Sites are being investigated for these demonstration projects along the west coast, for example, Westwave in Co Clare.

5.2.5 Summary including Key Pipeline Projects

Consultations with the ORE sector make it clear that if appropriate market conditions existed, there would be interest from energy companies to invest in the construction of offshore wind farms. Investment in the development of wave farms and tidal turbines would also follow once the technology emerges from its testing and development stages. Investment in offshore renewable energy projects will create business opportunities for Irish ports and harbours, as construction ports and centres for maintenance services, to meet the demand for ORE as projects come online.

The table below provides an overview of the sector for each type of offshore renewable energy (wave, fixed wind, floating wind and tidal). For each, we sought to provide information on:

- Current technological status;
- Current developmental status / development potential;
- Deployment levels and timeframes (the scale which the sector has potential to develop and the timescales for development); and
- Jobs / employment potential (potential job creation from development of the sector as well as in the wider supply chain).

The information in this table was gathered through consultations with developers.

This proposed project pipeline contributes to and informs the assumptions underpinning the modelling exercise and specific scenarios employed (see Section 8).

Table 5:3: Current Status of ORE Technologies including Key Pipeline Projects

Fixed Wind	
Technological Status	Mature technology with over 4,149 grid-connected wind turbines (installed capacity of 18,800 MW) in Europe.[8]
Development Status	To date, there is only one offshore wind farm in Ireland: the 25MW (7 turbines) Arklow Bank project off the coast of Wicklow, which was a deployed in 2004 by a consortium including an Irish wind farm developer and an international wind turbine supplier. Sites in Irish Sea have completed environmental impact assessments and over 1,000MW could be deployed over next 4-5 years using turbines and fixed foundations that have been deployed in UK part of the Irish Sea Irish energy companies, international utility companies and wind farm investors have made public announcements in 2017 about plans to deploy wind farms off the coastlines of Ireland. Ireland offers a unique position on the edge of the Atlantic with some of the best sites and offshore wind resources available. Deployment of offshore wind farms would greatly assist Ireland in reaching 2020 and 2030 targets
Key Pipeline Projects Deployment Levels and Timeframes	• In the 2020 – 2025 period, the first tranche of projects likely to be deployed would be 300MW to 500MW • Total deployment by 2025/30 could be 1000 – 1500MW (2-3 projects) • There are five developers known to be actively pursuing development and investments in offshore wind farms, with others active in the UK market that are well positioned to act quickly when the Irish market materialises.
Key Pipeline Projects Jobs / Employment Potential – Ports and Supply Chain	There are opportunities for job creation in: • development of the supply chain for ORE • exploring opportunities for international collaboration – skilled technicians imported from Denmark • opportunities for local stevedores to develop skills and experience and then export crews to other countries

[8] OFFSHORE WIND IN EUROPE - Key trends and statistics 2017

Floating Wind	
Technological Status	Technology coming through demonstration stages, for example Statoil's 30MW Hywind demonstration project in Scotland.
Development Status	Sites would be in deep water (>50-100m depth) on south coast (Celtic Sea) and west coast, where there is extensive wind resource in sites that are relatively near shore.
Key Pipeline Projects Deployment Levels and Timeframes	• Initial project size likely to be 100-200MW representing a scale up from current demo projects, with deployment possible by 2025 • Total deployment by 2030 could be 1,000 – 1,500MW (2-3 projects that are 500MW – involving extending the initial project) • There are three developers known to be actively pursuing development and investments in offshore wind farms, with others active in the UK market that are well positioned to act quickly when the Irish market materialises.
Key Pipeline Projects Jobs / Employment Potential – Ports and Supply Chain	There are opportunities for job creation in: • manufacturing associated with large concrete mooring structures or concrete platforms (fabrication facility employing 200 – 300 people). • development of the supply chain for ORE • exploring opportunities for international collaboration – the skilled technicians imported from Denmark • opportunities for local stevedores to develop skills and experience and then export crews to other countries

Tidal	
Technological Status	Underwater turbines that generate electricity from tidal currents are being tested and demonstrated around the world and Irish companies have developed turbines for these projects. Test facilities at Limerick Docks and Strangford Lough in N. Ireland have been used and Irish companies have also used test sites available in Scotland, Canada and France.
Development Status	Opportunities for large arrays (50 – 100 MW / turbines) confined to N. Ireland. Smaller scale opportunities available in Ireland on the east coast and potentially in the Shannon Estuary.
Key Pipeline Projects Deployment Levels and Timeframes	• Funding subject to UK feed-in tariffs that have recently excluded tidal energy • Companies in Ireland developing small scale turbines for export markets (such as Indonesia) that existing port facilities could cater for as typical machinery export business • Scaled development still over 10 years away.
Key Pipeline Projects Jobs / Employment Potential – Ports and Supply Chain	Large amounts of space needed as factory type setup required. Typical employment would be expected to be 200 - 300 of varying skills.

Wave	
Technological Status	Technology undergoing development and prototype testing. Some developers, including two Irish companies, have progressed from tank testing to sea trials on marine test sites in Ireland and at other test sites elsewhere. The SmartBay test site within Galway Bay is Ireland's quarter scale marine and renewable energy test and demonstration facility. The test site allows smaller scale devices, or those at an earlier stage in their development, to gain sea experience in less challenging conditions than those experienced at full-scale Atlantic Ocean test sites. The test site is suitable for developers wishing to undertake low-cost sea trials and validation of devices and components at intermediate scale before advancing to full scale prototypes and demonstrator projects. The Atlantic Marine Energy Test Site (AMETS) is being developed to support testing and demonstration of full scale devices. It is expected to become operational in tandem with the progression of the devices to higher, pre-commercial technology readiness levels and appropriate private sector investment to undertake these projects as a final step in the commercialisation process
Development Status	Ireland's large wave energy resources could play an important part of the future energy mix in Europe if cost competitive technology can be developed. The first commercial demonstration project could be started by a developer's WestWave project - located off the coast of Killard, Co Clare. Site studies and consultations with technology companies are being undertaken for the project in preparation for submitting a planning application; with potential deployment of 5MW (5 - 10 devices) in 2020 / 2021. Any future development activities and deployment timeframes will depend on when the new Maritime Area and Foreshore (Amendment) Bill is passed into legislation.
Key Pipeline Projects Deployment Levels and Timeframes	• Following on from the small demonstration projects, like WestWave, in the early 2020's projects could be scaled up to commercial arrays (50-100MW / ~100 devices) with construction and deployment in 2025-30 period • Two schemes like this (5MW with extension to 100MW) deployed in Ireland by 2030 would be in line with targets in the OREDP and wider European wave energy sector.
Key Pipeline Projects Jobs / Employment Potential – Ports and Supply Chain	• For construction a factory type setup would be required with space requirements likely to be >3,000m2 • Typical employment would be expected to be 200 - 300 of varying construction skills. • Hull construction costs / labour based on 800t of steel per device

Source: RSM/ Pure Marine Gen

5.3 Summary

Targets for renewable energy generation set out in both EU and national plans and strategies provide important policy drivers for the growth of the ORE sector in Ireland. The OREDP establishes the development potential of the ORE sector in Ireland. Together with a streamlined development consent process, (anticipated through the Maritime Area and Foreshore (Amendment) Bill and other planning legislation), these contribute to an environment that is becoming more favourable for ORE developers in Ireland.

Consultations with the ORE sector show that under appropriate market conditions, there would be interest from energy companies to invest in the construction of offshore wind farms. Investment in the development of wave farms and tidal turbines would follow as the technology emerges from its testing and development stages. Consultees discussed the development pipeline for different types of ORE. This evidence informs the economic modelling in Section 8.

To conclude, investment in ORE projects will create business opportunities for Irish ports and harbours, as construction and maintenance centres. A clear strategic ambition for the ORE industry, coupled with an appropriate legislative, planning and maritime area development framework (as envisaged in the MAFA Bill), would stimulate investment into the sector. This is a time-sensitive opportunity for Ireland, which could be missed if the appropriate framework is not put in place now.

6.0

Review of Irish Ports and Harbours

6.1 Introduction

This section provides an update on elements of the 2012 IPORES report (specifically in relation to Irish ports and harbours). It seeks to:

- Provide a comprehensive description of current capacities, infrastructure, facilities and services that ports offer to support the developing offshore renewable energy sector (including wind, wave and tidal energy resources);
- Demonstrate the level of awareness, strategic planning and marketing by ports in relation to addressing opportunities offered by the developing offshore renewable energy industry;
- Provide an assessment of the track record of ports in terms of experience with the renewable energy industry; and
- Note any significant changes / developments since the 2012 report.

6.2 Methodology

A framework was developed to assess the ports and harbours included in the study. It builds on the 2012 IPORES report and for each port or harbour, reflects the current position in the ORE market, existing projects and pipeline, and the future potential. In summary, the framework includes criteria relating to current suitability and future potential to meet the requirements of developers in the ORE sector.

Table 6.1 presents the criteria used as the basis for this technical assessment of ports and harbours, based on present and future requirements.

Each of the ports and harbours included in this study was examined against the criteria in the framework above. This included the following steps:

- Development of Factsheet 3 – The research team used existing port and harbour literature (e.g. masterplans) to compile a factsheet on each port (or harbour) seeking evidence against each of the criteria in the framework; and
- Detailed Consultations – Each of the ports and harbours included in this study was invited to take part in a consultation during September and October 2017. Factsheet 3 was provided to the port or harbour in advance of the consultation to enable the consultee to address any gaps in the desk-based research. In addition, in-depth consultations were completed with port (or harbour) representatives to gain an accurate assessment of capabilities and willingness to be involved in the ORE sector.

A summary of findings for each port and harbour is included in this chapter of the report; these are listed in the following order:

- Irish Port and Harbours presented in accordance with the National Ports Policy i.e. Tier 1 first, followed by Tier 2 and Tier 3, then harbours under local authority control;
- Northern Ireland ports and harbours.

A Review of Irish Ports Offshore Renewable Energy Services 2018

Table 6:1: Criteria Framework

Criteria	Sub-Criteria
Current Suitability of Ports and Harbours	
Infrastructure Facilities and Services	Water depth
	Quayside length
	Tonnage of fixed and mobile cranes
	Number of berths
	Size of berths
	Profile of vessel size capacity
	Vessels handled annually
	Cargo handled annually
	Loading restrictions
	Size and depth of approach channel/ estuary
	Area of unused storage / warehouse space
	Area of unused hinterland
	Area of unused assembly and construction space
	Area of unused office space
	Availability of support for stevedoring operations
	Availability of transport support services
	Is there any existing pipeline of projects (not in ORE) competing for infrastructure and facilities usage
Position in the Offshore Renewable Energy Market	How viable are ORE projects for the port given geographic location and natural assets?
	What competition, from other ports, does this port face when competing for contracts and projects?
	How well connected is the port i.e. with road networks / rail networks
	What access does port have to local markets for ORE?
Existing Projects and pipeline in the Offshore Renewable Energy Market (Track Record)	What past experience (if any) does the port have with the ORE market
	How many ORE projects currently operate out of the port
	What type of ORE projects (e.g. wind, wave and tidal) operate out of the port
	Do any support services currently operate from the port (i.e. wind turbine maintenance or construction)?
Future Potential of Ports and Harbours	
Infrastructure Facilities and Services	What development is the port intending to undertake to improve and enhance the ports facilities and infrastructure
Port Strategy and Growth Drivers	What awareness is there of the opportunities for the port in relation to the ORE sector
	Is the ORE sector something which the port sees as contributing to future growth and development?
	Has the port marketed itself or undertaken marketing activities i.e. attendance at conferences in order to attract potential investment form the offshore renewables sector
	Does the ORE sector feature in the strategic planning for the port
Offshore Renewable Energy Project Pipeline	What number/type of ORE projects is the port considering in the next 2-3 years?
	What number/type of ORE projects is the port considering in the next 5-10 years?

Source: RSM/ Pure Marine Gen

A Review of Irish Ports Offshore Renewable Energy Services **2018**

6.3 Dublin Port

Located on the east coast of Ireland, Dublin Port is situated along either side of the River Liffey out to the mouth of its estuary. Much of the port is located on the north side of the river and lies at the end of the East Wall and North Wall from Alexandra Quay. The port occupies a much smaller area on the south side of the river.

The port's core business relates to commerce, trade and tourism and there are no immediate plans to provide facilities at Dublin Port for ORE sector developments. However, there is potential to develop facilities on the Poolbeg peninsula that could be brought forward if suitable demand from offshore wind developers emerged. In addition, the Alexander Basin Redevelopment (ABR) Project has commenced and will mean that there will be limited space for development outside of the core business until after 2022 when this project has been completed.

Since 2012, Dublin Port has commenced its ABR project that will transform the port's infrastructure to cater for the continued growth in cargo and passenger volumes through the port. Cargo volumes are growing at record levels, with overall growth of over 30% at Dublin Port since 2013, and investment in port infrastructure is accelerating to meet demand. Dublin Port continues to invest in new infrastructure informed by its Masterplan to 2040.Dublin Port's investment decisions are informed by its Masterplan to 2040 which is currently under review.

Dublin Port is strategically well placed to take advantage of development potential arising from offshore windfarms and other renewable energy technologies located in the Irish Sea. However, the port's plans and strategy for growth are focused on developing the facilities and infrastructure for the core business activities in freight and passenger transport.

Dublin Port

The port is multi-modal and as such handles passenger ferries, unitised cargo, liquid bulk, dry bulk, cruise liners and, to a lesser extent, break bulk and new cars.

Quay Length & Water Depth

- Alexandra Basin: 247m long with water depths of between 9 and 10m Chart Datum (CD).
- Alexandra Quay (West): 360m long with water depths of 9.6m to 10.2m CD.
- Alexandra Quay (East): 360m long with water depths of 9.6m to 10.3m CD.
- Ocean Pier (West): 410m long with water depth of 9.5m CD.
- Ocean Pier (East): 240m long with water depth of 9.7m CD.
- Southern Quay: 357m long with water depth of 11m CD.

Quay Space

- 440,000m^2 of quayside space at the Alexandra Basin, Ocean Pier and South Deepwater Quay that are used for project cargo.

Craneage

- Three 64 ton (t) and two 102t mobile cranes located in Alexandra Quays
- Two mobile cranes (64t and 84t) which serve the South Deepwater Quay.
- The port has handled heavy lifts of up to 200t.

Support Services

- The port company operates two tugs (water tractor-types) with bollard pull of 54t each.
- Cargo handlers, forklift truck, loading shovels and weighbridge facilities provided by 6 onsite stevedore companies.

Road access to the port is good; the Dublin Port Tunnel provides a direct link to the national road network.

6.4 Port of Cork

The Port of Cork is on the south coast of Ireland and is accessed via a deep-water natural harbour. The port has six different terminals located at four locations from the centre of the city and down river to Tivoli, Cobh and Ringaskiddy. The port services the requirements of all six shipping modes i.e. lift-on, lift-off, Ro-Ro, liquid bulk, dry bulk, break bulk and cruise liners. It has access to the deep-water facilities close to the main shipping lines off the south coast of Ireland.

The Port of Cork has considerable experience with the ORE sector. It has been used as the primary servicing base for the offshore oil and gas exploration off the south coast for decades. The port has increasingly been used as landing location for wind turbines and other components of onshore wind farms. The Ringaskiddy terminal has been used to import wind turbines for farms in southern Ireland and the lifting and storage of other ocean energy equipment. The quarter-scale wave energy converter was manufactured and fitted out in Cock Dockyard before deployment at a test site of Spiddal, County Galway.

Whilst the Port of Cork does not have a strong ORE pipeline other than current work being undertaken in relation to the storage of components for wind turbines, there is significant potential, (linked to the development of the Ringaskiddy site), for this sub-sector to grow significantly. Cork Dockyard has pursued an active marketing strategy to attract offshore wind energy developers to use its facility as an assembly, operation, maintenance and servicing hub for offshore windfarms. The range of facilities and services on offer through the Port of Cork fulfil many of the requirements necessary to provide a major service base and hub for the sector. The proposed re-development of the Ringaskiddy site will add to the portfolio of locations at the port's disposal and will help to strengthen the case for using the Port of Cork to potential developers.

The Cork area, through the Port of Cork (Ringaskiddy and Cork Dockyard sites), has strong interest in becoming a hub for the ORE sector covering the south, south east and south west coast of Ireland. The port offers advantages including deep water, extensive quay space, land banks and hinterland, dockyard and drydock facilities with heavy lift capacity, marine engineering and construction skills. It also has experience with servicing the offshore energy sector (although this has been with the oil and gas industry).

Port of Cork

The port services all six shipping modes lift-on lift-off, Ro-Ro, liquid bulk, dry bulk, break bulk and cruise liners. The City Quays at the Port of Cork accounts for significant quantity of the port's total cargo (9.5 million t in 2015).

Quay Length & Water Depth

- Six main quays located in the city which have a total length of 952m
- Water depths of between 5.6m up to 8.8m Chart Datum (CD)
- Ringaskiddy, has a deep-water quay with a length of 485m and water depth of up to 13.5m CD
- The Cork Dockyard site, has 800m length of quay space, with water depth of 7m CD

Quay Space

- Approximately 180,000m^2 of open space for storage and lay-down, and 16,000m2 of hinterland space.

Craneage

- Two mobile cranes at Ringaskiddy (65t and 100t).
- One heavily lift crane with a 100t capacity at Cork Dockyard site

Support Services

- The port has stevedoring support service available from port and private operators.
- There is a dry dock facility, with jetties and berthing facilities for up to nine vessels.
- Tug boats with a bollard pull of 32t, 46t and 50t.

Cork can be accessed via the M8, which is connected to additional motorway routes which are direct to Dublin and Belfast.

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6.5 Shannon Foynes Port Company

The Shannon Foynes Port Company (SFPC) operates and manages six main facilities located within the Shannon Estuary. The Shannon Estuary waters stretch from Kerry/Loop Heads to Limerick City. The port handles approximately 2,000 vessels and 11.5 million tonnes of cargo each year.

The strategic location of the SFPC on the west coast of Ireland means that the port has access to the largest source of wave energy resources in Europe. In addition, the port's location means that it can provide sheltered facilities with good water depth and port services. Whilst historically, Foynes has had links to offshore oil and gas exploration activities, more recently the port has handled offshore exploration and wind farm imports.

The SFPC has supported the construction and testing of prototypes for both wave energy and tidal turbine developers. There are planned developments to provide additional quayside harbour working areas and possibly additional quay length at SFPC, which would further enhance the attractiveness of this location for developers.

The development of SFPC is focused on driving growth in new sectors including biomass, energy, offshore renewables, waste to energy and recycling, as well as growing existing business. However, it is anticipated that the existing four facilities on the Shannon Estuary will require investment and significant infrastructural improvement to facilitate the ORE sector. It is expected that the Port of Foynes will require an additional 127 hectares of port development, as set out in its 30-year masterplan "Vision 2041", with additional requirements for berthing facilities and deep water berthage capable of accommodating Panamax and Post-Panamax vessels.

SFPC is well located for an ORE hub on the west coast of Ireland. It has the space and facilities for locating a manufacturing, assembly and servicing centre for the ORE sector. The SFPC masterplan "Vision 2041" identifies the ORE sector as a potential growth sector for the port and has indicated that the demand for offshore renewables will require the port to consider this alongside its traditional commercial activities. The port would require significant private investment to upgrade and retrofit the facilities to be able to fully service the ORE sector.

Shannon Foynes Port Company

There are a variety of services that the SFPC provide; controlling navigation, warehousing, logistics and cargo handling. The port handles approximately 2,000 vessels and 11.5 million t of cargo each year

Quay Length & Water Depth

- Two quay walls which cover 560m.
- Seven berth facilities with the ability to berth vessels up to 300m in length.
- The deepwater offers a water depth up to 32m and a handling capacity of vessels up to 20,000 deadweight tonnes (DWT).

Quay Space

- 1.2 hectares of warehousing in Foynes.
- 0.56 hectares of warehousing at Limerick Docks.

Craneage

- The port offers five mobile cranes with a capacity of 63t.

Support Services

- Limerick Cargo Handling have exclusive rights for all stevedoring and cargo handling at Limerick Dock, handling over 11 million t of goods in 2016.

The SFPC is strategically located, next to national road routes, national rail network and two international airports.

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6.6 Port of Waterford

The Port of Waterford is located in the south east of Ireland, on the River Suir, 19 km from the open sea. The port's core business is in bulk, general cargoes and container handling.

The Port of Waterford has experience of handling ORE devices. It has handled the uploading of wind turbines and other components of wind energy equipment. In addition, Fastnet Shipping Ltd, a company based at the Port of Waterford has experience in providing services to offshore windfarms in the Irish Sea including UK projects (Tees Offshore and Robin Riggs) and supporting survey activities on Irish sites for the Kish and Codling Bank windfarms. It also operates many specialised catamaran (CAT) vessels which service turbines. The port also has experience of onshore wind projects: storing blades and towers for wind turbines.

The Port of Waterford has identified the potential of the renewable energy sector but its corporate plan for 2017-21 does not define or detail any specific strategy for potential investment. Given the experience and current infrastructure and facilities of the port, future development and opportunities of renewable energy are likely to be servicing, transportation and maintenance of wind farms.

The port has experience of working with wind turbines for onshore wind projects to store blades and towers. The Port of Waterford is well positioned to service tidal and wind energy projects off the south and east coast of Ireland. With all these factors combined, Waterford makes a potential base for renewable energy projects in Ireland and nearby energy markets.

Port of Waterford

The Port of Waterford is involved in bulk, general cargoes and container handling, and acts as a natural hub for the integration of port, shipping, road and rail freight services.

Quay Length & Water Depth

- The Belview terminal offers 850m of unbroken quay: the Belview bulk terminal (400m) and the Belview container terminal (450m).
- A private general cargo berth (120m) for discharging cement and general cargoes.
- Water depth is between 8 – 10m.

Craneage

- Bulk and general cargo – Cargo handling equipment: 1 x Liebherr 280 harbour mobile crane, 1 x Liebherr 250 harbour mobile crane, 2 x Liebherr 1081 harbour mobile crane.
- Container terminal – Cargo handling equipment, 2 x 40t wide-span gantry cranes, 1 x Reachstacker container handler

Support Services

- Secure and open storage available at several locations on-site: Belview (29.5 hectares) and Waterford City quays (2.8 hectares) facilities for short and long-term
- Infrastructure at Belview is capable of handling extra-long (circa 50 metres) or extra-wide loads (10 metres)

The port benefits from having a national rail link running through the port and good road connections to the rest of Ireland.

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6.7 Rosslare Europort

Rosslare Europort is located at Rosslare Harbour in County Wexford, Ireland, near the south eastern-most point of Ireland. Rosslare Europort's core business is in servicing car ferries and passengers. In terms of unitised freight tonnage, Rosslare Europort is the second biggest port in the State.

Rosslare Europort has the potential to service a range of windfarms in the Irish sea and those off the UK coastline. The port has some previous experience of the ORE sector: as part of the development of Ireland's first offshore wind farm (Arklow Bank (25MW)), over 20 shipments of wind turbine blades and towers were handled by Rosslare Europort. There are no current plans for the development of facilities for ORE, though the port has land that could be developed to meet needs of new customers as they arise. Rosslare Europort is seeking investors to commit up to €40 million for a major upgrade that will equip it to handle the ships of the future.

Since 2012, the principal areas of commercial activity for the port have not changed and the port's focus on passengers and freight have remained at the forefront of its plans. The port is willing and able to play a role in the operation and maintenance of the existing and future windfarm developments in the Irish Sea.

The strategic position of Rosslare Europort provides it with the potential to explore and develop market opportunities for servicing and maintenance of offshore wind farms. However, the port's current focus is on servicing the various ferry services which use the port as a terminus and in handling significant volumes of unitised freight.

Rosslare Europort

The port's core business is in servicing car ferries and passengers; it is second biggest port in Ireland in relation to unitised freight.

Quay Length & Water Depth

- Berth 1: 221m long with water depths of between 6.5m and 10m CD
- Berth 2: 214m long with water depths of between 6.5m and 10m CD
- Berth 3: 168m long with water depths of between 6.5m and 10m CD
- Berth 4: 184m long with water depths of between 6.5m and 10m CD

Craneage

- Mobile cranes are brought in on a needs basis.

Support Services

- Cargo handlers and other marine services provided by onsite stevedore companies.
- Range of storage facilities which include 121 unaccompanied trailer spaces and 900 vehicle unit spaces.

Road access to the port is good; it has a direct link to the national road network.

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6.8 Drogheda Port

Drogheda Port is located on the east coast of Ireland. The port handles around 0.5 million tonnes of cargo annually and has a key role in regional freight distribution within the Greater Dublin Area. It provides facilities for both general freight and container services and handles over 700 vessels annually.

Drogheda Port is designated a "Port of Regional Significance" in Ireland's National Ports Policy and has been transferred to local authority control (Louth County Council). The port has an important role to play in serving its hinterland and continuing to support national economic development in certain specialised trades, that includes off-shore energy servicing.

Drogheda Port has no experience in the ORE sector. This is mainly due to the insufficient infrastructure to assemble and maintain the offshore windfarms. Furthermore, the depth of the water restricts access for larger vessels needed for the service.

Drogheda Port is currently formulating a Masterplan and is committed to including actions to assess the opportunities in the ORE sector. The port recognises that opportunities in servicing and supporting ORE projects in the Irish Sea are likely to those best suited to the port.

Drogheda Port

The port provides facilities for both general freight and container services and handles over 700 vessels annually. The port handles around 0.5 million t of cargo annually and has an important role in regional freight distribution within the Greater Dublin Area.

Quay Length & Water Depth

- The Drogheda Port Company has two facilities for the loading and discharging of cargoes: the inner north quays and the deep-water facility (Tom Roes Point Terminal)
- Container and timber handling services are operated in the deep-water facility at Tom Roes Point. It has a berth of 160m in length a depth of 6m, and the port can facilitate vessels up to 130m.
- The inner north quay port is a general cargo facility. There are four berths along 430m of quay, cargo is handed by a combination of harbour mobile and crawler cranes.

Storage

- Within the site of Drogheda port, there are open storage facilities with 5.67 hectares and a paper store of 0.84 hectares.

Quay Space

- 84,000m^2

Craneage

- The port has two Liebherr LHM 250 harbour mobile cranes with additional tracked grabbing cranes. Secondary handling is provided by a modern fleet of dedicated container handling and general-purpose forklifts.

Support Services

- Availability of craneage, maritime services, pilotage and workboats to support port activity with the harbour masters office and administration located on the south shore
- Links with Europe, Scandinavia and the Baltic states

Direct access to both Dublin and Belfast on M1 motorway

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6.9 Port of Galway

The Port of Galway is situated at the centre of Galway City which is located on the west coast of Ireland. The main commercial activities of the port focus on bulk liquids, dry bulk and break bulk. A rapid catamaran ferry service also operates from the port transferring passengers to the Aran Islands. In addition, there are a small number of cruise ships annually bringing tourists to Galway.

The Port of Galway has some exposure to the ORE market, primarily though supporting prototype testing at the SmartBay test site in Galway Bay. However, these activities are directly linked to the level of activity at the Galway Test Site. The port has also handled some large wind turbines (58 turbines which were 55m long) for an onshore wind project.

The port has developed in informal working relationship with SFPC in relation to receipt of ORE energy devices. The blades and nacelles are handled at The Port of Galway whilst the towers are handled by SFPC. The Port will seek to continue their working relationship with Shannon Foynes and will continue to attract business in relation to onshore wind.

A key part of the strategy for the future development of the Port of Galway is having an integrated multi-purpose facility that will cater for the core activities as well as marine tourism and leisure, the offshore renewable sector and maritime business activities. The proposed developments at Port of Galway could provide facilities and infrastructure to take up opportunities in the ORE market, particularly, in the west coast. However, the development is dependent on the outcome of the application for planning permission and also on securing private sector investment.

The port views offshore renewables as an important part of its future business plans. The port recognises the potential job creation possibilities and wider economic impacts that the increase in commercial port activity could have on the area. At present, the port can be active as a servicing and maintenance facility for any offshore development off the west coast. The port can also work in conjunction with other ports (namely Shannon Foynes) in the assembly of turbines, although this is predominantly for the land based renewable sector. Large scale ORE projects based out of the Port of Galway are largely dependent on the successful redevelopment of the port.

Port of Galway

The main commercial activities of the port focus on bulk liquids, dry bulk and break bulk. A rapid catamaran ferry service also operates from the port transferring passengers to the Aran Islands. In addition, there are a small number of cruise ships annually bringing tourists to Galway.

Quay Length & Water Depth

- The Port of Galway has six quays available with a total length of just over 1000m in total.
- Water depth at low tide is about 3.6m CD whilst the rest of the port is 2.9m CD. The approach channel to the port has been maintained by periodic dredging at 3.5m CD.
- The gated docks provide berths for commercial vessels (up to 6,000t) and retains high tide water levels of over 8m CD.

Craneage

- One 40t harbour mobile crane is available suitable for grab discharge / loading and lifting work.

Quay Space

- Storage space alongside the quays is limited but laydown space is available at the nearby Galway Harbour Enterprise Park which comprises a 18.2 hectares industrial and business park.

Support Services

- Stevedoring, pilotage and other work boats readily available
- Situated at the centre of Galway City

Direct access to national road network (N59, N84 and N83) and motorways (M6, M7, M17 and M18).

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6.10 Greenore Port

Greenore Port is situated inside the entrance to Carlingford Lough, towards the eastern end of the Cooley Peninsula. The port lies between Belfast and Dublin. Greenore is Ireland's only privately owned commercial port. The port handles commodities which include: bulk animal feed, fertiliser, coal, steel, timber and general cargo. Greenore operates as the main steel port in Ireland, capable of handling over 250,000MT per year and handles an average of 400,000MT of dry bulk per annum.

Greenore Port has experience with the marine renewable energy industry through Open Hydro's adjacent technical centre, which manufactured and assembled tidal turbines for testing in Scotland. French naval defence company DCNS has acquired a majority and controlling share in OpenHydro, which maintains its links with, and technical centre next to, Greenore Port.

Greenore is owned by the Doyle Shipping Group – a company which was involved in the assembly of tidal turbines and has been involved in handling turbine components for many wind farm developments (including Arklow Bank, Robin Rigg offshore project, and the West of Dudden Sands project). Greenore's location means that there is potential for future business in relation to the service and maintenance of the wind turbines in the Irish Sea.

The port has no immediate plans for development of facilities to service the offshore wind sector though will respond as projects emerge in the Irish Sea. Greenore Port has highlighted that the next phase of investment will create a steel terminal on un-used land that is owned by the port. This will free up some quayside storage and allow the port to compete for other products which it does currently not handle.

Greenore Port

Greenore is Ireland's only privately owned commercial port. The port handles commodities which include: bulk animal feed, fertiliser, coal, steel, timber and general cargo. Greenore operates as the main steel port in Ireland, capable of handling over 250,000MT per year and handles an average of 400,000MT of dry bulk per annum.

Quay Length & Water Depth

- Greenore Port has can accommodate vessels of 55,000DWT, 8m depth, 200m long.
- Greenore has a quay wall with a total length of 260 m. It includes three berths with depths alongside of 4.9 m, 5.2 m and 5.5 m respectively

Craneage

- The outer berth accommodates vessels up to 185m and is serviced by a mobile Liebherr LHM 320
- The inner berth accommodates vessels up to 110m and is serviced mainly by a Liebherr gantry crane.

Support Services

- Pilotage, tugboats and communications available with a number of large warehouses at the facility.

Connected to the M1 motorway

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6.11 Killybegs Harbour Centre

Killybegs Harbour Centre is in County Donegal, on the north-west coast of Ireland. The port operates as a general cargo facility operating in tandem with the fishing harbour.

Killybegs has experience servicing the offshore oil and gas business. Sinbad Marine Services is an oil and gas logistics company that has been providing offshore support solutions to the oil and gas industry in Killybegs since 1997. Killybegs Harbour Centre has facilitated offshore exploration to the Corrib Field; furthermore, it has developed business relations with key multi-national companies such as Shell, Statoil, Lundin and Eni. EK Marine Ltd., Killybegs Stevedoring and Celtic Shipping agencies, have completed the unloading and lay down of 18 wind turbine tower sections from one of the largest cargo vessels ever to berth at the Port of Killybegs. The project saw the tower sections being lifted from the vessels on to a quayside trailer before being driven to the lay down area.

The future vision of Killybegs Harbour Centre is to maintain its position as Ireland's premier fishing harbour and to continue to develop its major commercial cargo port. Killybegs Harbour Centre is well placed for servicing offshore energy relating to windfarms and wave energy along Ireland's west coast. It has evolved into a multifunctional port serving the fishing, energy and cruise sectors, with a modern, sheltered, deep-water facility on the west coast.

Killybegs Harbour Centre

The port operates as a general cargo facility operating in tandem with the fishing harbour.

Quay Length & Water Depth

- The Killybegs Harbour Centre provides a substantial deep-water port, with a maximum draft of 12m at low water. The port is designed to cater for vessels up to 300m in length, 40,000DWT and with a maximum draft of 12m at low water
- Killybegs can accommodate large cruise liners, service vessels for the oil and gas industry, large scale delivery of wind farm components along with annual fish landings from both foreign and Irish vessels.

Storage

- Cargo sheds available on new pier and close to harbour: the two cargo sheds are 484 m² each. Freezer storage is also available locally.

Craneage

- The port has mobile crane capacity of up to 120t

Support Services

- Tugs, mobile cranes, synchro-lift, marine engineering, electronics and ship repairs

Transport links by national roads including the N56 and N15.

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6.12 Rossaveal Harbour (Ros An Mhíl)

Rossaveal Harbour (Ros An Mhíl) is in Connemara, County Galway, approximately 48km from Galway city. The inner harbour is positioned on the north-eastern shore of upper Cashla Bay. It is the largest and busiest fishing port in County Galway, and acts as the main base for the Galway and Aran Co-op fishing fleet. Rossaveal is also a ferry hub for the Aran Islands, and this has improved the tourism industry by connecting the three islands to mainland Galway. A passenger ferry service and a cargo company operate out of the harbour.

Rossaveal Harbour has no experience in the ORE sector and does not currently have the required infrastructure to assemble and maintain offshore windfarms. However, planning permission has been awarded for development of quay space that would be suitable for offshore energy projects. Plans to develop into the ORE sector are not directly included in Rossaveal's business plan. However, the port is aware of potential multi-purpose uses of its facilities that would include ORE.

Rossaveal is well located for quick access to sites off the west coast of Ireland and current planning permission for new facilities is targeting future growth in offshore energy sectors.

Rossaveal Harbour

It is the largest and busiest fishing port in County Galway, and acts as the main base for the Galway and Aran Co-op fishing fleet. Rossaveal is also a ferry hub for the Aran Islands

Quay Length & Water Depth

Depth of facilities at Rossaveal:

- No. 1-pier – 120m long with a water depth of 3.7m
- No. 2-pier west side – 155m long with a water depth of 3.7m, and 60m with a water depth of 5.8m
- No. 2-pier east side –reserved for cargo vessels and is 90m long with a water depth 3.7m

The harbour has an approach channel which is 3.7m deep, there is also a smaller deepwater pocket which has depths of between 5.8 and 6m depending on the tide.

Storage

- There is limited storage space available at the harbour in the form of gear stores.

Craneage

- The port has mobile crane capacity of up to 120t

Support Services

- Tugs, mobile cranes, synchro-lift, marine engineering, electronics and ship repairs

Galway is 40KM away, serviced by local buses. Galway airport at Carnmore is 50KM away.

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6.13 Wicklow Port

Wicklow Port is south of Dublin on the east coast of Ireland. The Port is a seaside tidal port at the mouth of the Leitrim River. In 2013, Wicklow Port Company transferred to Wicklow County Council; it was the first port to transfer under the Government's National Ports Policy.

In recent years, Wicklow port has witnessed the business develop and facilitate a broader range of services, including those which relate to cargo such as timber, glass and scrap metal and the green energy sector. The port has experience of servicing the wind turbine industry, and in 2013 handled one of the largest onshore wind turbine projects in the country.

Wicklow County Council, who manage the port, have not specified any plans for developments within the ORE sector as part of the vision for the port. Instead, the port is focused on strengthening the current core business sectors and expanding through the development of marine-related tourism activities.

Wicklow Port has experience and the ability to work with wind turbines and will respond to business opportunities that emerge for offshore wind energy in the Irish Sea. Significant investment targeted towards the maintenance and servicing of wind turbines, would benefit Wicklow Port and facilitate the creation of new jobs and secure a specalisation within this sector.

Wicklow Port

The port operates as a general cargo facility operating in tandem with the fishing harbour.

Quay Length & Water Depth

There are two piers: east pier and the west pier.

- The east pier is 95m long with a depth of 5.2m and
- The west pier is 93m long with a depth of 5.2m.

The anchorage depth is 6.4m to 7.6m and the cargo pier depth is 1.8m to 3m

Quayside length:

- Packet quay – 95m
- North quay – 130m
- South Quay – 126m

Support Services

Services available services include: extensive warehousing and additional open storage and stockholding facilities which extend to an area of more than 10 hectares. Further services include:

- Shipping agency
- Warehousing
- Cargo care
- Transportation and Distribution

Craneage

- A large Liebherr 954 materials handler to conveyor systems and specialized lifting equipment for unitised or bulk cargo.

Main road access to M11 and N11. Wicklow Train Station is 1.6km from the port

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6.14 Arklow Harbour

Arklow Harbour is in County Wicklow on the east coast of Ireland, at the entrance to the River Avoca. The harbour is mainly used by fishing vessels. It is the closest port to the first wind park in Ireland – Arklow Bank Wind Park. However, it does not provide deep waters and the current infrastructure would not be able to serve and maintain offshore windfarms.

Whilst the harbour has limited experience of the ORE sector, a local company, Arklow Marine Services offers services including: boat building, repair and refurbishment, offshore operations and maintenances (O&M). Arklow Marine Services design and build vessels to service renewable offshore wind farms. The company has experience of the specialist requirements for the service vessels and travelling to the wind farms. Arklow Marine Services provide O&M services to offshore wind farms, carrying out maintenance and repair of 3.6MW turbines.

Arklow Harbour is under the management of Wicklow County Council and it has no specific plans for the harbour to expand into the ORE sector. However, Wicklow County Council have identified the ORE sector as one where local companies, like Arklow Marine Services[9], could benefit from further investment and development in Ireland.

Arklow Harbour is dominated by the marina and fishing activity on the east coast of Ireland. It has limited experience of the ORE sector. Whilst there is a wind park relatively close to the harbour, it is not currently in a position to get involved in servicing and maintenance of offshore windfarms given current infrastructure and insufficient water depth.

Arklow Harbour

Arklow Harbour is used mostly by fishing vessels. The North Bank is the industrial area whilst the South Bank has a marina.

Quay Length & Water Depth

- Arklow Harbour has four berths which cover 80m, although it is restricted by shallow water-depths between 1.8m and 3.0m at low water, and maximum water depths of 4m.

Storage

- There are storing facilities available with approximately 1000m2 of storage facilities suitable for bulk or bagged cargo.

Support Services

- Local stevedoring, marine services, chandlers, shipping and forwarding agents

Situated on the main Belfast-Dublin-Rosslare motorway 55km to the south of Dublin and north of Rosslare with good rail connections

[9]Arklow Marine Services are an example of a locally based company which could win businesses and support the operation and maintenance sector for the ORE sector.

6.15 Fenit Harbour

Fenit Harbour is in County Kerry on the west coast of Ireland, and within the southeast corner of Tralee Bay. Fenit has traditionally served as a fishing village with a small commercial port. The harbour is shared with a small marina, fishing and commercial ships.

Fenit Harbour has stored turbines blades for onshore wind projects, however this is the extent of the harbour's experience with the renewable energy sector. The space used by the renewable energy project is now used by Liebherr Container Cranes Ltd. The harbour plays an integral part in the distribution of Liebherr container cranes.

There are plans to undertake a feasibility study for development of a new pier. The Kerry County Council Development Plan 2015-21 does not highlight any future investment for the ORE sector. With all their current facilities being used by Liebherr cranes, Fenit Harbour has no spare capacity to undertake further work in the ORE sector.

Fenit Harbour

Fenit has traditionally served as a fishing village with a small commercial port used for shipping and exploration off the South West of Ireland. The harbour is shared with a small marina, fishing and commercial ships, and the deep-sea port.

Quay Length & Water Depth

The main deep-sea pier is 175m long

In addition, the marina has 130 berths available with 2.5m - 4.5 m water depth:

- Channel is 4.9-6.1m
- Cargo pier is 6.4-7.6m
- Anchorage is 6.4-7.6m

Deep-sea port offers a minimum of 5m draft, regularly caters for ships up to 15,000t

Craneage

- The harbour has cranes that can handle up to 200t.

Storage Facilities

The main deep-sea pier is 175m long with extensive storage facilities available. Fenit Harbour also offers warehousing and open storage options for commercial clients.

Support Services

Has operated as a commercial port with transportation and distribution services, with Liebherr container cranes.

- Airport: Kerry airport 30 km
- Railways: Tralee station, 14 km

Serviced by national routes N21, N2, N69 and N70

6.16 Belfast Harbour

Belfast Harbour is the principal port of Northern Ireland located on the east coast. It is the primary logistics and distribution hub for Northern Ireland and home of major businesses including Harland and Wolff (H&W) and Bombardier. Belfast Harbour's position is one of the few harbours in the UK and Ireland with a readymade site for the assembly of offshore renewable devices and large-scale hinterland. The Harbour has made investments in the offshore renewable sector: £50million in a 20-hectare windfarm hub facility at their D1 site. Since the D1 facility opened, Belfast Harbour has delivered three contracts:

- A 387MW project development for deployment in the Irish Sea;
- A 250MW, 30-turbine assembly project for deployment in the Irish Sea. This took 9 months to complete; and
- A 600-650MW, 87-turbine assembly project for deployment in the Irish Sea. This took 20 months to complete.

Belfast Harbour is currently in the process of completing a 600MW contract for wind turbines in the Irish Sea and is running at capacity until about Q2, 2018. Belfast Harbour has the capacity to assemble approximately one turbine a week and therefore can realistically assemble 50 over the course of 12 months.

Belfast Harbour's most recent Corporate Plan (2014-2016) sets out a clear commitment to the growth of the ORE component of Belfast Harbour. The Harbour has reaffirmed this through the commitment of additional financial resources (in the region of £67million) to support to continuing development of the facilities and infrastructure. The Belfast Harbour Masterplan which sets out the vision for the harbour across the next 20–30 years also highlights the importance of the offshore renewables sector to its future. As the only port or harbour on the east coast of Ireland and Northern Ireland to have a facility like D1, Belfast Harbour is well placed to take on new contracts for further offshore wind projects in the Irish Sea.

Belfast Harbour, along with the Harland and Wolff Shipping complex, is strategically located and geared up to service offshore wind farm developments in the Irish Sea, North Sea and even perhaps the west coast of Ireland. It has a market-leading combination of facilities, infrastructure and support services along with the necessary engineering skills to facilitate further ORE developments. Looking ahead, with the UK leaving the European Union, there is greater uncertainty around the shipping logistics and import costs for ORE device components. In addition, the nature of the future economic/trading relationships between the UK and particularly Northern Ireland and Ireland are uncertain. Therefore, it is not clear how the UK departure from the EU will impact on future ORE projects coming through Belfast Harbour.

Belfast Harbour

Main cargo handling port for Northern Ireland. Significant elements of the business focused upon the tourism industry (cruise ships) and offshore renewable energy through the dedicated D1 facility.

Quay Length & Water Depth

- 480m of new quay with water depth of 10.2m CD to facilitate the large vessels which are required to transport the components for offshore energy devices.

Quay Space

- Quay space of circa 8km of operational quays and wharves. Two largest areas include:
  - Main dock - 51,708m^2
  - Belfast dock 16,750m^2
- 100,000m2 of hinterland available for handling project cargoes
- 20 hectares of logistics space for the pre-assembly of both turbines and foundations

Craneage

- Harland and Wolff site is also well served for heavy lifting and has two large cranes at the main dock with bearing capacity of up to 840t along with 4 support cranes (2x60t and 2x80t).
- At Belfast dock, two cranes of 40t and 80t
- Ship repair facility, two 40t cranes operate and one 9t crane that services the outfitting quay

Support Services

- Support services offered through several incumbent companies. These include pilotage with access to up to 5 tugs with bollard pull ranging from 13.5t to 45t, various workboats and stevedoring.

Connected to key motorways (M1 and M2), over 80 sailings and 100 flights per week from Belfast City Airport (which is under 10KM away).

6.17 Warrenpoint Port

Warrenpoint Port is one of Northern Ireland's main commercial ports, with its operation covering both the southern part of Northern Ireland and the northern part of the Republic of Ireland. It is located half way on the main transport corridor between Belfast and Dublin.

Warrenpoint Port has had little involvement in the ORE sector. It operates within a competitive business environment on the east coast of the island of Ireland and Belfast provides competition in the north for renewable energy projects. Furthermore, the implications of Brexit may restrict opportunities for EU funding.

Warrenpoint aims to be the preferred location for import and export of goods and therefore its strategic focus lies in developing this area of business. However, Warrenpoint's corporate objectives do include actions to support and develop the ORE sector and in particular, the O&M and servicing of offshore wind farms in the Irish sea.

Warrenpoint Port

The port operates as a general cargo facility operating in tandem with the fishing harbour.

Quay Length & Water Depth

- Warrenpoint Port has 6 general cargo and container berths with a total quay length 750 metres and a maximum tidal range of 5.3m.
- There is 300m of quay which are dredged to 7.5m and the remainder of the berths are dredged to a depth of 5.45m.
- The port has a Ro-Ro Ramp which is 39m long and 27m wide, capable of loading 120t for vessels up to 25m beam.

Containers Handled

- Container facility at Warrenpoint has the facility to handle containers vessels with 300m of deep water quays at 7.5 metres at low tide.
- The port has 3 x 45t Reach Stackers, with experienced stevedores, and a computerised stock control system. There was a total of 20,295 units handled through Warrenpoint in 2016.

Craneage

- Two Gottwald HMK Mobile Crane with capacity of 43t and 100t respectively; it also benefits from three harbour cranes.

Support Services

- Supported by qualified stevedores

On the A2 road with motorway access to Belfast city and Dublin port

6.18 Other Ports and Harbours in N Ireland

Foyle Harbour and Port of Larne were not directly consulted during the study, though a review of activities indicated that their position in relation to the ORE sector is similar to the 2012 report. High-level summary information for each is included below.

6.18.1 Foyle Harbour

Foyle Harbour is close to the wave and tidal resources of the north west and north coast of Ireland but a considerable distance from offshore wind sites in the Irish Sea. The harbour has good facilities and infrastructure and could offer potential as a future supporting base for servicing and maintenance of wave and tidal energy generating devices. At present, the port has no strategy in place to support the facilitation or development of the ORE sector.

6.18.2 Port of Larne

The Port of Larne is close to potential wind, wave and tidal energy sites off the north and north-east coast of Ireland and Scotland. Port infrastructure is focused mainly on Ro-Ro facilities and the port has no significant history with the ORE sector. At present, there are no plans to develop parts of the port to specifically cater for this industry. Future potential exists for the port as a possible service and maintenance base for the ORE sector.

6.19 Conclusions

Irish ports and harbours are willing to and have capacity to engage with the ORE sector: this section gathered information on capability, capacity and willingness of ports and harbours across the Island of Ireland to service the ORE sector. The study has found that across all ports regardless of size there is a willingness to explore the opportunities which the ORE sector presents.

Whilst at least 10 of the ports and harbours indicated their willingness to service the ORE sector (provided the barriers and constraints already mentioned were addressed), only three ports specifically mentioned the ORE sector as a key driver for their economic growth. None of the ports and harbours reviewed, except for Belfast, had a purpose-made facility for servicing the ORE sector. However, at least 10 ports and harbours have suitable base infrastructure (such as water depth, quay space, quay strength) where further investment could provide the level of facilities required to service the pipeline of projects that could be realised in Ireland's ORE sector over the next 10 years. With appropriate levels of investment, all of these ports and harbours could act as hubs for assembly of ORE devices (such as turbines) as well as providing operation and maintenance support services.

The key findings are detailed below:

- The majority of Ireland's ports are willing to meet the demands of the offshore renewable sector, subject to the availability of appropriate investment (evidenced by developments in Belfast, previous experience from Arklow Bank, availability of suitable development land in ports with good regional spread around the country);
- Belfast is already actively engaged in supporting ORE: it has established its new D1 Offshore wind terminal as one of the leading facilities for offshore wind farms in the Irish Sea and is well placed to win contracts as the construction / assembly port for other projects in the Irish Sea.
- For the Ireland's Tier 1 ports[10]
    - Dublin Port may have space constraints at existing facilities due to increased volumes in its core business areas, especially during the on-going construction of the Alexander Basin Redevelopment project, though there are options for development of quay space at Poolbeg if required. At present, Dublin Port has no strategic intent towards the development of the ORE sector and its focus continues to be on traditional commercial activities, particularly unitised trade and Ro-Ro ferry traffic. However, Dublin Port could respond to new business opportunities as they arise.
    - Port of Cork may have space constraints in the short term, although its new Ringaskiddy project, the development of Marino Point and options to upgrade or develop other facilities (for example at Bantry Bay) provide options for any additional space needed. Cork has identified the ORE sector as a potential growth area though its focus and immediate investment plans continue to be on traditional commercial activities until the ORE sector is established.
    - Shannon Foynes has a range of sites available for development for manufacturing or servicing facilities for the offshore energy sector. The strategic development of SFPC is focused on driving growth across all sectors but in particular in the areas of dry and liquid bulk goods and break-bulk cargo. Offshore renewables is identified as a key target for growth related to entry into new sectors in line with international and national growth forecasts

[10]Tier 1 ports are Ports of National Significance. These are ports that are: responsible for 15% to 20% of overall tonnage through Irish ports; and have clear potential to lead development of future port capacity in the medium and long term, when and as required. (National Ports Policy, DTTAS (2013)).

- Ireland's Tier 2[11] and Tier 3[12] ports, along with the Fisheries Harbour[13] at Killybegs have facilities available to support the servicing of offshore energy projects, with other development opportunities at Ros a' Mhíl, Arklow and Galway Harbour.

There is strong infrastructure within ports and harbours but weak supply chains: at least 8 Irish Ports and Harbours have suitable infrastructure and assets to support the development of the ORE sector, providing the investment is forthcoming from the private sector. However, the supply chain in Ireland is still poor compared to competitors in the UK. Consultations with industry indicated that a strong supply chain is critical to the development of the ORE sector. This includes cargo handling, shipping and logistical support, manufacturing facilities for turbine components, steel and concrete manufacturing for foundation bases as well as platforms for the wave devices and floating wind turbines. The development of the ORE sector provides several key opportunities to also develop the supply chain within Ireland and the supporting infrastructure needed.

Evidence from consultations with the ORE industry indicates that a well-developed ORE sector, using Irish ports and harbours as centres of construction, assembly, operation and maintenance will in turn encourage the development of:

- supporting infrastructure (such as roads and port/harbour access) as well as energy infrastructure (such as adequate grid connection and capacity).
- the local supply chain. Key opportunities include:
    - Manufacturing opportunities for fixed bottom wind farms. This is likely to be limited – though there may be opportunities for H&W in Belfast to build on recent success in suction bucket or jacket foundations depending on the water depth and site conditions for the wind farms.
    - If a long-term pipeline of projects was evident and of significant scale (100's of turbines), there may be opportunities to establish manufacturing facilities for concrete foundations for fixed bottom or floating wind foundations.
    - In conjunction with supporting the demonstration projects for wave energy (5-10 devices), there are opportunities to establish specialist manufacturing and outfitting facilities for wave energy devices for subsequent scale up of larger arrays.

Consultations with some of the benchmark ports (see chapter 8) reinforced the latter point: that a well-developed ORE sector (as described above) would encourage the development of the local supply chain.

[11]Tier 2 ports are Ports of National Significance. These are ports that are: responsible for at least 2.5% of overall tonnage through Irish ports; have clear demonstrable potential to handle higher volume of unitised traffic; and have the existing transport links to serve a wider, national marketplace beyond their immediate region. (National Ports Policy, DTTAS (2013)).
[12]Tier 3 ports are Ports of Regional Significance. This category includes all other ports that handle commercial freight. (National Ports Policy, DTTAS (2013)).
[13]The Fisheries Harbour Centre Act, 1968 sets out that a Fisheries Harbour is a harbour of national importance to the fisheries industry.

7.0

Review of Benchmarked Ports and Harbours

7.1 Introduction

Within the 2012 IPORES report, a benchmarking exercise examining six ports and harbours in the UK and Germany was completed. As part of the 2017 report, RSM were asked to revisit the benchmarks to examine the lessons that could be learned from them in relation to the development of the ORE sector and the conditions which provided the catalyst for the investment, using a selection of relevant ports.

The list of benchmarked ports includes five of the six ports (Mostyn, Barrow, Humber, Cuxhaven and Esbjerg) included in the 2012 report and which were updated for this report. A new benchmark, Orkney, was added given its experience of the offshore wind and wave sector and as a hub for the North Sea. The table below summarises the ports considered, including the rationale for inclusion. These ports have been selected as they have significantly expanded their ORE sector project workload in the past number of years and have taken advantage of the opportunities for private investment from developers which are presently within the wider ORE market.

The purpose of the benchmarking exercise was to examine the lessons that could be learned from the benchmarked ports in relation to the development of the ORE sector and the conditions which provided the catalyst for the investment. For each of the benchmarked ports, the following broad questions were addressed:

- Infrastructure and Facilities – what infrastructure and facilities did ports and harbours need to enable them to support the ORE sector including the development of local supply chains?
- Experience in Offshore Renewable Energy Sector – what was their experience of the ORE sector? How did the market develop and how has the port attracted investment from ORE developers?

As well as presenting findings against these points, we also detail the key lessons from each benchmarked port for the Irish market.

The summary of each benchmarked port presented in this section was developed from the following activities:

- Desk based research considering each benchmark port or harbour against the assessment criteria set out in Section 6.2 of this report;
- A consultation with a senior figure within the port or harbour authority confirmed details in relation to port development which were not apparent in the desk based research.
- Development of a factsheet for each benchmarked port or harbour containing the desk based information.

Table 7:1 Benchmark Examples

Port	Location	Ownership Model	Rationale for Inclusion
Port of Mostyn	North Wales	Privately owned limited company – "Port of Mostyn Ltd"	Major base for offshore wind farm construction and support services for the Irish Sea.
Port of Burrow-in-Furness	West Coast England	One of 21 ports in England, Scotland, and Wales owned and operated by Associated British Ports (ABPA Holdings Limited)	Considerable experience of the offshore wind energy sector. Port is the logistical centre for heavy lifts of monopiles and transition pieces for Walney Offshore wind farms
Orkney	Scotland	Owned by Orkney Islands Council.	Considerable experience of the offshore wind and wave sector and is a hub for the North Sea. The Orkney's also has extensive experience of testing new ORE technologies.
Humber Port	East Coast England	Associated British Ports (ABPA Holdings Limited) owns 4 ports on the Humber estuary - Hull, Goole, Grimsby and Immingham	Well located to service 3 offshore wind farms in the North Sea. Dedicated £400 million to make port one stop shop for North Sea wind energy including construction, assembly, installation and maintenance.
Cuxhaven	Germany	Privately owned by Niedersachsen Ports.	Leading location for production, assembly and logistic services for offshore wind turbines in North Sea. Cluster of offshore wind power and maritime industries.
Esbjerg	Denmark	The Port of Esbjerg is a public self-governing port owned by the Municipality of Esbjerg.	Has become a centre for shipping offshore wind turbines. In addition to handling 65% of all Danish wind turbines (which now supply 3 GW of offshore wind power), the port has shipped components to various British wind farms. To cope with future increases in Danish offshore wind power, twelve companies including DONG Energy and Bluewater Energy Services are planning the establishment of a Green Offshore Centre in Esbjerg.

7.2 Port of Mostyn

The Port of Mostyn is located on the Welsh side of the Dee Estuary in North Wales within 5.5km from of the Irish Sea. It is privately owned by the limited company "Port of Mostyn Ltd".

The port has an established history of handling bulk cargoes of coal, iron ore and steel for the region's heavy industries. More recently, the Port of Mostyn has developed to become one of the main centres in the UK for the assembly and installation of wind turbines, primarily due to its location in the Irish Sea where the first offshore wind farms in the UK were deployed.

The Port of Mostyn has become a key construction and service base for the ORE sector on the west coast of GB. Its location on the Irish sea makes it an appropriate setting for the construction and maintenance work of windfarms in the area.

The port was used for the construction and operation maintenance base for the first major offshore wind farm built in the UK at the North Hoyle site in 2004 (60MW). Since that time, seven Irish Sea offshore windfarm projects have been undertaken from the port. The most recent, and largest to date, is the 160-turbine (576MW) Gwynt-y-Mor windfarm located approximately 15 miles off the Welsh coast.

Contracts awarded to the port by wind farm developers to provide facilities for the construction and maintenance of wind farms enabled the port to finance the creation of new facilities at the port for offshore wind farms. The £50 million lease and investment into Port of Mostyn from the Gwynt y Môr's wind farm developer "RWE npower renewables" was the highest value, long-term contract awarded to a company in Wales, and reinforced the company's commitment to investing into the North Wales area[14].

While no direct government funding was made available to the port, the offshore wind farm developments that provided the long term contracts, which the port used to support investment in facilities to service the offshore wind farms, received grants and subsidies from the UK government. For example, the North Hoyle offshore wind farm cost around £80 million to construct and received a capital grant from the Department of Trade and Industry of £10 million[15]. The Gwynt y Mor wind farm received two renewable obligation certificates (ROCS), worth approximately £90, for each megawatt hours (MWh) of electricity produced (approximately £160 million per year in relation to project costs of around £2,300 million).

In addition to its strategic location in relation to sites for offshore wind farms, the conditions which provided the catalyst for investment and development of the port's involvement with the ORE sector included:-

- Linking with government policy - The port closely engaged with the Welsh and UK governments' strategies for the establishment and growth of the offshore wind sector. This means that port had a detailed understanding of the government policy to erect 7,000 wind turbines off the coast of the UK. It could also prepare to exploit this opportunity by positioning itself as a suitable location to secure contracts and investment from the offshore wind farm developers to provide facilities for the construction and maintenance of the wind turbines.
- Proactive in Diversification – the port was proactive in recognising and taking up the opportunities for diversification moving away from traditional business activities into the ORE sector. This required the port to commit its own resources to undertake a major programme of modernisation to meet ever-increasing shipping and port requirements.
- Developing Networks and Local Supply Chains - Historically ports have developed in support of local industries such as coal exports, steelmaking, agriculture and passenger transport. In the case of the Port of Mostyn, these traditional businesses have all but disappeared, and its survival has only been possible by the decision to diversify into construction and service base facilities for the offshore renewable energy sector. This has facilitated the development of a locally based supply chain which improves the port's attractiveness to potential ORE sector developers.

[14]Sources include: http://www.portofmostyn.co.uk/news.php?title=Inauguration_of_the_worlds_second_largest_offshore_windfarm_takes_place_at_the_Port_of_Mostyn. https://www.windpoweroffshore.com/article/1290411/work-starts-gwynt-y-mor-o-m-facilities
http://www.marineenergywales.co.uk/supply-chain/ports/
[15] "North Hoyle offshore wind farm: design and build", Proceedings of the Institution of Civil Engineers, Energy 160, February 2007

Port of Mostyn

The port has an established history of handling bulk cargoes of coal, iron ore and steel for the region's heavy industries. More recently, the Port of Mostyn has developed to become one of the main centres in Europe for the assembly and installation of wind turbines.

Quay Length & Water Depth

- 310m long with water depths of 6.5m Chart Datum (CD) at low tide.

Quay Space

- 78,000m^2 of quayside space
- 30.3ha of laydown facilities

Craneage

- 1,300t heavy lift crane

Support Services

- General handling, Ro-Ro and heave lift handling services available from onsite stevedores;
- Crane hire, workboat, diving and sub-surface engineering, ship chandlers and bunkering services provided by onsite companies.

The Port of Mostyn is strategically positioned close to Welsh-English border with direct access to the A548 coastal road connecting it to the GB motorway network.

7.3 Port of Barrow

The Port of Barrow is in the south-west of Cumbria. It lies within the enclosed dock system of the town of Barrow-in-Furness. The Port of Barrow is currently owned and operated by Associated British Ports (ABP), through the privately owned limited company ABPA Holdings Limited. The port's core business is focused on dry and liquid bulk and it handles around 30,000 tonnes of this each year. There are also specialised facilities at the port, which includes the BAE Systems submarine design and manufacturing facility. The port has a secure 6-hectare open storage facility which is the site of BAE Systems' ship-building facility.

The Port of Barrow plays a key role in serving the offshore energy industry in the UK. It has vast experience in the construction and maintenance of the offshore windfarms and has supported a range of projects run by DONG Energy and MHI Vestas. The Port of Barrow was involved with the heavy lifts for the offshore industry, including monopiles and transition pieces for Walney 1 and Walney 2 offshore wind farms in the Irish Sea. In addition, the Ormonde Offshore Wind Farm (developed by Swedish energy company Vattenfall) is located around 10km from the coast of Barrow-in-Furness in the Irish Sea, with 30 x 5MW turbines in a depth of 25m of water. The Operations and Maintenance (O&M) facility for the Ormonde wind farm is located on the dockside in Barrow port, however, Belfast port was used as the installation base. The development, construction and operation of the project has supported more than 800 jobs.

The Port's Action Plan highlights its desire to position itself as a centre of construction, maintenance and servicing for the ORE sector. To do this, the port draws attention to its experience in the ORE sector supporting the manufacturing of towers, blades, foundations and cabling and servicing and maintenance of wind turbines in the Irish Sea.

The Port actively seeks opportunities to support the ORE sector and is hoping to secure further work through proposals for new wind farms off the Isle of Man and other areas nearby, and capitalising on its proximity to the proposed 4.2GW Round 3 sites in the Irish Sea.

The location of the port was a major factor in securing contracts for the operation and maintenance of offshore wind farms near off the coast near Barrrow. Other success factors for the port's involvement with the ORE sector include:

- Established skills base and supply chain from other offshore sectors: Experience in handling pipeline storage and load-out operations for the offshore oil & gas sector and the highly-skilled workforce associated with the BAE Systems' ship-building facility located within the port are competitive advantages in attracting business from offshore wind farms.
- Existing Infrastructure: the heavy lift capabilities and port infrastructure developed for ship-building sector are transferrable to the offshore wind sector
- Seizing the opportunity presented by the ORE sector: The port developed an action plan to examine the potential of the docks for ORE sector servicing. As a result, the port has positioned itself as a centre of construction, maintenance and servicing.

Port of Barrow

The port of Barrow is currently owned and operated by Associated British Ports (ABP), the Statutory and Competent Harbour authority. Each year the port can handle around 300,000t. There are specialised facilities at the port, which includes the BAE Systems submarine design and manufacturing facility. The port has a secure 6-hectare open storage facility which is the site of BAE Systems' ship-building facility.

Quay Length & Water Depth

- 2690 m long with water depths of 7.9m.

Port Area

- 56 hectares of port area
- 6-hectare open storage facility

Support Services

- Currently 8,000 stevedores or between 400/500 when BAE excluded.

Links to the M6 by the A590; it also has a direct connection to the national rail network.

7.4 Orkney

Orkney Islands Council Harbour Authority is responsible for a ports' estate of 29 piers and harbours. Amongst this wide range of commercial and leisure ports, there are 5 main commercial piers: Hatston, Kirkwall Pier, Stromness Pier (including Copland's Dock) Lyness and the harbour of Scapa Flow. Scapa Flow has an area of 324 square kilometres and 1 billion cubic metres of water making it the second largest natural harbour in the world.

The ports are owned by the Orkney Islands Council. Under the Orkney County Council Act 1974, the accounts for the Harbour operation must be kept separate from the General Fund accounts of Orkney Islands Council.

Orkney is Northern Europe's preferred location for ship-to-ship transfer of crude oil, gas and other products. Four ferry services and multiple freight operators serve the islands. Hatston is the main commercial maritime hub in Orkney providing facilities for freight companies, oil and gas support vessels, lifeline ferry services (passenger and freight), cruise ships and fishery support vessels. The traditional work associated with Orkney is cargo, however, it also has experience of ORE with test sites for wave and tidal energy located in Orkney waters (with testing via the European Marine Energy Centre (EMEC) based in Stromness, established in 2003).

The waters around Orkney are home to some of Europe's best wave and tidal resources; these have a global role in the development of marine renewable energy. EMEC was the first centre of its kind in the world to provide developers of both wave and tidal energy converters with purpose-built, accredited open-sea testing facilities. The EMEC test sites attract developers from all around the globe; more devices have been tested at EMEC than at any other single site in the world. The development of EMEC received over £25 million of direct funding from the UK and Scottish governments and over £40 million of UK government and EU funding was directed towards projects deploying and testing prototypes at EMEC[16]. The Orkney ports were ideally located to benefit from the business opportunities that the government support from these projects created.

These new business opportunities prompted investment in the development of Lyness (island of Hoy) and Hatston (near Kirkwall), which provided the marine renewable industry with upgraded infrastructure: piers and quayside facilities at key locations. In addition, the pier of Stromness in Orkney has been upgraded so that it is capable of serving the needs of fishing boats, ferry services, and recreational boats, as well as the ORE sector.

These improvements were part of the Orkney Islands Council "Three Port Strategy" to support the on-going development of the ORE sector through the development of specialist facilities for wave and tidal generation in Orkney. The five-year strategy developed by Orkney Islands Council focused on the Research & Development, Operation & Maintenance, Device Deployment and Local Supply Chain growth for the wave, tidal and oil and gas industries. This strategy was underpinned by a £22 million investment from the Orkney Islands Council, the European Regional Development Fund and the Scottish Government[17]. The Scottish Government is the managing authority for the European Regional Development Fund (ERDF) programmes in Scotland and has overall responsibility for the implementation, management and effectiveness of funds distributed through the programmes. One of the priority actions for the funding is "Building a sustainable, low-carbon Scotland". Similar funding could be made available in Ireland.

[16]"Research Study for Marine Energy Test Zones in Northern Ireland", InvestNI, March 2011.
[17]A three port strategy incorporating Lyness, Hatston Pier and Copland's Dock in Stromness was delivered to support wave and tidal energy development and in addition the Harbour Authority upgraded its Vessel Traffic Systems (VTS), and acquired further land assets for development all at a cost of £22 million.

Key lessons for Ireland include:

- Orkney Harbour is located close to some of the best wave and tidal energy resources in Europe. The establishment of the EMEC test centre in the area has helped drive the development of the ORE sector in Orkney.
- The development of a successful ORE sector is contingent on strategic and targeted investment. The Orkney Islands Council received Scottish government and ERDF funding towards the development of port facilities and infrastructure to support the testing of wave and tidal energy technologies at the nearby EMEC test centre.
- There are business opportunities from the test and development of prototypes as well as large-scale farms;
- The development of multi-purpose port facilities is essential as business from testing prototypes typically has gaps between various stages of research and development and associated availability of funding. A port or harbour should accommodate a test or prototype device around core activities.
- Local support from Highlands and Islands Enterprise and Orkney Islands Council and other Orkney companies, to foster the evolution of this new industry as it moves towards the commercial deployment of wave and tidal technologies.

Orkney Ports Estate

Orkney is Northern Europe's preferred location for Ship-to-Ship transfer of crude oil, gas and other products. 4 ferry services and multiple freight operators serving the islands. Hatston is the main commercial maritime hub in Orkney providing facilities for freight companies, oil and gas support vessels, lifeline ferry services (passenger and freight), cruise ships and fishery support vessels.

Quay Length & Water Depth

- Six berths available with a size of 225 metres
- Hatston is now identified as the longest deep water commercial berth in Scotland at 385m in length and 10.5m draft.
- Lyness Pier has 26m of safe and sheltered mooring and 4 hectares of hard standing will assist with the assembly and maintenance of marine renewables devices.

Quay Space

- Lyness Pier has 4 hectares of hinterland for storage and assembly.

Craneage

Cranes are available by arrangements with local contractors.

Support Services

- Bulk and Lo-Lo and Linkspan. The pilot launch 'Kirkwall Bay' is normally available for towage.

Close to the west of Shetland and North Sea development areas

7.5 Able Humber Port: East Coast of England

ABLE Humber Port, situated on the South bank of the River Humber on the East coast of the UK is a new privately owned port, being developed by Able UK Ltd, with the aim of providing a multi-purpose facility which will serve the needs of the Offshore Renewable Energy sector.

The new development includes ABLE Marine Energy Park (AMEP) and ABLE Logistics Park (ALP) and the UK Treasury has confirmed AMEP as an Enterprise Zone that is eligible for 100% enhanced capital allowances. AMEP is situated on the widest part of the Humber Estuary. The Humber's natural characteristics offer a sheltered harbour location with two deep water channels providing quick and unhindered access to the open seas.

AMEP was conceived in late 2009, and after a planning process lasting over three years, the port achieved planning permission in February 2015. The Quay Design has been completed for a concrete quay with a capacity: 20T/m^2 UDL and patch loads up to 60T/m^2. The quays are designed to be capable of operating at -17m CD.

The quay is designed to provide an installation base for the ORE sector and to accommodate the needs of jack-up installation vessels and associated construction vessels. The development aims to provide the robust infrastructure that the OWT industry seeks, allow tenants to benefit from economies of scale by creating a truly integrated offshore wind cluster and play a pivotal role in accelerating offshore wind installation rates and achieve vital cost reductions. Land is available for development immediately and the first quays are planned to become available in 2018. To date, £50m has been invested in preparing AMEP for the speedy construction of industrial facilities for its tenants.

Other ports in the Humber Estuary are also active in the Offshore wind sector, for example the ports of Grimsby and Immingham owned by Associated British Ports (ABP).. ABP are also working with Siemens on the £310m Green Port Hull development. Hull City and East Riding Councils and Associated British Ports (ABP), along with partner organisations, have been working together in the Green Port Hull vision. Funding from the UK government, through the Regional Growth Fund, has been secured for skills and employment, business support, and research and development to ensure that local people and business gain maximum benefit from the renewable energy sector. 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. The blade manufacturing facility has created 1,000 jobs within the supply chain.

The Humber estuary has potential to provide economies of scale to the ORE industry due to the facilities and infrastructure available at the ports in the area as well as the proximity to several large-scale wind farms:

- Humber Gateway Offshore Wind Farm (73 turbines, 219MW capacity)[18];
- Westermost Rough Offshore Wind Farm (35 turbines, 210MW capacity)[19];
- Race Bank Wind Farm (91 turbines, 574MW capacity)[20]

The development of the new Able Marine Energy Park (AMEP) is supported by the Triton Knoll offshore wind farm (90 turbines, 860MW capacity) being developed by the Innogy Renewables UK Ltd. The Triton Knoll developer has publically stated that it intends to be the first customer and use AMEP as a construction base if the facilities are built in time.

[18]https://www.thecrownestate.co.uk/energy-minerals-and-infrastructure/offshore-wind-energy/offshore-wind-electricity-map/
[19]https://www.thecrownestate.co.uk/energy-minerals-and-infrastructure/offshore-wind-energy/offshore-wind-electricity-map/
[20]https://www.thecrownestate.co.uk/energy-minerals-and-infrastructure/offshore-wind-energy/offshore-wind-electricity-map/

Other investors in offshore wind developments in the Humber area include DONG Energy, which agreed to invest £6 billion in the Humber region over the period of 2013 – 19[21]. Over this period this provides:

- An average of 1,600 construction jobs per year in the Humber region;
- The creation of up to 500 long-term jobs in DONG Energy's operations and maintenance;
- £1.2 billion potential Gross Value Added (GVA) which could be secured by the Humber from 2010 – 2030.

Lessons for Ireland from the proposed new development of ABLE Humber Port and existing ports in the Humber Estuary include:

- Attracting investment from energy companies to develop large scale offshore wind farms stimulates investment in ports and provides opportunities to attract manufacturing facilities to the area.
- Local Government support for the development of a skilled work force and a strong local supply chain provides additional incentives to attract investment from the energy companies for the construction of offshore wind farms.
- Cooperation and collaboration among local businesses and port companies, supported by national government, can help attract inward investment.
- There are opportunities to develop new port facilities and port services to cater for the specific requirements of offshore wind farms that offer more flexible and offer different pricing mechanisms from conventional ports.

ABLE Humber Port [under development]

New port being developed by Able UK Ltd and designed specifically for the marine renewables sector, to provide for the manufacturing, storage, assembly and deployment of next generation offshore wind turbines and the associated supply chain

Quay Length & Water Depth

- Total quay length: 1,389m
- Quay width: 28m
- Quays designed to be capable of operating -17.00mCD

Quay Space

- Concrete quay capacity: 20T/m2 UDL with patch loads up to 60T/m²
- Berths pocket 60m wide
- Berths: Engineered floor (100T/m²)
- Quays designed to allow vessels to jack-up alongside

[21]Impact of DONG Energy Investments in the Humber Area (Regeneris Consulting, November 2015) – see http://www.hornseaprojectone.co.uk/en/news/articles/dong-energy-to-invest-£6-billion-in-humber-by-2019 and https://assets.dongenergy.com/DONGEnergyDocuments/uk/Offshore%20Wind%20Week/REGENERIS%20DONG%20Impact%20on%20the%20Humber%20Study%20-%20FINAL.pdf

7.6 Cuxhaven, Germany

The Seaport of Cuxhaven is situated directly on the Elbe estuary leading to the North Sea. The port is positioned opposite the entrance to the North Sea canal.

The ports is owned by the German company Niedersachsen Ports GmbH, that owns and operates five seaports, seven island supply ports and three regional ports along the German North Sea shore.

Other port facilities in the area include Cuxport, which is privately owned by Rhenus Group, a global logistics service company with a turnover of €4.6 billion.

The port of Cuxhaven is located near sites available for the development and construction of offshore wind turbines, for example, large scale offshore wind farms being developed in the area by DONG energy include:

- Borkum Riffgrund 1 (78 turbines / 312 MW) – operational
- Borkum Riffgrund 2 (56 turbines / 450 MW) – under construction

Since 2007, the "Offshore Base Cuxhaven" has been developed. The location and existing facilities at the port for shipping large wind turbine generators and erecting them at sea enables the ports to win contacts as offshore wind farms began to be deployed in the area. Through proactive investments of the State of Lower Saxony and the support of the EU, an optimal infrastructure for offshore wind energy was created that has two offshore terminals, heavy duty roads and the heavy load platform for the trans-shipment of completely assembled offshore systems / offshore components, which provides ideal conditions for the offshore industry on the German North Sea coast.

The expansion of the port's offshore terminal was seen as a natural step after Siemens decided to build a wind turbine factory in Cuxhaven, and after a number offshore wind-related companies established their presence in the area. Siemens invested around €200 million to build its first production facility for offshore wind turbine components in Germany.

The City of Cuxhaven has aligned itself optimally to the economic opportunities of renewable energy, which has led to the establishment of "Offshore Base Cruxhaven". Funding from the State of Lower Saxony and the EU was used to create an infrastructure to build and ship all of the components necessary for offshore wind turbine generators. In recent years, more than € 80 million has been invested in the infrastructure of the Offshore Base Cuxhaven, and in addition, private investors in the offshore industry have invested more than € 100 million in Cuxhaven during 2007 and 2008. Additional private and public investments are forthcoming in the next few years.

A Cuxhaven Port Business Community (HWG) was established that coordinates the interests of its member companies that represent several maritime business sectors. HWG acts as the interface between the maritime sector, the town's marketing activities and regional developments and the the many business cooperation arrangements at the site provide potential for collaboration between companies operating in the port town.

Lessons for Ireland from Cuxhaven Port include:

- Exploiting location advantages to offshore wind farms by Investing in appropriate infrastructure to pursue opportunities in the ORE sector. For example: Cuxhaven Port had invested in heavy load berths which allowed it to get involved in offshore wind turbine manufacturing;
- A coordinated approach with local government and the private sector to attract additional funding, including from the EU, to help develop new infrastructure and develop a strong local supply chain with an appetite for growth.

Cuxhaven Germany

The port of Cuxhaven has modern port facilities that meet the demands of the maritime economy at an advanced level. Facilities are available at two offshore terminals as well as the multi-purpose terminal operated by Cuxport.

Quay Length & Water Depth

- The quay lengths available are 376m (Offshore Terminal I) and 737m (Offshore Terminal II)
- Water depth between 9.5m and 12.7m.

Quay Space and Storage

- 231 hectares are areas of land and storage facilities
- Heavy load platform – 1,600sqm with a load capacity of 90 metruc tons / sqm.

Craneage

- Gantry crane (600t)
- Crawler crane (up to 1,200 t lifting capacity)

Support Services

- Ro-Ro ramps (up to 380t)
- 3 berths for jack-up installation
- Stevedoring operations occur at the production, installation and base port

7.7 Esbjerg, Denmark

The Port of Esbjerg is Denmark's largest port on the North Sea and is a public self-governing port owned by the Municipality of Esbjerg. There are more than 200 businesses located at or near the port. These employ more than 10,000 people and make up Denmark's strongest offshore cluster, which includes offshore wind, oil and gas.

The Port of Esbjerg is the leading port in Europe in terms of handling and shipping out wind power. The port's experience in the offshore wind industry developed over a decade ago with the installation of the world's first large-scale offshore wind farm, Horns Rev I. In 2016, a total of 1100MW of offshore wind power was shipped from the Port of Esbjerg. MHI Vestas Offshore Wind has increased its presence at the Port of Esbjerg. The company is based at the new East Port, and from 2013 five projects have been executed from the facility. MHI Vestas uses the area for pre-assembly and the shipment of offshore wind turbine components. The Port of Esbjerg, also offers the operation and maintenance (O&M) and decommissioning for the wind turbines. The port encourages early involvement with the port in the planning for offshore wind projects. This includes hosting tours of the port facilities and the port playing an active role in assessing costs and identifying areas for cost reductions.

In 2000, the Port of Esbjerg went from being state-owned to a public self-governing port owned by the Municipality of Esbjerg. Since 2003, the Port of Esbjerg invested around €250 million in new areas and port facilities to meet the demands from the offshore industry and pave the way for future growth. The facilities developed at Port of Esbjerg are multi-purpose and in addition to being a leading North Sea offshore wind port, the port is the base for the Danish offshore oil and gas industry and an international hub for multimodal transport with six scheduled RoRo routes.

Sources of funding have included €4.7 million from the TEN-T programme 2007-2013 for infrastructure and facilities to improve the maritime link between Esbjerg and Zeebrugge. A study on developing an intermodal rail/road/sea terminal at the Port of Esbjerg was funded through the European Regional Development Fund.

The Port of Esbjerg has joined the Danish, Belgian and German governments, with a number of leading energy companies, shipping companies and wind turbine manufacturers from the offshore wind industry to further the deployment of offshore energy. A joint statement from all stakeholders involved[22] confirms the ambition to exploit the potential of offshore energy in the North Sea. The industry will install 60 GW of new capacity in the North Sea between 2020 and 2030, or a minimum of 4 GW per year. The Port of Esbjerg also expects to increase activity towards 2030, both within existing and new business areas. Therefore, to be able to meet the future demand, the Port of Esbjerg needs approximately 1,000,000m^2 additional laydown space and 1km of additional quay length developed between 2022 to 2030.

Lessons for Ireland from Port of Esbjerg include:

- The importance of the proximity of the supply chain: at the Port of Esbjerg, the entire supply chain for the offshore wind energy industry (which includes the handling, manufacturing and servicing of wind installations) is located at the port. This makes the port particularly attractive to developers of offshore wind farms.
- Ensuring that any infrastructure improvement projects are multipurpose to deal with any gaps in the pipeline of offshore projects;
- Early involvement with the port in the planning for projects is important as a flexible approach is needed to support the development of offshore wind farms
- A co-ordinated approach and collaboration between the port and the offshore wind farm developers enables the ports to play an active role in supporting the growth of the offshore wind sector.
- The port ownership model is similar to Ireland's main ports and development of new facilities has been financed from revenues generated by the port and supported by EU funding, which could be replicated by Irish ports.

[22]Danish, Belgian and German governments, with a number of leading energy companies, shipping companies and wind turbine manufacturers from the offshore wind industry

Esbjerg, Denmark

A major Nordic intermodal hub, covering more than 4,500,000m2. More than two thirds of the offshore wind capacity in Europe originates from the Port of Esbjerg, and in total more than 6.5GW of offshore wind capacity has been shipped out from the port since the beginning of the offshore wind era.

Quay Length & Water Depth

- The 16km-long approach channel is 200m wide and is maintained with the least water depth of 10.3m.
- The Port of Esbjerg can accommodate vessels up to 250m in length and has more than 12km of quay.
- The Englandskaj serves as a passenger quay with a length of 310m and an alongside depth of 7.6m, while the Fargehavn handles containers, passengers and ferries over a length of 420m and has an alongside depth varying from 4.4. – 9.3m.

Craneage

- Nine cranes with up to 150t capacity.

Support Services

- Stevedoring activities conducted at the port by Niels Winther

The port is directly accessible by the E20 motorway and the rail network, and Esbjerg airport is 15 minutes by car.

7.8 Summary

The ports included in the benchmarking exercise illustrate how the establishment of a pipeline of ORE projects in a region can support the business case for investment in port infrastructure, the local supply chain and new manufacturing facilities, which promotes further growth in the ORE sector and leads to economic benefits in terms of job creation.

Ports in Europe who have successfully exploited opportunities in the ORE sector provide key lessons for Ireland's ports with ambitions to pursue opportunities in the ORE sector. These include:

- Supporting the establishment of the ORE sector in Ireland – the ORE sector presents new business opportunities for Irish ports. Government policy that supports and facilitates the financing of ORE projects is a key requirement to attract the investment from the energy companies to construct the offshore projects. Ports can support the establishment of an ORE sector by collaborating with the energy companies developing ORE farms, and the local supply chain, to make a clear case to government of the wide range of economic benefits of the ORE sector. It is also essential that the conditions needed to secure investment to construct ORE projects, and any new port facilities needed to support this, are clearly presented to government so that appropriate policy and frameworks can be put in place. The growth of an ORE sector in Ireland could support investment in new multi-purpose facilities at the ports that cater for any new requirements from the ORE sector, as well as supporting growth in the ports' traditional business areas.
- Early engagement from the ports with ORE developers – ports have a key role to play in the construction and operation of ORE projects. Early involvement of the ports with developers active in their region can help developers find the most cost effective ways to deliver their offshore projects, which will facilitate the financing and construction of the projects. Supporting the continual drive for cost reduction on ORE projects means larger offshore farms can be built in the future, which in turn generates more business for the ports. Engagement with the ORE developers also provides valuable insights on the potential pipeline of projects that will inform the review and updating of the ports master plans.
- There are a wide range of port development opportunities linked to the ORE sector – Ports should consider areas required to support ORE development and develop detailed plans to demonstrate how they can fulfil (some or all of) the requirements. Options include accommodating test or prototype devices around the ports other core activities, establishing a base for the operation and maintenance of turbines or providing the heavy lift capabilities and large quay areas for the handling, assembly and construction of offshore wind farms and other ORE projects. For the large scale offshore farms, the investors and energy companies involved can enter into long term contracts with the ports to cover a pipeline of projects they plan to develop in the region. This in turn enables the ports to commit the investment in upgraded and new facilities to support the ORE development and construction activities. In other cases the ORE developers or turbine manufacturers can partner with the port and provide direct investment in any new port facilities required. A range of models for investment in new port facilities to cater for the ORE sector are possible in Ireland that mirror what has been achieved elsewhere in Europe.
- Developing networks and strong local supply chains - Historically ports have developed in support of local traditional industries such as coal exports, steelmaking, agriculture, fishing and ferry terminals. As traditional businesses have declined, the survival of some ports has only been possible by making proactive, strategic decisions to pursue emerging opportunities like the ORE sector. In addition to the right infrastructure, access to a skilled workforce, a strong local supply chain and committed local businesses improves a port's attractiveness to potential business from ORE sector developers.
- Identify sources of EU funding for any new port facilities required - The development of the ORE sector is a priority at EU level and funding is available to support the development of the sector, and its supply chain. For example, the "Low Carbon Economy" is a priority area for the European Regional Development Fund (ERDF), which has been used by member states to support investment in port facilities to meet the requirements of the ORE sector. In Ireland, the ERDF is delivered through two Regional Operational Programmes managed by the relevant Regional Assembly and Enterprise Ireland (EI) has responsibility for implementing and managing relevant ERDF grants. Further information on EU funding for ports is available through the IMDO.

8.0

Estimating Potential Job Creation from ORE Developments

8.1 Introduction

This section estimates the potential for job creation, both at specific ports and through the supply chain, arising from offshore renewable energy sector developments, and activities and services provided from Irish ports.

Job creation is reported under three separate scenarios. Firstly, the report considers a baseline level of activity broadly consistent with existing targets, policy environment, and plans for development and investment. This scenario is then varied to produce a "high deployment" scenario where the infrastructure to support deployment of offshore renewable energy is upgraded and used to its full capacity, and a "low deployment" scenario where a lower level of activity is supported by use of existing facilities.

8.2 Approach / Methodology

8.2.1 Introduction: Evidence Underpinning Economic Model

The overall approach to estimating job creation potential has been to: collate the available market intelligence and use this to undertake an assessment of the potential to create jobs and then build a realistic economic model to quantify this. (Market intelligence has been gleaned from the offshore renewable energy sector, the benchmarking exercise, and consultations with the ports on the types of services supplied, and associated skills required). This approach has allowed the creation of a set of scenarios, and an economic model, which reflect the latest available information direct from ports and potential developers. These scenarios are considered to appropriately reflect the supporting infrastructure and supply chain required for potential ORE developments on the island of Ireland.

8.2.2 Approach to Modelling – Underpinned by Installation/Capacity rather than Investment

The review of market intelligence identified that the opportunities for offshore renewable energy deployment chiefly concerned offshore wind. Offshore wind farms have hitherto been constructed with fixed foundations. However, recent technological developments have made it possible to construct wind turbines with floating foundations, which have the advantage that they can be deployed in deeper water. There is also the potential to develop test sites for wave energy and (under a high deployment scenario) to scale these up.

A conclusion from the market intelligence (including consultations) was that the capacity of Ireland's port infrastructure to manufacture and deploy ORE installations (that is: the rate at which they could be assembled, floated out to their location, and installed), and the extent to which the supply chain could be provided locally[23], was a key determinant of the overall employment impact. It was also the case that much more information was available about the type and scale of potential development than any projected costs. For these reasons, the employment model and scenarios have been designed to use the number, rated power (in MW), and type of installation as their baseline for calculating impact, rather than expenditure. The job creation impact per MW of capacity (direct, indirect, and induced) have been estimated using benchmark ratios from the review of literature. This has allowed us to prepare scenarios by varying the capacity and throughput of the port infrastructure in response to potential development activity.

8.2.3 Job Creation Impact: Typology

Job creation occurs at various stages and timelines within offshore renewable energy projects, and depends upon their size and the types of projects (offshore wind, wave and tidal). Job creation will take place at every step in the supply chain to the ports and offshore renewable installations, and the model distinguishes between the following:

[23]Evidence of this from:

- Temporary employment supported during the construction of each project
- Direct employment at each project
- Indirect employment supported by supply chain expenditure (for example: jobs at ports supported by ongoing maintenance and services)
- Induced employment supported by expenditure of wages (for example: retail and personal service jobs which are supported in the locations where direct and indirect employees live).

8.2.4 Sources and General Assumptions – all Scenarios

The key sources of information for the model have been:

- Stakeholder consultations (see table presented in Chapter 5 – Section 5.2);
- Detailed information on the pipeline of projects identified by industry (see Chapter 5 – Section 5.3);
- The Economic Impact of the Irish Bio-Economy: Bio-Economy Input-Output Model – Development and Uses (Teagasc, SEMRU, NUI Galway, Marine Institute 2015);
- Ireland's Ocean Economy (SEMRU 2017);
- The Value of Wind Energy to Ireland (Pöyry, Cambridge Econometrics 2014);
- Economic impact of the proposed Neart na Gaoithe offshore windfarm (University of Strathclyde Fraser of Allander Institute, 2017);
- Beatrice Offshore Windfarm Limited project: Socio-Economic Impact Report (SSE, NEF Consulting 2017); and
- The Economic Impact of the Development of Marine Energy in Wales (Regeneris, Cardiff Business School, 2013).

Calculations of the "jobs per megawatt" for offshore wind turbines are largely based on The Value of Wind Energy to Ireland (2014), which also provides benchmark estimates of the indirect and induced impact of fixed turbines. The net impacts of maturing supply chains and port infrastructure, and in particular, the ability to manufacture floating foundations for offshore wind turbines, are based on the two Scottish case study projects: Neart Na Gaoithe (NNG), and Beatrice Offshore Windfarm Limited (BOWL). Direct and indirect jobs from wave energy are based on The Economic Impact of the Development of Marine Energy in Wales (2013).

Apart from sources cited above and detailed information extracted from these to underpin the model, regarding the broader context, it is also assumed that development is not constrained by external effects. These general assumptions apply to all scenarios and reflect challenges highlighted earlier in the report. It is necessary to make these assumptions (that the challenges are overcome and do not pose an obstacle to development) to underpin the development of the economic model which provides a forecast of the employment potential of ORE developments. However, it is important to state that for these forecasts to be realised, the challenges underpinning the assumptions would need to be addressed and resolved.

Specifically, the assumptions underpinning the model are:

- the policy environment allows for development of sector (regulatory such as: planning consents, licensing, suitable mechanism / feed-in tariff in place to lead to development of offshore wind, etc.);

- consultations with supply chain companies who are actually doing work in the UK e.g. Irish Sea contractors who made reference to this issue
- consultations with Belfast Port and H&W – this is a conclusion that could be drawn from consultation with them

- investment is available to support the developments;
- logistics of supply are not adversely impacted by Brexit;
- adequate access to the grid for the proposed developments;
- adequate generation capacity within the grid / grid infrastructure to accommodate additional energy production;
- suitable locations exist for all the potential developments.

The scenarios discussed in this chapter reflect the range of what could be developed in order to ascertain the range of potential economic benefits and how they are linked to activities at the ports. What will happen in practice will be determined by progress on the issues referred to in the assumptions above.

The three scenarios are investigated in detail in the following sections.

8.2.5 Consistency of approach with existing data, research and reports

An objective of the research was to make maximum use of information derived from SEMRU publications on the Irish marine economy, and provide compatibility with their results. Three relevant publications from SEMRU or using SEMRU data are:

- The Economic Impact of the Irish Bio-Economy: Bio-Economy Input-Output Model – Development and Uses (Teagasc, SEMRU, NUI Galway, Marine Institute 2015)
- Ireland's Ocean Economy (SEMRU – an ongoing series, latest publication 2017)
- A Study of the Current and Future Skills Requirements of the Marine/ Maritime Economy to 2020

The sector definitions and data for "Marine Renewable Energy" and "Marine Manufacturing, Construction, and Engineering" are appropriate for the present study. However, there are some caveats. The "Marine Renewable Energy" sector includes substantial research and development activity which is not directly relevant to this study (i.e. it is not a direct match for the jobs involved in operating offshore renewable devices). The "Marine Manufacturing, Construction, and Engineering" sector is a good match for the activity required in installing offshore renewables, but the Bio-Economy Input-Output Model reveals that the sector in general is very tightly-bound to the Irish economy via its supply chain, whereas the supply chain for construction of offshore renewables relies extensively on imports.

As a result, the information available for the two sectors discussed above is not suitable for use in the job creation model – in particular, for the construction phase, the indirect and induced employment which would be estimated using the Bio-Economy Input-Output Model would be greatly in excess of what would be expected given the largely overseas nature of the Irish supply chain for offshore renewable installations.

However, as the activities described by the "Marine Manufacturing, Construction, and Engineering sectors are a good match for offshore renewable installation, it seems likely that the occupation and skills implications of offshore renewables construction will be described accurately by referring to the sector profiles in the "Ireland's Ocean Economy" and "Future Skills Requirements" documents.

A further point in relation to consistency is that the proposed scenarios are all well within the development potential that was reported in the Strategic Environmental Assessment (SEA) in the OREDP and which is projected at 6,000MW by 2030 (4,500MW from Offshore wind and 1,500MW of Wave and Tidal Devices.[24]

[24]Offshore Renewable Energy Development Plan, Department of Communications, Energy and Natural Resources, February 2014, p.30, Table 3. Total Development Potential for each Assessment Area.

8.3 Three Scenarios - Summary

8.3.1 Description

The distinguishing characteristics of the three potential scenarios are therefore as follows:

- The number and type of ORE installations: fixed wind, floating wind, or wave;
- The location and timeline for construction, linked to the capacity of ports to support their manufacture and deployment;
- Development of the (currently immature) supply chain and support infrastructure on the island of Ireland, which affects the level of employment impacts that can be captured relative to those that take place or are serviced from overseas.

The three scenarios are summarised in the table below.

Table 8:1: Summary of the Scenario Characteristics

Energy Type		Baseline	High deployment	Low deployment
All	Total Energy production (MW)	1,505 MW	5,200MW	1,005 MW
Fixed wind	Fixed wind turbines (10MW) Indicative[25] number of turbines (sites)	100 (2 sites)	300 (6 sites)	100 (2 sites)
	Manufacture	None	Foundations (1 project)	None
	Construction	Existing capacity	Existing capacity	Existing capacity
Floating wind	Fixed wind turbines (10MW) Indicative[26] number of turbines (sites)	50 (1 site)	200 (4 sites)	None
	Manufacture	Foundations	Foundations	-
	Construction	New facility	Major new facility on west coast	-
Fixed and Floating Wind	Wind farms in Irish Sea	2	5	2
	Wind farms outside Irish Sea	1	5	None
Wave	Wave energy units (1MW)	5 (pilot)	100 (from 2 pilots)	5 (pilot)
	Manufacture	Devices and outfitting	Devices and outfitting	Belfast or GB
	Construction	Existing capacity	Major new facility on west coast	Existing capacity
All	Port development to capacity of Belfast	Expansion at one core port	Expansion at one core port	None
All	Operation and Maintenance	Ireland	Ireland	Belfast or GB

Source: Consultations, literature review, and market intelligence collation

[25]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

[26]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

All of the scenarios are based on extensive and recent consultation with the ORE sector; they draw on evidence about the pipeline of projects and their potential generation capacity which could be realised if market conditions were unconstrained.

In the high deployment scenario, we consider three types of ORE including fixed wind, floating wind and wave. Total energy deployment under this scenario is forecast to be 5,200MW by 2030. Whilst this is broadly consistent with findings from the OREDP and the associated Strategic Environmental and Appropriate Assessment of Ireland's Offshore Renewable Energy Potential. It is important to note that the mix of ORE in the deployment scenario was developed from the consultations with developers.

8.3.2 Proposed Timescales for Deployment

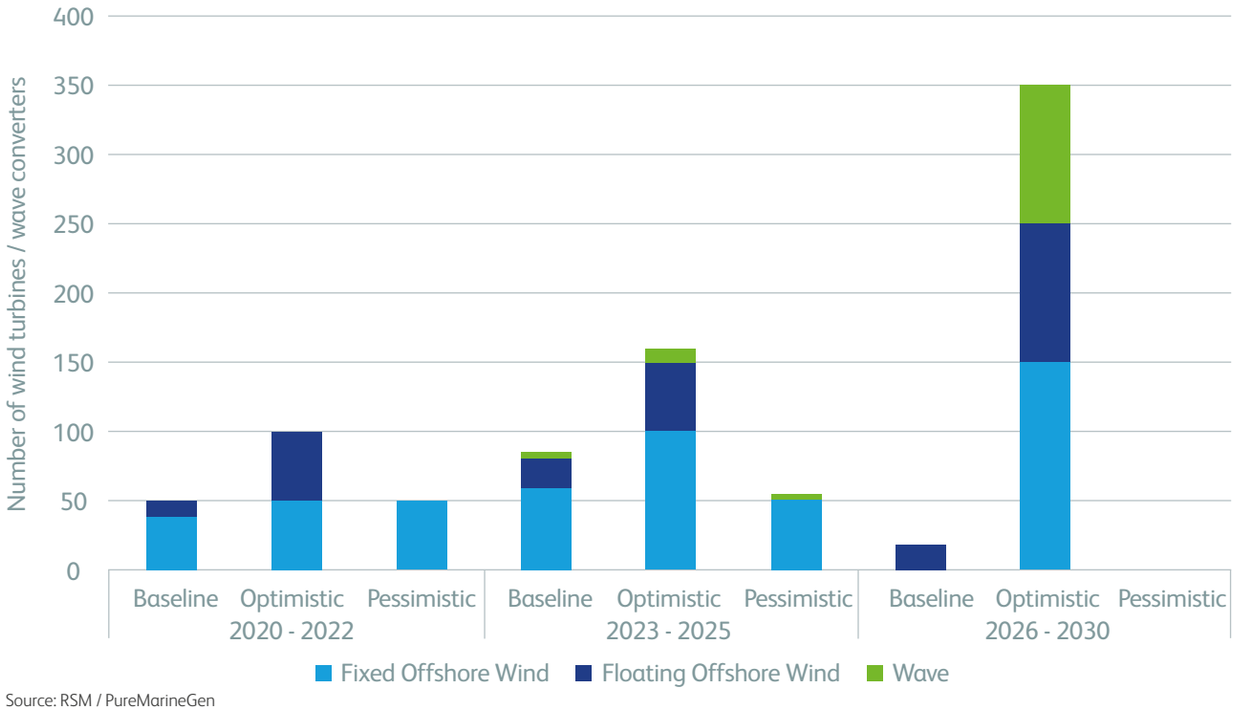
The timelines for deployment under each scenario have been grouped into three periods: 2020-22, 2023-25, and 2026-2030 (i.e. two three-year periods followed by a five-year period). These periods have been selected to provide three phases: firstly, initial deployment and infrastructural improvements; secondly, scale-up to full deployment, and (depending upon scenario) a final period of either enhanced deployment or scaling back of activity.

The actual impacts can vary within each of these periods as investment and activity are unevenly distributed. However, the model outputs show the total deployment in each of the three periods, and the job creation impacts, expressed both as annual Full Time Equivalent employment (FTE) and as overall person-years, across each of the three periods.

8.3.3 Overview of Scenarios

The chart below illustrates the three scenarios including energy / development mix and timescales.

Figure 8:1: Overview of Scenarios



Source: RSM / PureMarineGen

8.4 Scenario 1: Baseline

8.4.1 Description of Scenario

Based on the review of market intelligence and the consultations, the baseline scenario describing the most probable level of activity to 2030 (with appropriate permissions, policy environment, and investment) is as described in the table below.

This is based on current farms/projects where this is scope for further development and other sites where some preparatory activity has taken place and subject to removal of current barriers and constraints, these could be underway within 2-3 years. These include for example:

- Arklow Bank stage 1 (25MW) is already operational; the site was initially developed for a 500MW that could be realised in the near term;
- Codling Bank has received consents and others (Oriel and Dublin Array) could also be ready for construction in a short time frame (1-2 years).
- Site investigation studies have been undertaken at other sites where wind farms could be constructed within 2-3 years;
- A developer indicated that they could be ready to construct from starting on a new site within 2-3 years; they are already reviewing site options in Ireland.

Table 8:2: Baseline – Estimate of Deployment Levels

Technology	No of farms / projects	Indicative[27] No of turbines / units per farm	Total Energy production (MW)	Construction / Assembly facility at Ports	Manufacturing facility
Fixed Wind	2	50	1,000MW	Existing	None
Floating Wind	1	50	500MW	New	Foundations
Wave Energy	1	5	5MW	Existing	Devices and outfitting

Source: Market intelligence review and consultations

8.4.2 Specific Assumptions underpinning the Scenario

8.4.2.1 Wind

- Scale: Each of the offshore wind farms is assumed to comprise 50 turbines rated at 10MW. Assembly – this is an indicative number of turbines for the purposes of modelling.[28]
- Construction /Manufacturing Facilities at Ports on island of Ireland: installation of a single wind farm of the scale described above would require a facility such as Belfast's D1 for 12-18 months' work. Under the baseline scenario, it is also assumed (based on the consultations) that there will be a port development to the equivalent capacity of Belfast's D1 in one of the core ports: Dublin, Cork, or Shannon Foynes, and that both these ports will be used during the scenario period.

[27]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions
[28]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

- Location of Wind Farms: The additional port development will also permit one of the three wind farms to be installed off the south or west coast (with the remaining two sited in the Irish Sea).
- Developers: There are at least three potential developers for the wind farms.
- Fixed vs Floating and Manufacturing Location: One of the three wind farms will be installed using floating foundations; these foundations will be manufactured in Ireland, allowing a higher proportion of the activity to be captured within the economy of the island.
- Operation and Maintenance: The Irish Sea sites are likely to be maintained from Belfast or another Irish port rather than Great Britain; the site off the south or west coast will be maintained from its port of manufacture.

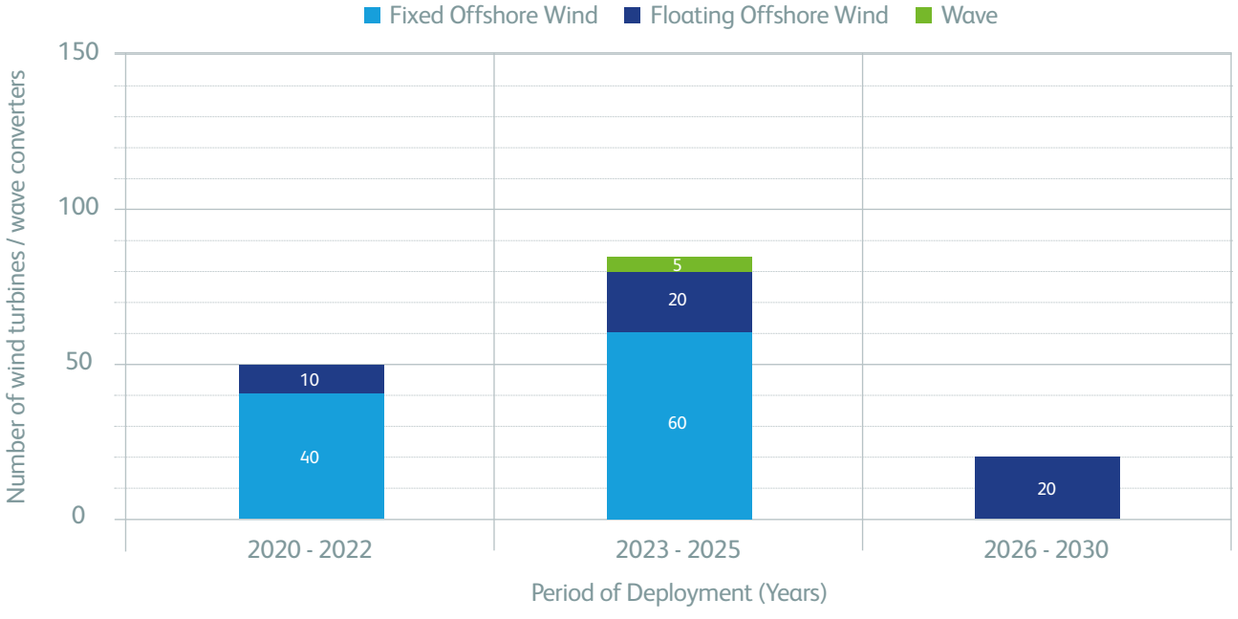
8.4.2.2 Wave

Wave energy investment is expected to be limited under the baseline scenario, but it is assumed that a demo project of 5 devices (5 MW total rated power) will be installed on the west coast, potentially developed by ESB. This assumption is based on ESB plans: ESB were successful with an application for EU funding and were awarded €20 million towards the construction and operation of a 5MW (~5 device) demonstration wave farm. They are currently assessing suitable sites, including a site in Co Clare, and are also assessing the suitability of a range of wave devices for the project. None of the grant has been drawn down yet: it will only be paid when the wave farm is operational. The lack of a mature technology is the main barrier to progress at present. Manufacture of potential devices for this project will not require any additional development of port facilities for the project to proceed.

8.4.2.3 Timescales

The most probable timeline for deployment under the baseline scenario is shown in the figure below.

Figure 8:2: Possible timeline for deployment under Baseline Scenario



Source: RSM/PureMarineGen

8.4.3 Key Findings

The job creation potential of the baseline scenario is described below. None of these jobs currently exist. The projected figures for job creation have been determined by consultations on the number and scale of offshore renewable installations that might reasonably be developed over the plan period, the port capacity and facilities required to install and maintain them, a review of the published economic literature on job creation and supply chain impacts for comparable ORE projects and the Irish economy in general, and an economic model which reflects all these factors.

Table 8:3: Job creation impacts: baseline scenario

	Temporary direct employment in construction phase (person-years)		Permanent direct employment in operations and maintenance (person-years)		Indirect + induced employ-ment (person-years)	Total employ-ment (person-years)	Peak total FTE jobs	
	Wind	Wave*	Wind	Wave	Wind + wave	Wind + wave	Const	O&M
2020-22	3,300	0	200	0	1,300	4,900	1,500	170
2023-25	5,300	160	800	10	2,300	8,500	2,500	440
2026-30	1,300	0	1,700	20	1,700	4,700	400	570
Total	9,900	160	2,700	30	5,300	18,000	2,500	570

Notes:
* Wave: Person-years in the construction phase include indirect and induced effects
All results have been rounded to 2 significant figures; however, unrounded statistics have been used in all calculations. In some cases, the total row may not appear to equal the sum of its contents – this is an effect of the rounding process and does not affect calculation accuracy.

Over the period 2020-22, there are projected to be an average of 1,100 direct FTE construction jobs provided by wind farm construction. These would give rise to a further projected 450 indirect and induced FTE jobs (due to the supply chain effects and the expenditure of wages). By the end of the period, there are projected to be 120 direct operations and maintenance FTE jobs and a further 50 indirect and induced operations and maintenance FTE jobs.

In 2023-25, as floating wind generation increases and the demonstration wave project comes online, there are projected to be an average of 1,800 direct FTE construction jobs. These would give rise to a further ~800 indirect and induced jobs. (Note that the ratio of indirect and induced jobs to direct jobs – the "employment multiplier" - is slightly higher than for 2020-22 as floating wind becomes more prominent in the installation mix and its manufacturing inputs are captured in Ireland). By the end of the period, there are projected to be 320 direct operations and maintenance FTE jobs and a further 120 indirect and induced operations and maintenance FTE jobs.

Installation of wind farms is lower in the final period 2026-30, requiring a projected 260 direct FTE jobs and 140 indirect and induced jobs. Due to increasing total installed capacity but reduced installation activity, employment in operations and maintenance for this final period is more significant than the temporary construction employment; by 2030, there are projected to be 370 permanent maintenance jobs and a further 200 indirect and induced operations and maintenance jobs.

The model results (in terms of job creation potential) across the three periods are summarised into total person-years (and peak total FTE jobs within each period) in the table below:

In summary, if this scenario was realised, the job creation potential over eleven years (2020 to 2030) is projected to amount to 18,000 person-years. Around half of this would be from temporary employment during the construction phase (job creation potential: 9,900 person-years), with almost one third arising from indirect and induced employment (5,300 person-years) and about 15% arising from direct employment (2,700 person-years)).

Some examples of specialist employment which would capture effects locally, as derived from the consultations, are as follows:

Construction and assembly at Belfast (12-18 months per 500MW wind farm):

- 100 direct FTEs for wind turbine construction
- 30-40 direct FTEs for foundation development
- 30-40 indirect FTEs (cargo handlers/electricians) to support construction
- 10-15 indirect FTEs (cargo handlers) to support foundation development

Construction and assembly at a core port redeveloped to similar capacity to Belfast (12-18 months per 500MW wind farm):

- 100 direct FTEs for wind turbine construction
- 30-40 direct FTEs for foundation development
- 30-40 indirect FTEs (cargo handlers/electricians) to support construction
- 10-15 indirect FTEs (cargo handlers) to support foundation development

8.5 Scenario 2: High Deployment

The detail of this scenario was discussed and agreed with the Steering Group.

8.5.1 Description of Scenario

The high deployment scenario modifies the baseline scenario by:

- making full use of port capacity (including a second facility of equivalent scale to Belfast) throughout the period 2020 to 2030;
- making greater use of floating turbines (and therefore a higher proportion of construction impact captured in Ireland); and
- developing greater supply chain integration leading to higher indirect and induced impact in the second and third time periods.

This corresponds to all the wind farms currently being developed (4-5) (as discussed under the baseline scenario) being brought through for construction. Plans for floating wind by two developers would be realised by the development of 4 projects; the wave energy proposals would result from ESB and one other accelerating development. These assumptions are supported by evidence from the consultations. It was clear from consultations that this is easily achievable if there was a desire within government to do so. In summary, all of these projects are either being actively developed or considered as feasible by interested developers, subject to appropriate levels of investment and clarity as to regulatory conditions.

Table 8:4: High Deployment – Estimate of Deployment Levels

Technology	No of farms / projects	Indicative[29] No of turbines / units per farm	Total Energy production (MW)	Construction / Assembly facility at Ports	Manufacturing facility
Fixed Wind	6	50	3,000MW	Existing	Foundations (for 1 project)
Floating Wind	4	50	2,000MW	New	Foundations
Wave Energy	2	100	200MW	Existing	Devices and outfitting

Source: Market intelligence review and consultations

8.5.2 Specific Assumptions underpinning the Scenario

8.5.2.1 Wind

- Scale: As with the baseline scenario, each of the offshore wind farms is assumed to comprise 50 turbines rated at 10MW – this is an indicative number of turbines for the purposes of modelling.
- Construction /Manufacturing Facilities at Ports on island of Ireland To deploy ten such farms requires continuous use of Belfast's D1 facilities, development and use of a second core port (Dublin, Cork, or Shannon Foynes) to the equivalent capacity, and installation or manufacturing facility for large floating structures on the west coast.
- Location: The additional port development will permit five of the ten wind farms to be installed off the south or west coast (with the remaining five sited in the Irish Sea).
- Developers: There are at least three potential developers for the wind farms.
- Fixed vs Floating and Manufacturing Location: Four of the ten wind farms will be installed using floating foundations; the foundations and/or mooring blocks will be manufactured in Ireland, allowing a higher proportion of the activity to be captured within the economy of the island. In addition, facilities will be installed to permit one set of 50 mooring blocks for a fixed foundation wind farm to be manufactured in Ireland.
- Operation and Maintenance: Delivered from Belfast or a core Irish port in all cases, not Great Britain

8.5.2.2 Wave

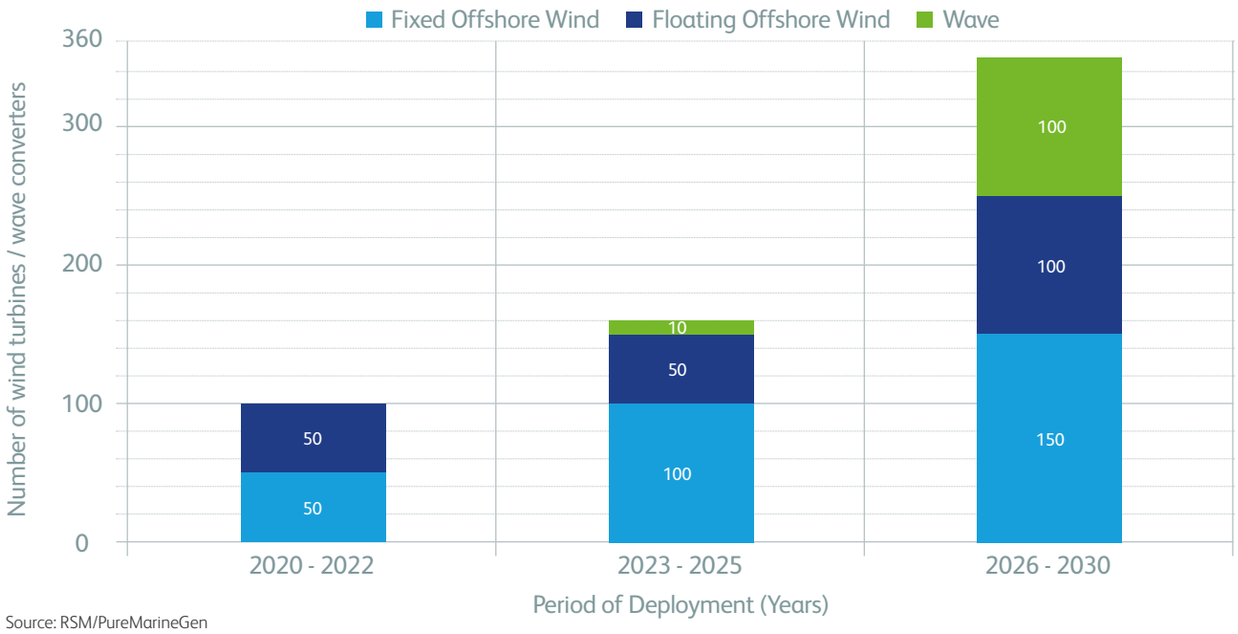
Under the high deployment scenario, 2 demonstration projects of 5 1MW devices each will be installed on the west coast, potentially developed by ESB. These will then be scaled up into two 50-unit wave farms.

8.5.2.3 Timescales

The most probable timeline for deployment under the high deployment scenario is shown in Figure 8.3.

[29]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

Figure 8:3: Possible timeline for deployment under High Deployment Scenario



Source: RSM/PureMarineGen

8.5.3 Key Findings

The job creation potential of the high deployment scenario is described below. None of these jobs currently exists. The projected figures for job creation have been determined following the same process as described for Scenario 1.

Table 8:5: Job creation impacts: high deployment scenario

	Temporary direct employment in construction phase (person-years)		Permanent direct employment in operations and maintenance (person-years)		Indirect + induced employ-ment (person-years)	Total employ-ment (person-years)	Peak total FTE jobs	
	Wind	Wave*	Wind	Wave	Wind + wave	Wind + wave	Const	O&M
2020-22	6,600	0	500	0	3,100	10,000	3,200	300
2023-25	9,900	320	1,500	20	4,600	16,000	4,700	900
2026-30	17,000	2,900	4,800	260	8,900	33,000	5,300	1,800
Total	33,000	3,200	6,800	270	17,000	60,000	5,300	1,800

Notes:
* Wave person-years in the construction phase include indirect and induced effects
All results have been rounded to 2 significant figures; however, unrounded statistics have been used in all calculations. In some cases, the total row may not appear to equal the sum of its contents – this is an effect of the rounding process and does not affect calculation accuracy.

Under the high deployment scenario, employment in construction scales up continuously, to a maximum of 3,900 direct FTE construction jobs projected between 2026 and 2030 when both wind and wave power are being built at scale. There are a further 1,300 permanent operations and maintenance jobs (FTE) projected by 2030. Including a further 1,900 indirect and induced FTE jobs, the total FTE employment impact by 2030 is projected to be just over 7,000.

The model results across the three periods are summarised into total person-years (and peak total FTE jobs within each period) in the table above.

In summary, if this scenario was realised, the job creation potential over eleven years (2020 to 2030) is projected to amount to 60,000 person-years. More than half of this would be from temporary employment during the construction phase (job creation potential: 33,000 person-years), with more than one quarter arising from indirect and induced employment (17,000 person-years) and about 12% arising from direct employment (7,100 person-years)).

Some examples of specialist employment which would capture effects locally, as derived from the consultations, are as follows:

Construction and assembly at Belfast (12-18 months per 500MW wind farm):

- 100 direct FTEs for wind turbine construction
- 30-40 direct FTEs for foundation development
- 30-40 indirect FTEs (cargo handlers/electricians) to support construction
- 10-15 indirect FTEs (cargo handlers) to support foundation development

Construction and assembly at a core port redeveloped to similar capacity to Belfast (12-18 months per 500MW wind farm):

- 100 direct FTEs for wind turbine construction
- 30-40 direct FTEs for foundation development
- 30-40 indirect FTEs (cargo handlers/electricians) to support construction
- 10-15 indirect FTEs (cargo handlers) to support foundation development

Additional facility for foundation manufacture and construction:

- 600 direct person-years per 500MW wind farm for highly skilled welders and metal workers (400 direct FTEs to complete in 18 months)

8.6 Scenario 3: Low Deployment

The detail of this scenario was discussed and agreed with the Steering Group.

8.6.1 Description of Scenario

Under the low deployment scenario, there is no development of additional facilities for manufacture or construction; wind farm installations still take place but these use existing technology and are installed from Belfast. The level of activity to 2030 is as described in the table below.

This reflects partial construction of the farms/projects currently under development (as discussed under the baseline scenario).

Table 8:6: Low Deployment – Estimate of Deployment Levels

Technology	No of farms / projects	Indicative[30] No of turbines / units per farm	Total Energy production (MW)	Construction / Assembly facility at Ports	Manufacturing facility
Fixed Wind	2	50	1,000MW	Existing	None
Floating Wind	0	-	None	None	None
Wave Energy	1	5	5MW	Existing	None (Belfast or GB)

Source: Market intelligence review and consultations

8.6.2 Specific Assumptions underpinning the Scenario

8.6.2.1 Wind

- Scale: Under the low deployment scenario, two offshore wind farms of 50 turbines each will still be built (1,000MW total) – this is an indicative number of turbines for the purposes of modelling..
- Construction /Manufacturing Facilities at Ports on island of Ireland: There will be no relevant port expansion or installation of new manufacturing or construction facilities.
- Location: Irish Sea
- Developers: There are at least three potential developers for the wind farms.
- Fixed vs Floating and Manufacturing Location: They will be deployed from Belfast, will use fixed bottom foundations (not floating), and will be in the Irish Sea – because of which, some manufacture could be based in Great Britain.
- Operation and Maintenance: It is assumed that the low level of operation and maintenance employment required is based on the island of Ireland, but there is a risk that maintenance will take place from Great Britain.

8.6.2.2 Wave

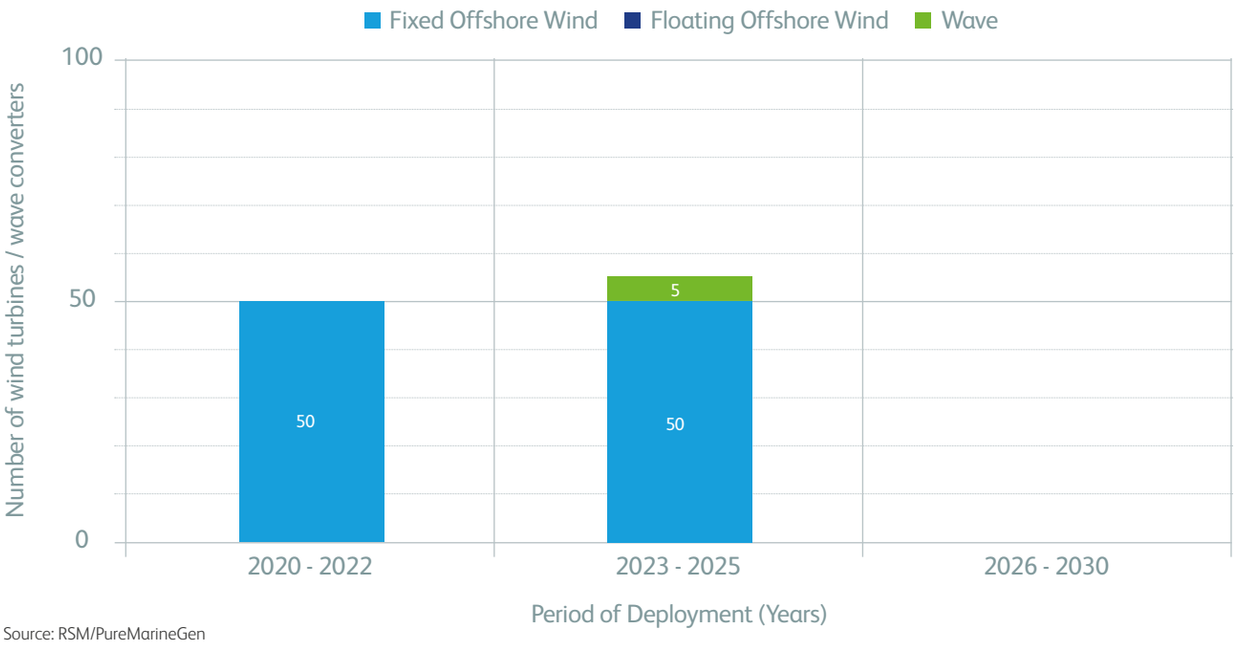
There will be a demonstration project for wave energy on the west coast of Ireland, as in the baseline scenario.

8.6.2.3 Timescales

The most probable timeline for deployment under the low deployment scenario is shown in the figure below.

[30]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

Figure 8:4: Possible timeline for deployment under Low Deployment Scenario



Source: RSM/PureMarineGen

8.6.3 Key Findings

The job creation potential of the low deployment scenario is described below. None of these jobs currently exists. The projected figures for job creation have been determined following the same process as described for Scenario 1.

Table 8:7: Job creation impacts: low deployment scenario

	Temporary direct employment in construction phase (person-years)		Permanent direct employment in operations and maintenance (person-years)		Indirect + induced employ-ment (person-years)	Total employ-ment (person-years)	Peak total FTE jobs	
	Wind	Wave*	Wind	Wave	Wind + wave	Wind + wave	Const	O&M
2020-22	3,300	0	200	0	1,200	4,700	1,500	160
2023-25	3,300	160	600	10	1,300	5,400	1,500	330
2026-30	0	0	1,200	20	400	1,600	0	330
Total	6,600	160	2,100	30	2,900	12,000	1,500	330

Note:
* Wave person-years in the construction phase include indirect and induced effects
All results have been rounded to 2 significant figures; however, unrounded statistics have been used in all calculations. In some cases, the total row may not appear to equal the sum of its contents – this is an effect of the rounding process and does not affect calculation accuracy.

Over the periods 2020-22, and 2023-25, there are projected to be an average of 1,100 direct FTE construction jobs provided by wind farm construction. These would give rise to a further projected 440 indirect + induced FTE jobs (due to the supply chain effects and the expenditure of wages). By the end of 2025, there are projected to be 240 direct operations and maintenance FTE jobs and a further 80 indirect and induced FTE jobs – these are reported here but the scenario allows for the possibility that operations and maintenance are delivered from Great Britain.

The model results across the three periods are summarised into total person-years (and peak total FTE jobs within each period) in the table above.

In summary, if this scenario was realised, the job creation potential over eleven years (2020 to 2030) is projected to amount to 12,000 person-years. More than half of this would arise from temporary employment during the construction phase (job creation potential: 6,600 person-years), with around one quarter arising from indirect and induced employment (2,900 person-years) and about 15% arising from permanent direct employment in operations and maintenance (2,100 person-years)).

Some examples of specialist employment which would capture effects locally, as derived from the consultations, are as follows:

Construction and assembly at Belfast (12-18 months per 500MW wind farm):

- 100 direct FTEs for wind turbine construction
- 30-40 direct FTEs for foundation development
- 30-40 indirect FTEs (cargo handlers/electricians) to support construction
- 10-15 indirect FTEs (cargo handlers) to support foundation development

8.7 Summary

8.7.1 Projected Job Creation Potential

The overall projected job creation impacts (between 2020 and 2030) of the three scenarios are summarised in the table below. These are based on the general assumptions detailed in Section 8.2.4 above and the specific assumptions for each scenario detailed in Sections 8.3 – 8.6 of the report. Note any changes to these assumptions will impact on the results below.

Table 8:8: Summary Job Creation Impacts 2020-2030

	Baseline	High deployment	Low deployment
ORE energy production, scale and characteristics of development			
Total Energy production (MW)	1505 MW	5,200MW	1,005 MW
Fixed wind turbines (10MW) Indicative[31] number of turbines (sites)	100 (2 sites)	300 (6 sites)	100 (2 sites)
Fixed wind turbines (10MW) Indicative[32] number of turbines (sites)	50 (1 site)	200 (4 sites)	None
Wind farms outside Irish Sea	1	5	None
Wave energy units (1MW)	5 (pilot)	100 (from 2 pilots)	5 (pilot)
Port development to capacity of Belfast	Expansion at one core port	Expansion at one core port	None
Operation and Maintenance	Ireland	Ireland	Belfast or GB
Job creation potential			
Person-years of employment:	18,000	60,000	12,000
- Construction phase	10,000	36,000	6,800
- Operations and maintenance*	2,700	7,100	2,100
- Indirect and induced	5,300	17,000	2,900
Peak total FTE employment	2,900 (2023-5)	7,100 (2026-30)	1,800 (2023-5)

* Operations and maintenance cover the 11-year period 2020-2030
All model results have been rounded to 2 significant figures; however, unrounded statistics have been used in all calculations. In some cases, the total row may not appear to equal the sum of its contents – this is an effect of the rounding process and does not affect calculation accuracy.

[31]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions
[32]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

8.7.2 Consistency with other reports/projections considering potential of offshore wind

Having developed estimates of job creation potential as detailed above, it is also worth putting these in context – in relation to previous studies which also considered offshore wind projected developments, in particular:

- Industrial development potential of offshore wind (GL Garrad Hassan on behalf of SEAI, 2011); and
- An Enterprising Wind: The job creation potential of the wind sector in Ireland (Siemens, Irish Wind Energy Association, 2014).

At the outset, it is critical to note that there are some crucial differences between the two previous reports and this current report.

Given these substantial differences between the three reports, any comparison of findings would be flawed as it would not be "like with like".

It is however, encouraging to note that all three reports coincide on some of the broader contextual issues which have an important influence on the development of offshore renewable energy including the key drivers of and key barriers to ORE development. There is also resonance across the three reports with the key findings emerging from this study supported by findings in the two previous reports.

9.0

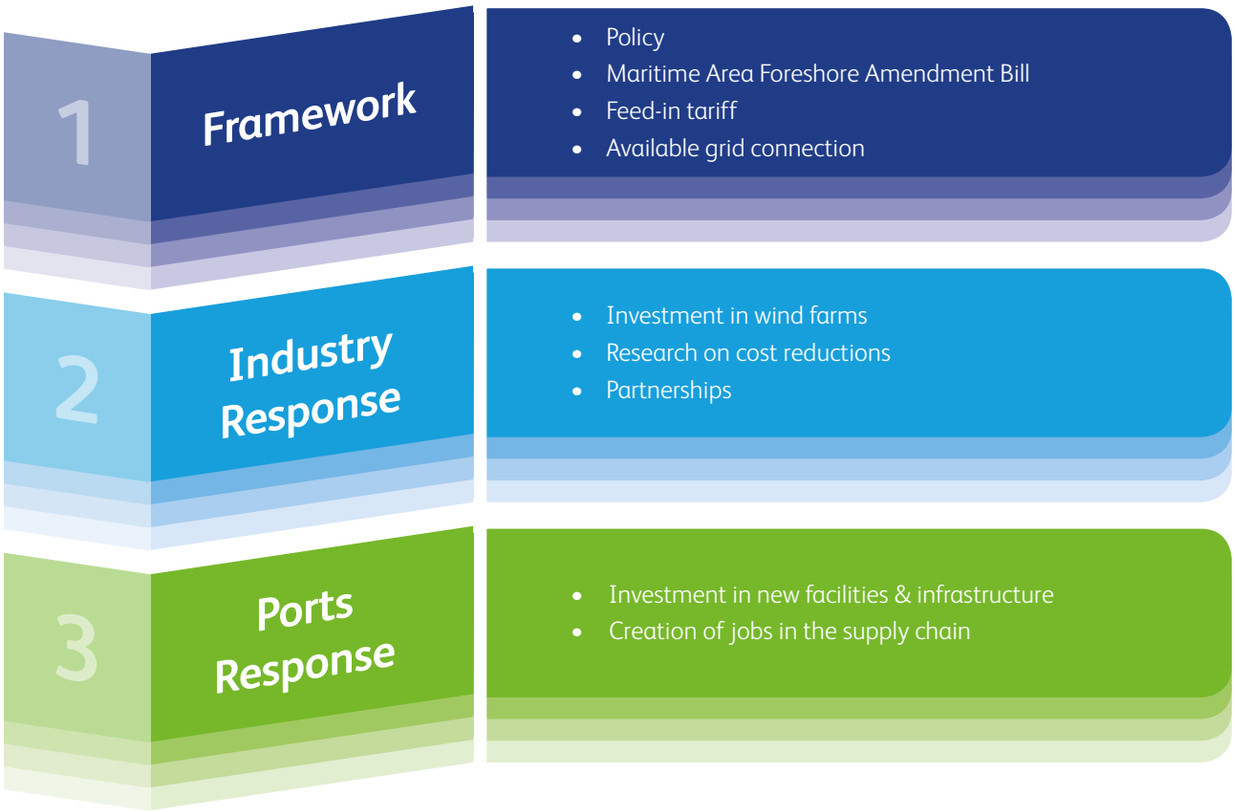
Conclusions

When the Irish Ports Offshore Renewable Energy Services (IPORES) Report was published in 2012, the offshore wind sector in Europe had deployed around 5GW (~1,250 turbines) of offshore wind farms and single prototypes for wave energy and tidal energy had been deployed as demonstrator projects at test sites, such as EMEC in Scotland and Strangford Lough on N. Ireland. The Arklow bank offshore wind farm was the only operational ORE project in Ireland, though site development activities were underway at sites throughout the Irish Sea.

To date, no further offshore wind projects have been deployed in Irish waters, while in the rest of Europe around 11GW (over 2,000 turbines) have been deployed over the last 5 years, representing an investment of over €22 billion by energy companies in the construction and operation of these projects. This investment in offshore construction activities triggered a response from the ports and supply chain, chiefly those with a geographical advantage to the sites for the ORE projects, where ports invested in the development of new facilities to support these new business opportunities. The new Offshore Wind Terminal developed by Belfast Harbour, opened in 2013, is a prime example for such port developments. A strong pipeline of offshore wind projects being developed by energy companies in the Irish Sea, along with an agreement with an energy company to lease the new facilities, prompted an investment of £50m by the ports to build the terminal: it was then leased to the offshore wind developer.

Similar business opportunities can be created for other Irish ports if the framework to support the deployment of offshore wind farms elsewhere in Europe can be replicated to stimulate and sustain the deployment of ORE projects in Irish waters. This model is described in Figure 1. While wave and tidal energy prototypes have not yet advanced beyond the prototype testing and demonstrator projects to enable arrays of devices to be deployed in ORE farms, the same model is relevant once the technology challenges have been addressed in these emerging sectors.

Figure 1



A renewed focus on the potential for economic growth and job creation from ORE projects in Ireland has been stimulated by the Government's energy policy "'Ireland's Transition to a Low Carbon Energy Future" and proposals for a Renewable Energy Support Scheme, which is also supported by the Offshore Renewable Energy Development Plan and Harnessing Our Ocean Wealth.

The adoption of new legislation (Maritime Area and Foreshore (Amendment) Bill) and introduction of a suitable tariff to support the finance and construction of ORE projects are essential to facilitate the commencement of construction and operation of offshore wind farms and other ORE projects in Irish waters. This will create business opportunities in Ireland's ports for construction, assembly, operation and maintenance activities.

9.1 Port requirements for the ORE sector

There has been significant investment in Ireland's ports sector since 2012 – in particular in Ireland's Tier 1 ports (Dublin Port, Port of Cork and Shannon Foynes Port) where infrastructure development projects costing ~€370 million have commenced. While the development of port capacity in Tier 1 ports is mainly focused on the increasing volumes of freight and cargo linked to economic growth, new business areas, such as the ORE sector, have been identified as future opportunities. Belfast Harbour has led the way in terms of seizing the opportunities in the ORE sector and handled 305,000 tonnes of wind farm components in 2017.

Consultations with the ORE sector make it clear that if the framework shown in Figure 1 was in place, a pipeline of projects would emerge given the current interest shown from major energy companies and investors in Ireland's offshore wind, wave and tidal energy resources.

The establishment of a long-term ORE market would enable Irish ports to invest to extend existing facilities to meet the demand for ORE as projects come online.

With regards to port facilities and infrastructure, consultation with the ORE sector identified the following high level requirements for each type of ORE.

- Construction ports for offshore wind:
  - Heavy lift cranes (>2 x 80t);
  - Large laydown areas (around 20 hectares) for handling and assembling of wind turbines;
  - Deep water for installation vessels, with a range of 8m – 10m for quay water depths.
- Similar facilities for wave and tidal energy are likely to be required though some of the new floating devices being developed might utilise lower water depth. Some of the wave device under development are ship-like structures and dry-dock facilities maybe needed for construction.
- For Operation & Maintenance (O&M) and servicing:
  - close to deployment site for low transit times and ideally within 2-4 hours sailing time. However, ports that are 200-300km from an offshore wind farm have also been used previously;
  - warehousing and engineering services on-site (around 100,000m2 for handling project cargo and supporting stevedoring operations for all types of ORE;
  - accommodation and transport links for crew transfers, to provide essential links of transportation and communication connections for all types of ORE.

The commercial opportunities from the development of the ORE are significant; at least 8 Irish ports and harbours are ready to take advantage of the opportunities. Some of the ports and harbours have identified the ORE sector as one of their key growth drivers; others have the facilities and space to provide services to the sector. However, investment in new facilities will require evidence that developers can provide a sufficient pipeline of ORE projects and clear policy commitment from the Irish Government in relation to the development of ORE is required for this to happen.

In the meantime, there is need for further engagement between the ports and harbours and ORE industry to support the exploration of projects and in particular to understand the needs and requirements as well as the anticipated pipeline and development timescales.

9.2 Awareness of commercial opportunities in ORE

Across all ports (regardless of size) there is a willingness to explore opportunities which the ORE sector presents. Whilst at least 10 of the ports and harbours indicated their willingness to service the ORE sector, only three specifically mentioned the ORE sector as a key driver for their economic growth.

None of the ports and harbours reviewed, except for Belfast, had a purpose-made facility for servicing the ORE sector. However, at least 10 ports and harbours have suitable base infrastructure (such as water depth, quay space, quay strength) where further investment could provide the level of facilities required to service the pipeline of projects that could be realised in Ireland's ORE sector over the next 10 years. With this investment in place, all of these ports and harbours could act as hubs for assembly of ORE devices as well as providing operation and maintenance support services.

The key findings are detailed below:

- The majority of Ireland's ports are willing to meet the demands of the offshore renewable sector, subject to the availability of appropriate investment.
- Belfast is already actively engaged in supporting ORE: it has established its new D1 Offshore wind terminal as one of the leading facilities for offshore wind farms in the Irish Sea and is well placed to win contracts as the construction / assembly port for other projects in the Irish Sea.
- For Ireland's Tier 1 ports[33]
  - Dublin Port may have space constraints at existing facilities due to increased volumes in its core business areas, especially during the on-going construction of the Alexander Basin Redevelopment project, though there are options for development of quay space at Poolbeg if required. At present, Dublin Port has no strategic intent towards the development of the ORE sector and its focus continues to be on traditional commercial activities, particularly unitised trade and Ro-Ro ferry traffic. However, Dublin Port could respond to new business opportunities as they arise.
  - Port of Cork may have space constraints in the short term, although its new Ringaskiddy project, the development of Marino Point and options to upgrade or develop other facilities (for example at Bantry Bay) provide options for any additional space needed. Cork has identified the ORE sector as a potential growth area though its focus and immediate investment plans continue to be on traditional commercial activities until the ORE sector is established.
  - Shannon Foynes has a range of sites available for development for manufacturing or servicing facilities for the offshore energy sector. The strategic development of SFPC is focused on driving growth across all sectors but in particular in the areas of solid and liquid bulk goods and break-bulk cargo. Offshore renewables is identified as a key target for growth related to entry into new sectors in line with international and national growth forecasts.

[33]Tier 1 ports are Ports of National Significance. These are ports that are: responsible for 15% to 20% of overall tonnage through Irish ports; and have clear potential to lead development of future port capacity in the medium and long term, when and as required. (National Ports Policy, DTTAS (2013)).

- Ireland's Tier 2[34] and Tier 3[35] ports, along with the Fisheries Harbour[36] at Killybegs have facilities available to support the servicing of offshore energy projects and there are also development opportunities at Ros a' Mhíl, Arklow and Galway Harbour.

The supply chain in Ireland is still poor compared to competitors in the UK. Consultations with industry have indicated that the presence of a strong supply chain is critical to the development of the ORE sector. This includes cargo handling, shipping and logistical support, manufacturing facilities for turbine components, steel and concrete manufacturing for foundation bases as well as platforms for the wave devices and floating wind turbines. The development of the ORE sector provides several key opportunities to also develop the supply chain within Ireland and the supporting infrastructure needed.

Whilst many ports and harbours in Ireland have the capability and willingness to service and facilitate the ORE sector, there has been limited promotion and therefore awareness of this due to uncertainties around the potential to proceed with development and also timescales. Ports and Harbours, supported by Government, should seek to proactively promote their facilities and development potential to the industry.

Opportunity to Develop the Supply Chain

Irish companies have been successful in winning business from offshore energy projects locally and internationally. Some of these businesses are located near port and harbour facilities, although this is not a prerequisite. The development of the ORE sector in Ireland provides growth opportunities for those companies. In addition, growth of the ORE sector generally provides opportunities for businesses not currently involved in the sector to become part of a growing supply chain. This development could pave the way for clusters to develop around port and harbour facilities used for construction and servicing of these offshore projects. Successful implementation of this recommendation is dependent on evidence of investment in ORE projects being committed.

Opportunity to Learn from Benchmark Ports and Harbours

Ports and harbours in other countries have responded to ORE market opportunities, with the support of appropriate policy drivers and investment. The examples considered in this report have undergone significant changes in their focus and strategic direction to leading players in the ORE market place. There is a wealth of knowledge and experience to be gleaned from these examples; this may be more easily shared between ports and harbours that are not closely located and likely to be competing for the same business. Some areas that might be covered include:

- Special considerations for ORE that are outside traditional port business;
- New ORE related skills needed in the ports for strategic planning and to understand the nature of this new business area; and
- Development and management of multipurpose facilities to accommodate the variability in activity from ORE projects.

9.3 Job creation potential arising from developing the ORE sector

The development of the ORE sector has the potential to deliver significant economic benefits for Ireland. The overall projected job creation impacts (between 2020 and 2030) of the three scenarios are presented below; these are based on the general assumptions detailed in Section 8.

[34]Tier 2 ports are Ports of National Significance. These are ports that are: responsible for at least 2.5% of overall tonnage through Irish ports; have clear demonstrable potential to handle higher volume of unitised traffic; and have the existing transport links to serve a wider, national marketplace beyond their immediate region. (National Ports Policy, DTTAS (2013)).

[35]Tier 3 ports are Ports of Regional Significance. This category includes all other ports that handle commercial freight. (National Ports Policy, DTTAS (2013)).

[36]The Fisheries Harbour Centre Act, 1968 sets out that a Fisheries Harbour is a harbour of national importance to the fisheries industry.

The scenarios are: a baseline level of activity broadly consistent with existing targets, policy environment, and plans for development and investment; a high deployment scenario where the infrastructure to support deployment of offshore renewable energy is upgraded and used to its full capacity; and a low deployment scenario where a lower level of activity is supported by use of existing facilities.

Table 9:1: Summary Job Creation Impacts 2020-2030

	Baseline	High deployment	Low deployment
ORE energy production, scale and characteristics of development			
Total Energy production (MW)	1505 MW	5,200MW	1,005 MW
Fixed wind turbines (10MW) Indicative[37] number of turbines (sites)	100 (2 sites)	300 (6 sites)	100 (2 sites)
Fixed wind turbines (10MW) Indicative[38] number of turbines (sites)	50 (1 site)	200 (4 sites)	None
Wind farms outside Irish Sea	1	5	None
Wave energy units (1MW)	5 (one pilot)	100 (extension pilot)	5 (pilot)
Port development to capacity of Belfast	Expansion at one core port	Expansion at one core port	None
Operation and Maintenance	Ireland	Ireland	Belfast or GB
Job creation potential			
Person-years of employment:	18,000	60,000	12,000
- Construction phase	10,000	36,000	6,800
- Operations and maintenance*	2,700	7,100	2,100
- Indirect and induced	5,300	17,000	2,900
Peak total FTE employment	2,900 (2023-5)	7,100 (2026-30)	1,800 (2023-5)

Note:
* Operations and maintenance cover the 11-year period 2020-2030
All model results have been rounded to 2 significant figures; however, unrounded statistics have been used in all calculations. In some cases, the total row may not appear to equal the sum of its contents – this is an effect of the rounding process and does not affect calculation accuracy.
Source: Consultations, literature review, market intelligence collation, and modelling exercise

[37]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions
[38]This number is indicative: it is used to provide a reference number for the purposes of modelling to estimate job creation; it is not linked to any EIS or specific projects/existing planning permissions

The evidence reviewed as part of the modelling and through the benchmarking exercise shows the significant economic benefits of such investment in the ports and supply chain. The research indicates that:

- The development of the baseline scenario would require approximate investment of between €350- €600million to develop the wind turbine sites, €150-€250million to develop the floating wind turbine sites and €50-€100million to develop the wave energy units.
- It is estimated that for every €1 invested in the ORE sector in Ireland there is approximately €2.50 – €3.50 of wider investment in supply chain.

Seizing the opportunities offered by the development of the ORE sector has the potential to provide significant economic benefits for Ireland. Robust estimates of potential job creation are grounded in current market intelligence derived from recent consultation with ORE industry, literature review and benchmarking. These forecasts could be used to strengthen, support and drive the agenda to develop the ORE sector illustrating the role that ports and harbours (with capacity and interest) have to play in developing the sector and the benefits that could accrue.

10.0

Recommendations

The recommendations from this study are focused on creating the conditions to establish an ORE sector in Ireland and supporting Irish ports to and the supply chain in order to maximise the economic benefits to the country.

Recommendation One: Framework to attract investment in ORE

Government needs to establish an ambitious, inter-departmental, long-term plan for the generation of electricity from offshore resources to act as a framework for the development of the ORE sector.

Recommendation Two: Promote the economic case for the ORE sector in Ireland

Publicise and promote the findings of this study to raise awareness of the potential of the ORE sector supported by ports and harbours to deliver significant economic impacts. Use the economic impacts to help drive the agenda to develop the ORE sector and unlock existing barriers and constraints.

Recommendation Three: Engagement and cooperation

There is a need for further engagement between industry and ports/harbours in order to foster mutual understanding of ORE industry requirements and project development pipelines. This engagement should also involve ports and energy companies cooperating to ensure the framework required for the establishment of the ORE sector in Ireland is urgently addressed by government. Networking and information events organised or facilitated by government agencies will be required to achieve the level of engagement and cooperation needed.

Recommendation Four: Increased marketing activities by Irish Ports

Ports and Harbours with a commercial interest in the ORE sector should undertake increased levels of marketing to energy companies and investors active in the ORE sector, and in particular those currently active in Ireland. This will support the ports and harbours in making themselves known to potential developers. Marketing activities should include participation in international ORE conferences and events, with support from government agencies.

Recommendation Five: Promote Supply chain opportunities

Arrange supply chain events in conjunction with international developers and investors committed to developing offshore renewable energy projects in Ireland. Promote Ireland's research expertise in advanced manufacturing, materials and renewables to attract investment from local and international businesses to develop new products and services to drive down the costs of generating electricity from Ireland's offshore resources.

Recommendation Six: Arrange fact-finding visits to other EU ports

Support and encourage Irish ports to visit EU ports that have had success in the ORE sector, in particular the benchmark ports/harbours.

11.0

Glossary

Table 11:1: Acronyms

Abbreviation	Explanation
ALP	ABLE Logistics Park
AMEP	ABLE Marine Energy Park
AMETS	Atlantic Marine Energy Test Site
BOWL	Beatrice Offshore Windfarm Limited
BZEE	German Centre for Renewable Technology
CA-EBS	Compressed Air Emergency Breathing Systems
CAT	Catamaran
CD	Chart Datum
DAFM	Department of Agriculture, Food and the Marine
DCNS	French naval defence company
DTTAS	Department of Transport, Tourism and Sport
DWT	Deadweight Tonnes
EMEC	European Marine Energy Centre
ESB	Electricity Supply Board
EU	European Union
FOET	Further Offshore Emergency Training
FTE	Full Time Equivalents
GB	Great Britain
GDA	Greater Dublin Area
GDP	Gross Domestic Product
GVA	Gross Value Added
GW	Gigawatt
HOOW	Harnessing Our Ocean Wealth
IDA	Development Agency of Ireland
IMDO	Irish Maritime Development Office
IPORES	Irish Ports Offshore Renewable Energy Services
IT	Institute of Technology
LAT	Lowest Astronomical Tide
LHM	Liebherr Mobile Harbour
LOA	Length Overall
LYIT	Letterkenny Institute of Technology
MDT	Multi-Departmental Team
MI	Marine Institute
MRIA	Marine Renewables Industry Association

Abbreviation	Explanation
MW	Megawatts
NNG	Neart Na Gaoithe
NPV	Net Present Value
NUIG	National University of Ireland Galway
O&M	Operation & Maintenance
ORE	Offshore Renewable Energy
OREDP	Offshore Renewable Energy Development Plan
RESS	Renewable Electricity Support Scheme
RO-RO	Roll-on/roll-off
SEAI	Sustainable Energy Authority of Ireland
SEMRU	Socio-Economic Marine Research Unit
SFPC	Shannon Foynes Port Company
UK	United Kingdom

Table 11:2: Units of Measurement

Measurement	Unit of measurement	Description / Notes
Distance / Length	Metre (m)	1 m = 100cm (centimetre)
	Kilometre (km)	1 km = 1000m
Area	Hectares (ha) or m2	1 hectare = 10,000 m².
(Water) depth	Metre (m)	Lowest Astronomical Tide (LAT) - The lowest levels which can be predicted to occur under average meteorological conditions Chart Datum (CD) are, usually Lowest Astronomical Tide (LAT) in tidal waters.
Power	Watt (W)	
	Megawatt (MW)	A megawatt is a unit of power in the International System of Units (SI). There are 0.000001 megawatts in a watt, where 1 MW = 1,000,000 watts
	Gigawatt (GW)	A gigawatt is a unit of power in the International System of Units (SI). There are 0.001 gigawatts in a megawatt, where 1 GW = 1,000 MW
Weight	Tonnes - (t)	Tonne is a non-SI metric unit of mass equal to 1000 kilograms, the conversion of 1 tonne to 1 ton is 0.98420.
Current profile of vessel size capacity	Deadweight Tonne (DWT)	Tonne is a non-SI metric unit of mass equal to 1000 kilograms, the conversion of 1 tonne to 1 ton is 0.98420.

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