Assessment of the Irish Ports & Shipping Requirements for the Marine Renewable Energy Industry

June 2011

Report prepared on behalf of

SUSTAINABLE ENERGY AUTHORITY OF IRELAND

In co-operation with

IMDO-Ireland
Marine Institute Foras na Mara

Irish Maritime Development Office

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About the SEAI:

The Sustainable Energy Authority of Ireland (SEAI), established by Government under the Sustainable Energy Act 2002, has a mission to play a leading role in transforming Ireland into a society based on sustainable energy structures, technologies and practices. Its key objectives are implementing strong energy efficiency actions, accelerating the development and adoption of technologies to exploit renewable energy sources, supporting innovation and enterprise for our low-carbon future and supporting evidence-based response that engage all actors.

Following the announcement in January 2008, by the Minister for Communications, Energy and Natural Resources, of a package of measures to stimulate and accelerate the development of Ocean Energy in Ireland, the Ocean Energy Development Unit (OEDU) was established as a collaborative initiative of SEAI, the Marine Institute and DCENR, to co-ordinate and manage the implementation of the OE Strategy.

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About the IMDO:

The Irish Maritime Development Office (IMDO) is Ireland's national dedicated development, promotional and marketing agency for the shipping services sector.

The office has been established for over nine years and is part of the Marine Institute which is a state agency responsible for researching the potential of Ireland's vast marine resources.

The Irish Maritime Development Office operates under the auspices of the Irish Department of Transport and is charged with responsibility for undertaking the following activities through its statutory remit:

- To promote and assist the development of Irish shipping and Irish shipping services and seafarer training.
- To liaise with, support and market the shipping and shipping services sector.
- To advise the Minister on the development and co-ordination of policy in the shipping and shipping services sector so as to protect and create employment.

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Foreword

There are profound changes taking place in the energy landscape in Europe, changes which may have far-reaching consequences for Ireland. We have very large marine renewable energy resources that can, potentially, supply our European neighbours with significant amounts of the secure and carbon-free electricity that they will require. There are many technical, economic and regulatory issues to be resolved before the full scope of Ireland's opportunity in this sector is clear and we are taking steps to address these.

I welcome the production of this report, initiated by the Sustainable Energy Authority of Ireland, with the active participation of the Irish Maritime Development Office. It represents an example of the type of collaboration that is essential if Ireland is to capture the considerable opportunities in the marine renewable energy sector, and one which we intend to extend.

However, the preparatory work in respect the industrial supply chain in Ireland, of which this report is one example, is essential to maximising the economic benefit to Ireland under any scenario for utilisation of our marine renewable energy resources. SEAI, in collaboration with Enterprise Ireland, is undertaking further such work on the engineering industry in Ireland. We hope that these initiatives will contribute to realising the very significant economic and employment potential associated with the harnessing of our offshore wind, wave and tidal resource.

Pat Rabbitte TD

Minister for Communications, Energy and Natural Resources

Foreword

It is clear from this report that the Irish Ports & Shipping services sector have a significant role to play in supporting the future growth potential of our marine renewable resources. I welcome the fact that many Irish Ports have already begun to position themselves to capture a share of this market both as a gateway ports and also as service hub providers. Similarly a growing number of Irish shipping firms and owners appear to have also identified the niche sector potential that this growing market presents.

While the report does illustrate that progress has been made in several areas, it also highlights that the industry is still very much in its preliminary phase of growth. Considerable challenges still lie ahead which will require greater co-operation between the Ports, manufacturers, developers and relevant government bodies to work together in a more coherent manner to ensure that Ireland Inc. does not lose out on the opportunity that this resource is likely to provide. I also recognise the need to improve our foreshore licensing service.

I also echo the comments of my colleague the Minister for Energy, in commending the efficient inter-agency approach to capture and capitalize on the key research findings.

Leo Varadkar TD

Minister for Transport, Tourism and Sport

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Executive Summary

This study of Ireland's shipping and ports infrastructure begins by establishing the geographical distribution of ocean renewable energy around the Irish coast. This is necessary to determine the appropriate port resources needed for developments at the various coastal locations. In general it is established that the east coast is best placed to support fixed offshore wind and tidal installations, whereas the south and west coasts are best placed to support wave, fixed and floating wind installations.

In terms of shipping, the study assesses the vessel type and the numbers required for various deployment scenarios for marine renewable energy in Ireland, under the heading of Offshore Wind, using an example of the fleet deployed during the installation of the Thanet offshore windfarm in UK waters. It is shown that an assorted fleet of up to 35 specialised vessels is necessary for this scale of deployment. The status of Irish vessel owners with respect to marine renewable energy developments and their capability to provide appropriate vessels is then established. Four significant ship-owning companies are operating in Ireland, based in Wicklow, Waterford, Cork and Killybegs. The current aggregated capability would not be sufficient to support a development of the size of the Thanet windfarm without chartering additional specialised vessels on the world market.

Ireland has a vibrant ports sector which is well placed to service the needs of the offshore renewable energy industry. In the near future, offshore development will be focused on the fixed offshore wind industry; the ports are generally aware of the opportunities in this sector and in many cases are actively marketing and engaging with developers. The larger ports in particular could potentially service first-phase requirements with some reorganisation of activities. However, for larger-scale offshore developments, it is likely that new infrastructure will be required. Many of the ports are actively planning new developments or improved facilities, which would further enhance their capability to service the wind sector in the future.

There is an acknowledgement among the ports that the construction of wave and tidal developments will present a more long-term opportunity. However, some ports are currently focused on engaging in this sector at the R&D stage.

The study identifies a spatial framework of first-phase port locations for wind, wave and tidal developments.

It is established that the development of the offshore renewable energy industry is an economic growth opportunity that can bring benefits to many areas of Ireland. To take this opportunity there is a need to bring forward a first phase of port locations that establish a competitive position for Ireland in this market. As the industry develops, and builds on existing strengths, a wider range of locations will play important roles.

The total capital expenditure for offshore wind projects for developing 30GW of offshore wind in the UK alone is estimated to be between €88bn and €102bn. The initial focus on a first phase of locations will complement other actions drawing on Ireland's energy and engineering experience that would ensure that Ireland may also benefit from this European opportunity.

The development of appropriate locations is critical to Ireland becoming a base for construction and assembly of wind turbines and marine devices. Suitable locations are also required to grasp the opportunity to develop operations and maintenance hubs for offshore wind and wave farms both in the Irish Sea and off the Atlantic coast of Ireland.

If these sites are not available, there is a danger that offshore wind developers and wave and tidal manufacturers could source the manufactured equipment for projects outside Ireland. If this happened, the

economic benefit to Ireland would be minimal, despite the country's renewable energy generation potential. This risk and the scale of the economic opportunity are the key drivers behind the need for an Infrastructure Plan for Renewable Energy in Ireland. If Ireland is successful in developing a strong supply chain in offshore renewable energy, many Irish ports and harbours will be involved in related economic activity.

The report sets out the background, the economic growth requirements, and the nature of the infrastructure required for offshore wind, wave and tidal sectors, and the locations that over the medium term are well placed to provide this growth.

1.0 Introduction

Initially, this report reviews the current status of marine renewable energy resources around the coast of the island of Ireland, using the recently published Strategic Environmental Assessment (SEA) base information. This step is necessary to identify which ports are likely to service which marine renewable energy sectors (fixed offshore wind, tidal, wave and floating offshore wind), given the geographical distributions of the resources.

The report then focuses on two industry reviews. First, the current state of Irish shipping is reviewed to establish the status of Irish vessel owners with respect to marine renewable energy deployment, operation and maintenance. To place this review in an international context, the fleet of vessels used recently in completing the Thanet offshore windfarm in UK waters is reviewed and used as a guide. Individual Irish ship-owners and specialist offshore support companies are identified and their strengths and weaknesses reviewed. Secondly, the Irish ports and related infrastructure are reviewed. The report sets out a spatial framework of first-phase sites required to support the development of the offshore renewable energy industry (wind, wave and tidal) in Ireland. It distinguishes the infrastructure needs of the offshore wind, wave and tidal sectors in terms of both timing and nature/location of the infrastructure and shipping resources.

The report sets out an approach to move to early, appropriate private and public investment in infrastructure at first-phase port locations. A set of first-phase locations is identified for wind (both onshore and offshore); for wave and tidal, the need for sites to support the current and future testing phases is recognised, while a short further stage of industry liaison is set out to move to a clear view for all first-phase sites.

The development of the offshore renewable energy industry is an economic growth opportunity that can bring benefits to many areas of Ireland. To take this opportunity, there is a need to bring forward a first phase of locations that establish a competitive position for Ireland in this market. As the industry develops, and builds on existing strengths, a wider range of locations will play important roles. The initial focus on a first phase of locations will complement other actions drawing on Ireland's energy and engineering experience that would ensure that Ireland benefits from this opportunity.

For the location of these first-phase sites, required to support the development of the offshore renewable energy industry (wind, wave and tidal), a dominant issue is the physical location of the various renewable resources and existing port facilities that may be cost-effectively enhanced to service the emerging opportunities.

2.0 Renewable Resources

It is essential to appreciate the geographical disposition of wind, wave and tidal energy resources around Ireland before selecting the best-suited localities for port development to support the exploitation of those resources. A broad array of information sources has been consulted to provide a consolidated overview of the ocean energy resources considered in this study.

The vast majority of the data in the assessment of the ocean energy resources is publicly available – for example, the SEAI Wind Energy Atlas, the Marine Institute Wave Energy Atlas, the draft Offshore Renewable Energy Development Plan (OREDP) in Ireland and, in Scotland and Northern Ireland, the Marine Renewable Energy Resources Atlas. Recent Strategic Environmental Assessments in Ireland and Northern Ireland provide current views of the theoretical, accessible and practical resources for offshore wind, wave and tidal energy and are reported in this section.

2.1 Offshore wind resource in the Republic of Ireland

Ireland has exceptional offshore wind resources, in terms of both strength and consistency. The shallow seas along the coastline of Ireland are potential locations for offshore windfarms. Offshore wind generates power between 70% and 90% of the time (EWEA Oceans of Opportunity 2009). Irish waters have sufficient space available to allow for the development of offshore windfarms without impacting significantly on other stakeholders who use the waters.

A study carried out by the Irish Department of Public Enterprise and the Northern Irish Department of Enterprise, Trade and Investment in 2000 – *Assessment of offshore wind energy resources in the Republic of Ireland and Northern Ireland* – states that the total wind resource within 12 nautical miles (22.2km) of the Republic's territorial waters is estimated at approximately 1,018 TWh/year, from 3.0 MW turbines at grid spacing of 500m. This is an assessment of the total available energy that could theoretically be derived from offshore wind energy around the coast of Ireland. This resource has been evaluated by estimating the offshore mean hourly wind speeds and converting these values into energy contours.

The proportion of this resource which can feasibly be developed is subject to a combination of conditions including climatic conditions, engineering feasibility, and environmental and legislative considerations. In addition, areas designated for other uses of the sea – for example, aggregate dredging and commercial shipping – will reduce this resource further. The resulting accessible resource may be quantified after taking consideration of:

- the physical and constructional constraints
- environmental issues
- statutory permissions and planning legislation

According to the report, the total feasible resource based on 3.0 MW turbines at 500m spacing throughout the resource area ranges from 48.7 TWh/year to 55.5 TWh/year when considering water depths less than 20m and minimum distances offshore, between 2km and 10km.

Thus, in terms of full load-hour potential, Ireland has one of the best wind-energy climates in Europe. The potential offshore wind resource in Ireland is large-scale and much greater than the capacity of our electricity system to absorb it all for domestic use. The recent strategic environmental assessment on the development scenarios in the Offshore Renewable Energy Development Plan (OREDP) provides useful information as to the development potential for offshore wind in the different resource assessment areas when environmental effects are taken into account. Installed power in MW is used as a measure of capacity in this respect.

The Government has announced plans (subject to state-aid clearance) for a Renewable Energy Feed-in Tariff (REFIT) of €140 per megawatt hour for electricity produced from offshore wind. Currently, two proposed offshore wind developments have already secured a foreshore lease and, separate to this, three offshore wind projects are due to receive a grid connection offer under the Gate 3 process. Both a grid connection and a foreshore lease are necessary for projects to be developed. These projects are described in the strategic environmental assessment as "already existing renewable infrastructure". It is recalled that thus far only 25 MW has actually been constructed.

To date, two foreshore leases have been granted (in 2002 and 2005) – for the operation of a 520 MW windfarm on the Arklow Bank and a 1,100 MW windfarm on the Codling Bank, both in the Irish Sea. Seven turbines totalling 25.2 MW have been installed on the Arklow Bank. The remaining two sites that have received consent currently have no offer of connection to the Irish grid.

Approximately 800 MW of offshore wind projects in Gate 3 are due to receive an offer of a grid connection. Offshore wind projects included in Gate 3 are Dublin Array 10 (off Bray Head, Co Wicklow – in the Irish Sea) (364 MW); Oriel (Dundalk Bay, Co Louth – in the Irish Sea) (330 MW) and Fuinneamh Sceirde Teo ('Sceirde' on the map) (outer Galway Bay – Atlantic coast) (100.8 MW).

The two projects that have secured foreshore leases (Arklow and Codling) did not meet the cut-off date that the Commission for Energy Regulation (CER) set out in the Gate 3 direction and are thus not in line to receive a grid connection offer.. While they are consented to from a foreshore perspective, they can only build out when they have a grid connection.

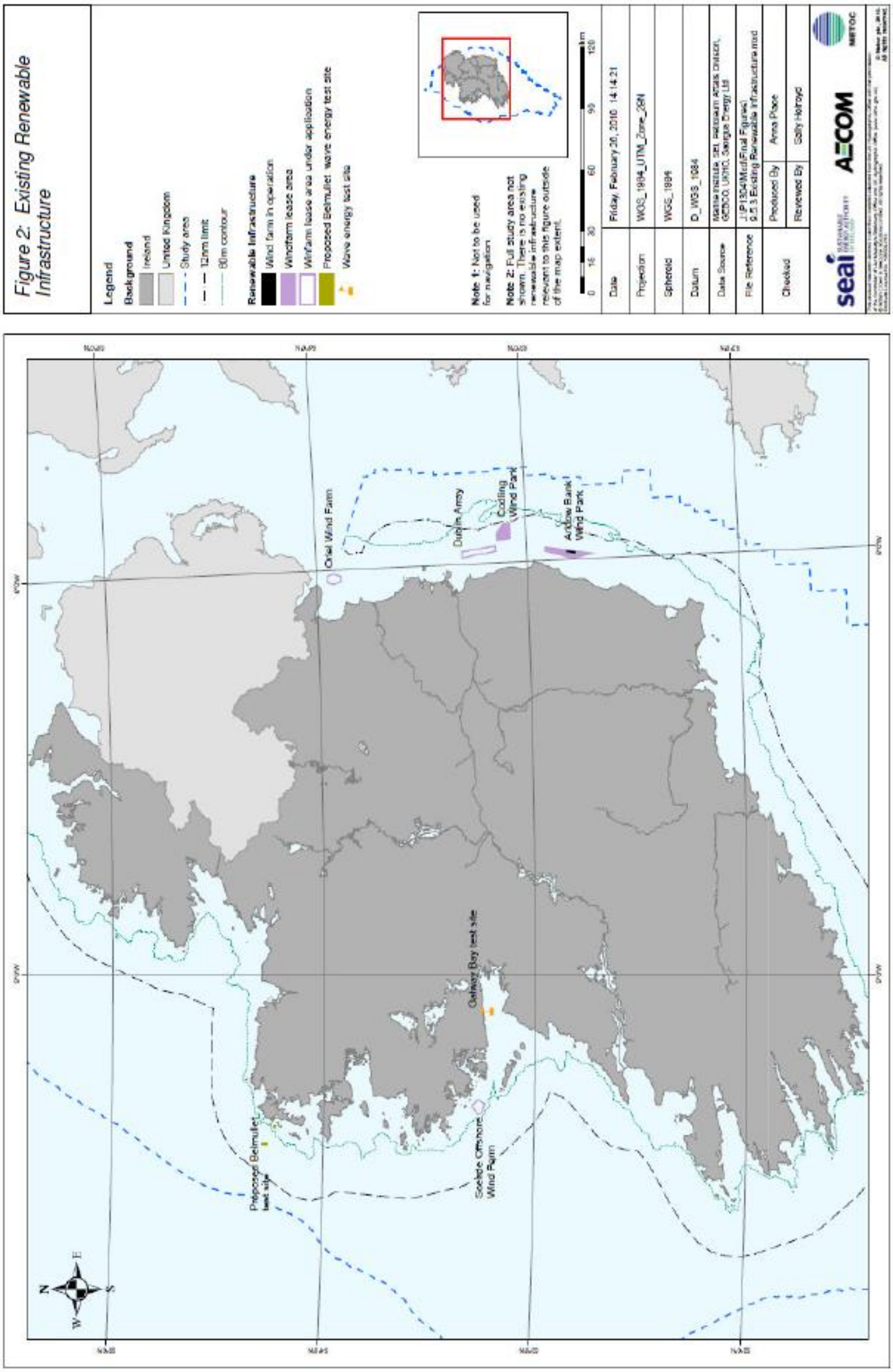
Notwithstanding the current lack of grid connection for these projects, other opportunities in future might provide for development on these sites. Several offshore grid initiatives could lead to offshore grid-connection possibilities, while the Renewable Energy Directive provides for various "co-operation mechanisms" which, subject to agreement between the governments concerned, could provide joint project opportunities.

A summary of the current state of play is provided in Table 2.1 below. A map showing these developments follows, taken from the recent Strategic Environmental Assessment (Figure 2.1). The map also references the existing Galway Bay wave test site and the planned grid-connected Belmullet wave test site off Co Mayo.

Table 2.1: Offshore wind projects included in Gate 3

	Location	MW	Grid Connection offer	Foreshore Lease
Arklow Bank	Irish Sea	520MW	No grid connection offer. Application post cut-off date for Gate 3	Yes
Codling Bank	Irish Sea	1100MW	No grid connection offer. Application post cut-off date for Gate 3	Yes
Dublin Array (called Kish Banks in the Gate 3 Direction)	Irish Sea	364MW	In Gate 3	Foreshore Lease application being processed by DEHLG
Oriel	Irish Sea	330MW	In Gate 3	Foreshore Lease application being processed by DEHLG
Sceirde or 'Fuinneamh Sceirde Teo' (called Doolick in the Gate 3 Direction	Atlantic	100.8MW	In Gate 3	Foreshore Lease application being processed by DEHLG

Figure 2.1: Existing renewable infrastructure – Republic of Ireland



In addition to the offshore developments identified, a significant number of other foreshore licence/lease applications for offshore wind developments have been received by the Department of Environment, Heritage & Local Government (DEHLG). These applications have not yet been processed and are currently also without a grid-connection offer.

2.2 Offshore wind resource in Northern Ireland

The *Assessment of offshore wind energy resources in the Republic of Ireland and Northern Ireland* (2000) states that the total wind resource within 12 nautical miles (22.2km) of Northern Irish territorial waters is approximately 187 TWh/year from 3.0 MW turbines at grid spacing of 500m. As for RoI, this is assessed and based on the total available energy that could theoretically be derived from offshore wind energy around the coast.

The technical resource based on 3.0 MW turbines at 500m spacing ranges from 9.3 TWh/year to 36.9 TWh/year. Again, these figures were based on a maximum depth of 50m, at a minimum distance of 2–10km from the Northern Irish coastline, and 3.0 MW wind turbines.

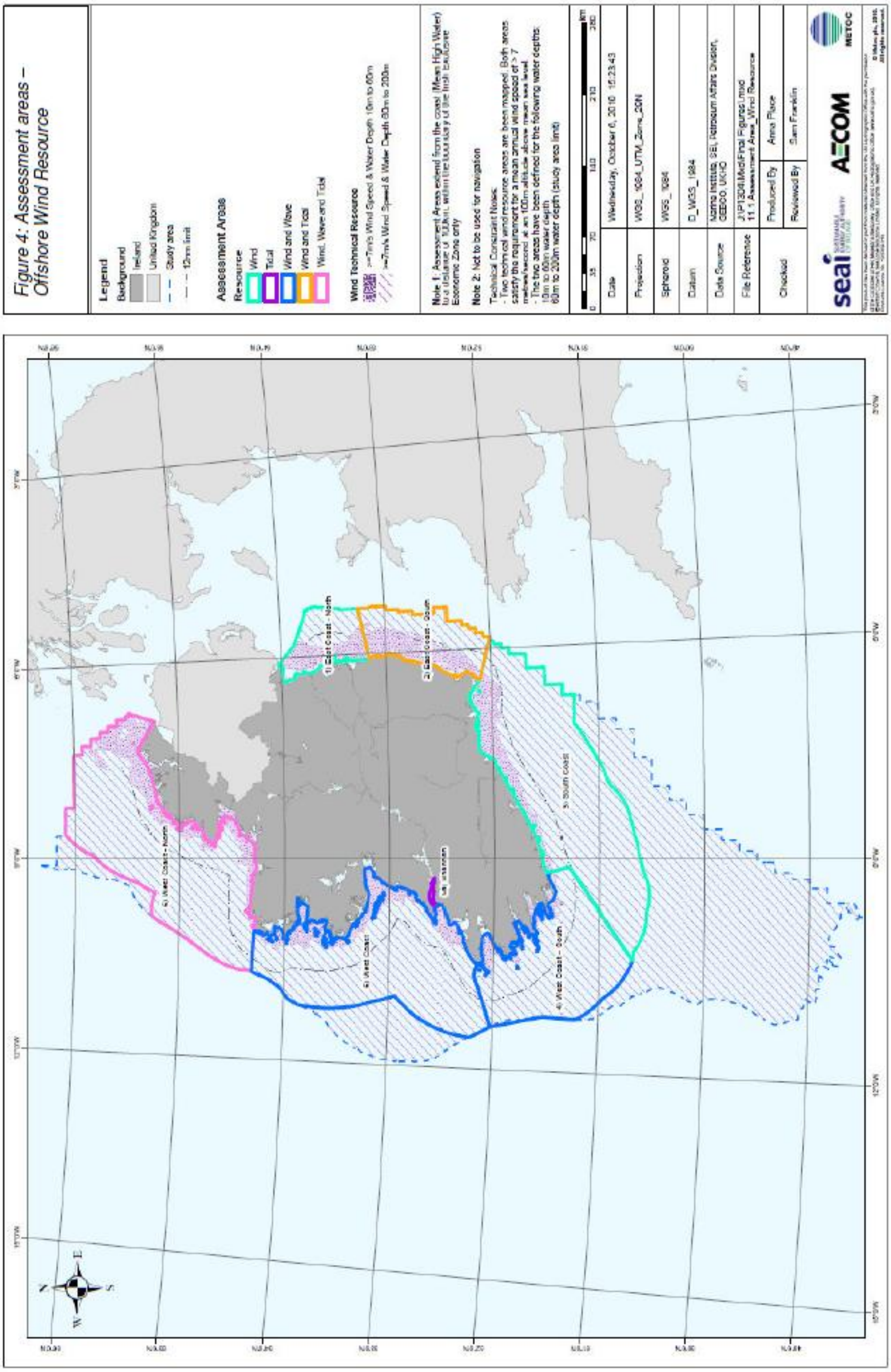
The theoretical practical resource of potential offshore wind-generated energy for Northern Ireland ranges from 0.10 TWh/year to 6.53 TWh/year, based on a maximum depth of 20m, at a distance of 2–10km from the coast and 3.0 MW wind turbines.

Currently, there are no offshore wind projects operating in Northern Ireland waters.

Another high-level offshore wind resource study was undertaken by Action Renewables on behalf of the Department of Enterprise, Trade and Investment (DETI) in 2004, *A Study into the Renewable Energy Resource in the Six Counties of Northern Ireland*. It highlights key areas of viable resources that can be economically exploited. Nominal installed capacity of 500 MW was estimated. In assessing the potential for possible offshore windfarms, this figure was assumed using characteristics for a 3.6 MW wind turbine and a water depth of 20m or less.

Figure 2.2 shows the offshore wind energy resource around the Republic of Ireland. Figure 2.5 shows the same for Northern Ireland.

Figure 2.2: Offshore wind energy resource – Republic of Ireland



2.3 Wave resource in the Republic of Ireland

Ireland has an excellent wave energy resource due to its favourable climate and location beside the Atlantic Ocean. A study by Pontes, M.T. et al (1998), *Assessing the European Wave Energy Resource*. calculated the theoretical wave resource for Europe at around of 320,000 MW; the highest resource levels in Europe were available off the west coast of Ireland, with an average wave power of 76 kW/m.

The public consultation document 'Options for the development of wave energy in Ireland' (2002) estimates that the practical wave energy resource offshore is greater than 6,000 MW or 59 TWh per annum. The potential is there for wave energy to be a crucial contributor towards Ireland's future energy requirements.

In 2005, the Sustainable Energy Authority of Ireland carried out the study *Accessible Wave Energy Resource Atlas*. The study identified the theoretical wave resource of 525 TWh that exists within the total limit of Irish waters (including Northern Ireland). Similarly as with wind, it is important to consider the physical constraints likely to be associated with wave-energy technology converters. Exclusion areas were removed for the resource calculation. The resource was limited to a distance of 100km from the shoreline so as to determine the economic limit for cable network to deliver power ashore from the generators. With this approach, the accessible wave energy resource was estimated to be 21 TWh. This is identified as the most up-to-date assessment but is not a definitive estimate of Ireland's potential, since technology performance continues to improve.

In this report, the technical resource was estimated based on the projection of the electrical power and energy levels that the historical wave regimes would attain if allowed to act on a cordon of real converters or converter groups. A reference wave converter was chosen for this purpose, in which the Pelamis wave energy converter device was used to determine the technical resource. The maximum technical energy resource was estimated to be 28 TWh per year.

In calculating the practical resource, specific deletions were made: areas with depth <50m, areas at overfalls (a turbulent stretch of water caused by marine currents over an underwater ridge), areas at wrecks, areas further than 100km from the coast (the practical economic limit of transmission cabling at the scales envisaged), areas where surface currents exceed 1.0 knot (Pelamis). In general, these are within 50m depth zone or in areas where the average power resource is relatively small (Irish Sea, North Channel).

The overall accessible electrical power-flow level obtainable according to the report, using the Pelamis cordon at different distances from the coast, was 2.4 TWh per year. The deletions made to establish the accessible resource were cable and pipeline corridor width, fishery blocks, marine traffic separation zones and submarine exercise areas.

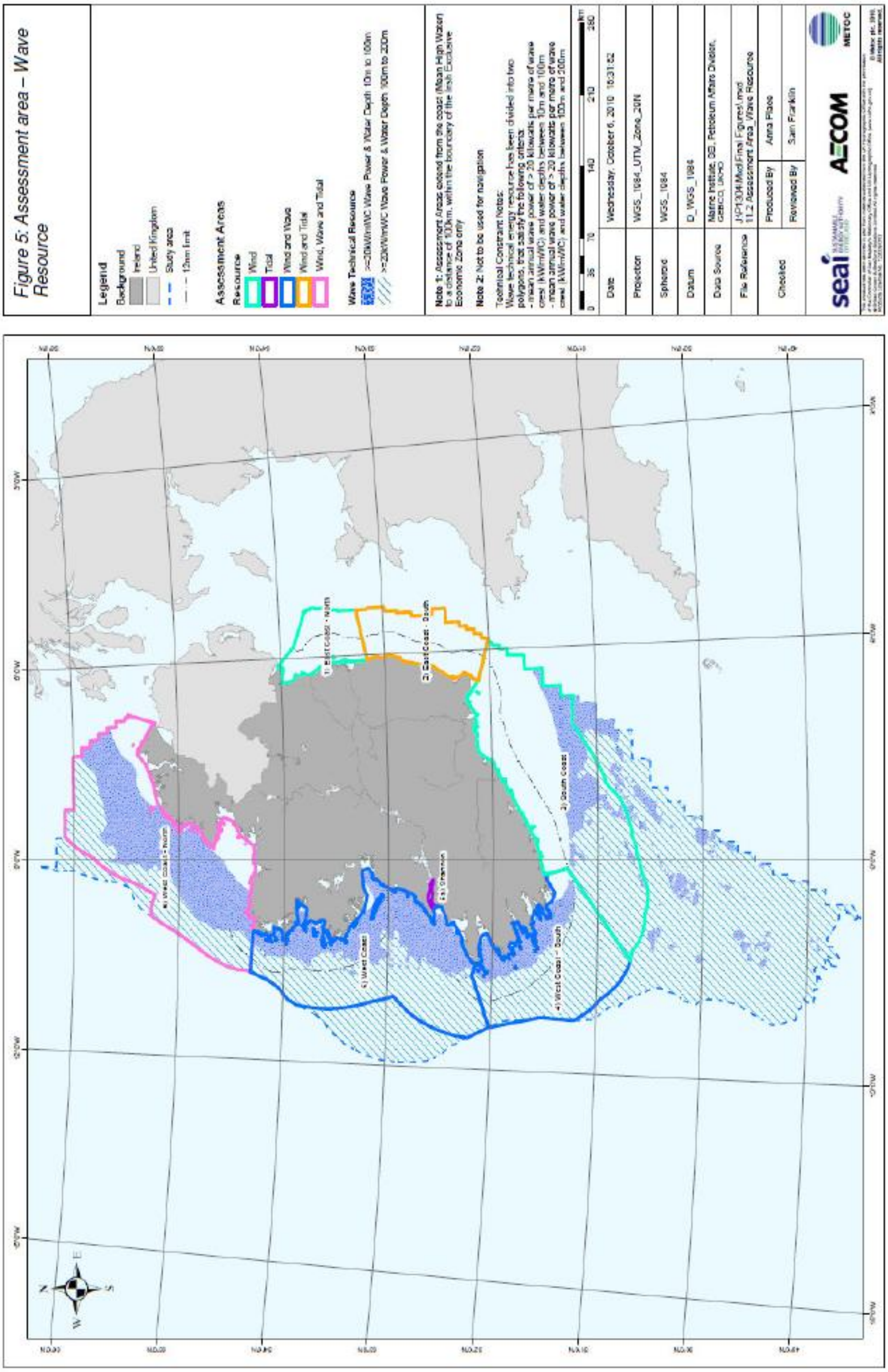
As expected, according to the report, the more exposed parts off the west coast provide the highest returns of energy (North-West Donegal, West Mayo, West Galway and South-West Kerry). The highest value obtained within 50km of the coast is 550 MWh/m off North-West Mayo. Near the coastline, values of 250–375 MWh/m are more common on the Atlantic seaboard.

2.4 Wave resource in Northern Ireland

Northern Ireland has little or no technical offshore wave power resource areas, as identified in the Northern Irish SEA completed for the Department of Enterprise, Trade and Investment, (DETI) in 2009. The UK Marine Resource Atlas (2007) and the Ireland Wave Energy Atlas (2005) data, published by the Irish Marine Institute, demonstrate that the range of wave resource power around Northern Ireland is generally low, in the range of 0 to 10 kW per metre of wave crest, when compared with the west of Scotland and the Republic of Ireland in which power resource of >30 kW per metre of wave crest has been identified.

Figure 2.3 shows the location of wave energy resources for the Republic of Ireland.

Figure 2.3: Location of wave energy resources – Republic of Ireland



2.5 Tidal resource in the Republic of Ireland

A study carried out by the Sustainable Energy Authority of Ireland in 2004, *Tidal and Marine Current Energy Resources in Ireland*, generated the values shown in Table 2.2.

Table 2.2: Outline of tidal & marine energy resources – Republic of Ireland

Classification	Development	Resource (TWh/y)
Theoretical	Gross energy content between 10m depth contour and 12 nautical miles limit	230
Technical	Theoretical resource limited by existing turbine support structure technology and to a minimum current of 2.0 m/s	10.5
Practical	Technical resource limited by wave exposure, sea- bed conditions, shipping lanes, military zones and disposal sites	2.63
Viable	Accessible resource limited by commercial constraints including development costs and market reward	0.92

The main objectives of this study were to identify potential sites for electricity generation, provide detail analysis of the areas identified, calculate the accessible resource of tidal energy using existing technologies, and predict the additional contributions which future technologies are expected to make.

It can be seen that the majority of the tidal energy resource is to be found on the east coast of Ireland as the resource on the west coast is mainly concentrated in the Shannon Estuary. At the time of publishing the report, tidal-energy technology was in the early stages of development and stream velocities of at least 2.0m/sec were required for efficient generation. It is envisaged that, with further technological development, efficient generation from stream velocities of 1.5m/sec should be practicable by the year 2015.

2.6 Tidal Resource in Northern Ireland

There are many exposed areas off Northern Ireland's coast that are characterised by strong tides. Their tidal resource is influenced by a combination of factors:

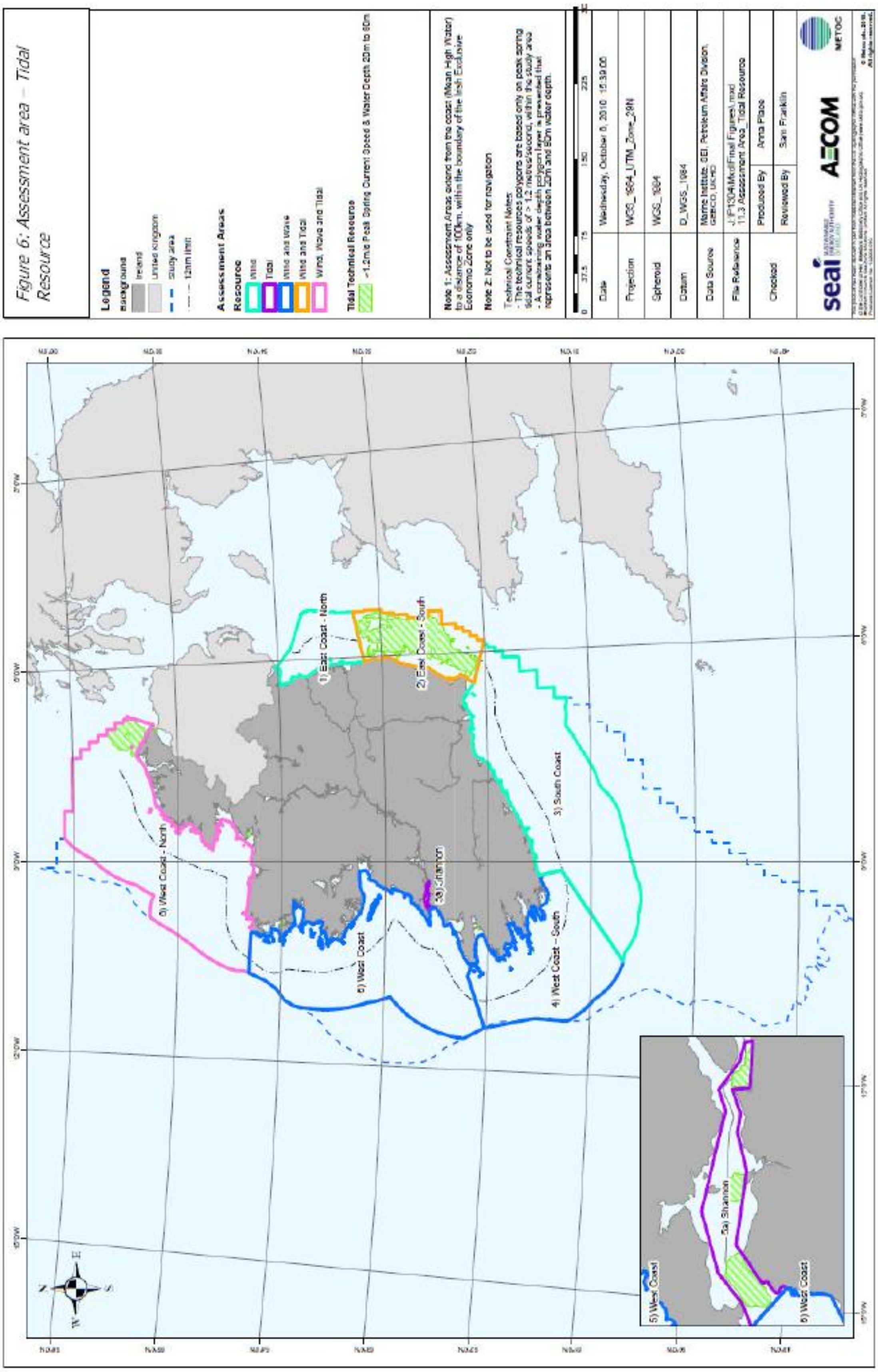
- rapidly shelving bathymetry, providing relatively deep water close to the coast for tidal energy converters to operate
- several large loughs, which concentrate tidal flows through narrow straits

- several small islands located near to land and separated by deep channels that experience very strong tidal currents

A DETI 2003 report ('A study into the economic renewable energy resource in Northern Ireland and the ability of the electricity network to accommodate renewable generation up to 2010') estimated that, with first-generation device technology (i.e. operating within a water depth of 20–40m), a potential capacity of 67 MW could be installed. The strongest tidal currents were predicted in areas with water depths ranging between 40 and 80m. It was anticipated that, if tidal device technology could operate in the deeper areas, an estimated total resource capacity of 650 MW could be possible. Currently, there is 1.2 MW (3,800 MWh/year) installed capacity in Strangford Lough. This is due to the strong tidal current flows available and suitable water depth in the central Narrows areas. The lough is also being used as a development site by Marine Current Turbines (MCT).

Figure 2.4 shows the location of tidal energy resources around the coast of the Republic of Ireland.

Figure 2.4: Location of tidal energy resources – Republic of Ireland

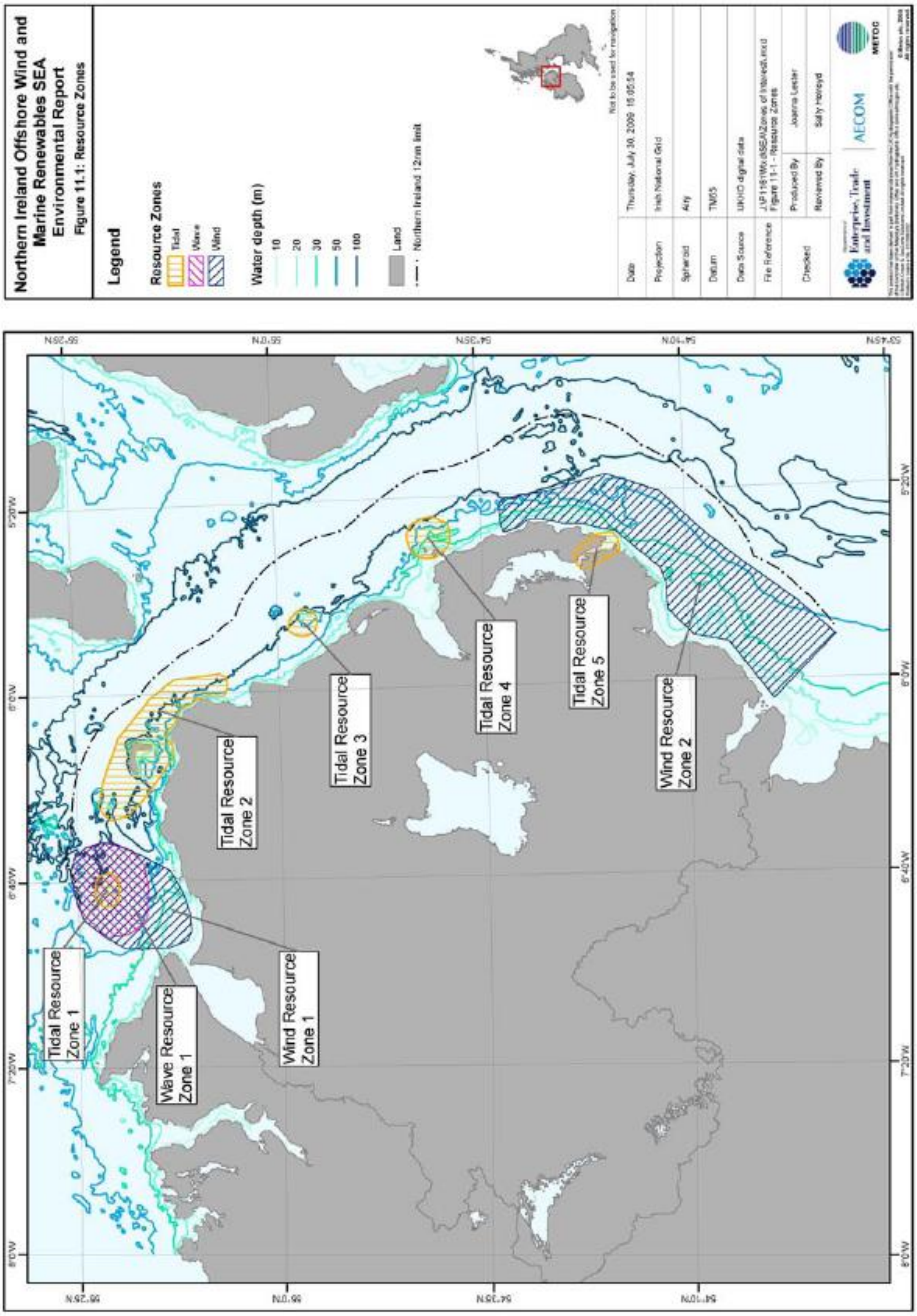


The resource charts illustrate how offshore wind resources exist all around the Irish coast but are limited by shallow water constraints on the east coast sites, whereas wave energy resources are concentrated down the west coast and tidal energy resources down the east cost.

The main objective of the SEA in Ireland was to identify where development is most likely to occur, to identify the potential environmental constraints in those areas and, taking potential environmental effects/constraints into account, to project the levels of development that could occur in the various 'Assessment Areas'. The port infrastructure required to support all three renewable resources is similar and is reviewed later.

The Northern Ireland SEA provides a summary resource chart which identifies potential offshore wind, tidal and wave resource sites, as shown in Figure 2.5.

Figure 2.5: Potential offshore wind, tidal and wave resource sites in Northern Ireland



2.7 Summary – Northern Ireland

Based on the results of the cumulative assessment summarised in the Northern Ireland SEA, it was concluded that between 900 MW and 1,200 MW of electrical generating capacity could be derived from offshore wind and tidal stream array developments in Northern Ireland waters without significant adverse effects on the environment.

In terms of the potential for offshore wind, Table 2.3 shows potential for between 600 and 900 MW of electrical generating capacity to be developed in Zones 1 and 2. The main factor influencing the amount of development that could occur in Zone 1 is the potential for offshore windfarm developments to affect the Giant's Causeway World Heritage Site (WHS) and the Causeway Coast Area of Outstanding Natural Beauty (AONB). The level of likely effect would be influenced by the location, size and configuration of any offshore windfarm development.

Table 2.3: Offshore wind potential – Northern Ireland

Resource Zone Capacity Offshore Wind (excluding environmental factors)			Resource Zone Capacity for Offshore Wind (including environmental factors)	
Zone	**Potential no. of offshore wind developments that could be accommodated** (based on average size of 300 MW)	**Total Potential MW from offshore wind** (based on average size of 300 MW)	**Likely no. of offshore wind developments that could be accommodated** (based on average size of 300 MW)	**Likely MW from offshore wind** (based on average size of 300 MW)
Zone 1	2	600 MW	1	300 MW
Zone 2	3	900 MW	2	600 MW
Potential Offshore Wind (excluding environmental factors)		1500 MW	**Likely Offshore Wind (including environmental factors)**	**600 MW to 900 MW**

Table 2.4: Tidal potential – Northern Ireland

Resource Zone Capacity for Tidal Arrays (excluding environmental factors)			Resource Zone Capacity for Tidal Arrays (including environmental factors)	
Zone	**Potential no. of tidal developments that could be accommodated** (based on average size of 50 MW)	**Total Potential MW from tidal developments** (based on average size of 50 MW)	**Likely no. of tidal developments that could be accommodated** (based on average size of 50 MW)	**Likely MW from tidal developments** (based on average size of 50 MW)
Zone 1	1 to 2	50 MW to 100 MW	2	100 MW
Zone 2	4	200 MW	4	200 MW
Zone 3	1 to 2	50 MW to 100 MW	0	0 MW
Zone 4	2	100 MW	0	0 MW
Zone 5	1	50 MW	0	0 MW
Potential Tidal Developments (excluding environmental factors)		550 MW	**Likely Tidal Developments (including environmental factors)**	**300 MW**

Based on the results presented above, it is estimated that there is potential for the development of between 900 MW and 1,200 MW of offshore wind and tidal marine renewable energy generating capacity within Northern Ireland waters.

2.8 Summary – Republic of Ireland

The following general observations can be made with respect to the development potentials associated with offshore wind, tidal and wave power in the Republic of Ireland.

Floating wind is still an emerging technology. It is unlikely that there would be any significant commercial-scale developments in operation by 2020. Therefore, although there is strong potential for the development of this technology in Irish waters, its overall contribution towards achieving the scenarios set out in the Offshore Renewable Energy Development Plan (OREDP) may be limited.

Opportunities for offshore wind off the south and west coast (Assessment Areas 3, 4, and 5) are constrained by water depth, shipping and navigation, seascape, protected sites and other sensitive receptors close to shore. Although the assessment has identified some development potential in these areas, they generally appear to be unsuitable for fixed wind development. Therefore, given the limitation with floating wind and constraints on the south and west coast for fixed wind development, it is likely that the 4,500 MW scenario identified in the OREDP would have to be met with fixed wind developments in Assessment Areas 1, 2 and 6. In fact, there is potential for the entire scenario to be met entirely with development in Assessment Area 6. However, availability of grid connections and grid capacity in this area is not good and could therefore prove to be a limiting factor for developments off the north-west coast.

The 4,500 MW scenario could also potentially be achieved entirely with fixed wind developments off the east coast (total identified potential for Areas 1 and 2 is between 4,200 MW and 4,800 MW) providing that no significant adverse effects are identified at the project stage (for example, relating to shipping and navigation, and nature conservation). Of the potential 4,200 MW to 4,800 MW, there is already 2,314 MW either consented to or due to receive a grid-connection offer in the Gate 3 process. It is therefore likely that limited additional development would be required in this area to achieve the 4,500 MW scenario.

Overall, in terms of wave and tidal energy, the high scenario set out in the OREDP is to develop 1,500 MW generating capacity. Based on the results of the assessment, it is concluded that, overall, the potential developable wave resource, in both shallow (10m to 100m) and deeper water (100m to 200m) is substantial – totalling between 27,500 MW and 31,100 MW generating capacity across all areas, with at least 12,500 MW in shallower waters. In comparison, the overall potential tidal energy resource is much more limited, ranging between 1,500 MW and 3,000 MW across Assessment Areas 2 and 6.

Based on these figures, it appears that the development scenario for 1,500 MW for wave and tidal energy generating capacity could be achieved entirely from wave energy, with a contribution from tidal energy. However, a number of factors need to be considered:

- Most of this resource is located off the west coast. Consequently, although there is a significant resource, realisation of this potential resource, even achieving the scenario of 1,500 MW generating capacity, would depend not only on industry developing the necessary technology to a commercial scale by 2020, with significant progress by 2030, but also on the provision and availability of onshore infrastructure such as grid connections and capacity.
- There is no tidal potential in the Shannon Estuary due to environmental constraints.
- There is potential for tidal energy to contribute towards achieving the scenario of 1,500 MW for wave and tidal energy generating capacity, but environmental constraints associated with this technology are generally greater than for wave developments due to the proximity of the resource to the coast. There is more scope for avoiding protected sites and sensitive receptors in Assessment Area 6, although the availability of grid connections in this area is still a consideration.

Table 2.5 illustrates the conclusions from testing the OREDP development scenarios – i.e. the assessment results of the development potential for these technologies – taking into account potential environmental constraints and other marine activities/users, for each of the different offshore renewable energy technologies within the assessment areas. This table is described in the Environmental Report as a summary of the results of the Cumulative Assessment. It summarises the total amount of development that could potentially occur within each assessment area without likely significant adverse effects on the environment.

Table 2.5: Development potential in each assessment area (without adverse environmental effects)

Assessment Area**	Fixed Wind (MW)	Wave: 0 to 100m Water Depth (MW)	Wave: 100m to 200m Water Depth (MW)	Tidal (MW)*	Floating Wind (MW)**	Total
1: East Coast (North)	1200 to 1500***	-	-	-	-	**1200 to 1500**
2: East Coast (South)	3000 to 3300****	-	-	750 to 1500	-	**3750 to 4800**
3: South Coast	1500 to 1800	-	-	-	6000	**7500 to 7800**
4: West Coast (South)	600 to 900	500 to 600	3000 to 3500	-	5000 to 6000	**9100 to 11000**
5: West Coast	500	5000	6000 to 7000	-	7000	**18500 to 19500**
5a: Shannon Estuary [15]	-	-	-	0	-	**0**
6: West Coast (North)	3000 to 4500	7000 to 8000	6000 to 7000	750 to 1500	7000 to 8000	**23750 to 29000**
Total	**9800 to 12500**	**12500 to 13600**	**15000 to 17500**	**1500 to 3000**	**25000 to 27000**	**63800 to 73600**

A dash indicates that a limited technical resource is available

The tidal resource is based on tidal stream technologies only and does not include tidal barrages. Although there is a large potential floating offshore wind resource, this is still very much an emerging technology. It is unlikely that it would be developed at a commercial scale by 2020. The development potential in Assessment Area 1 takes into account the proposed Oriel Windfarm (330 MW) and the northern section of the Dublin Array (approx. 150 MW). The development potential in Assessment Area 2 takes into account the approved Arklow Bank Windfarm (520 MW) and Codling Bank (1,100 MW) and the southern part of the proposed Dublin Array (approx. 214 MW) which is due to receive a grid-connection offer in the Gate 3 process.

Those areas where a limited technical resource is available may contain a potential resource for some of the technologies. However, the resource assessment has concluded that for technical reasons – e.g. water depth, distance from shore, etc – the resource available is unlikely to be developed in the timescale of the OREDP (i.e. by 2030).

3.0 Geographic Distribution of Irish Ports and Marine Renewable Resources

In the previous section it was shown how the offshore renewable energy resource is divided around the coast of Ireland into the following regions:

1. East Coast (North)
2. East Coast (South)
3. South Coast
4. West Coast (South)
5. West Coast
6. Shannon Estuary
7. West Coast (North)

In each of these areas, certain marine renewable energy resources predominate, as shown in Table 3.1:

Table 3.1: Distribution of renewable energy resources in Ireland

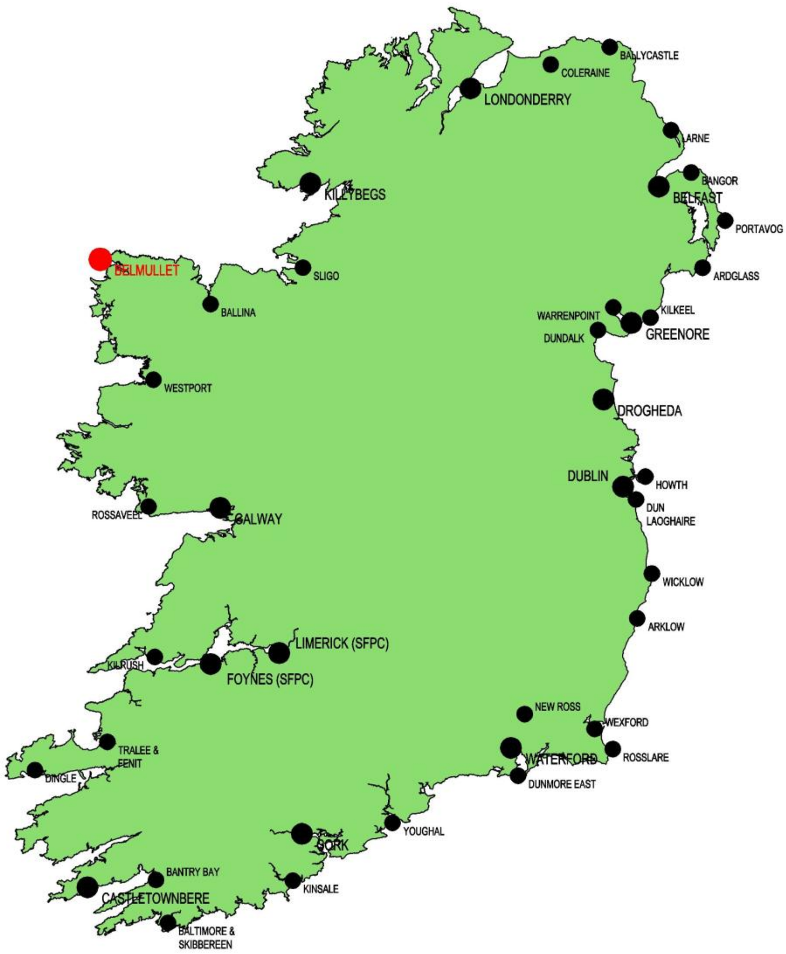
Region	Offshore Wind (Fixed)	Tidal	Wave	Offshore Wind (Floating)
1. East Coast (North)	Yes	Yes	-	-
2. East Coast (South)	Yes	Yes	-	-
3. South Coast	Yes	-	-	Yes
4. West Coast (South)	Yes	-	Yes	Yes
5. West Coast	Yes	-	Yes	Yes
6. Shannon Estuary	-	Yes	-	-
7. West Coast (North)	Yes	Yes	Yes	Yes

Thus, for all ports on the North East and South-East coasts, the principal target renewable marine resources are fixed offshore wind and tidal. This resource range will require particular port facilities in respect of quay lengths, water depths, adjacent hinterland areas and crane-lift potential. Conversely, in these areas there is very little wave resource and water depths are insufficient to support floating-wind deployments. The same logic may be applied to the other coastal regions.

Thus, the ports located within the boundaries of the seven coastal regions may be considered as candidates to support the deployment of the various technologies associated with the predominant renewable resources within the boundaries of the regions.

Figure 3.1 shows the distribution of the principal and secondary ports, as well as the wave-energy test site at Belmullet. A second tidal energy test site may be developed in Northern Irish waters.

Figure 3.1: Principal and secondary ports, with Belmullet wave test site



4.0 Assessment of Offshore Support Vessel Requirements

This section assesses the range and number of specialist vessels that would be required for developing a typical 300 MW offshore windfarm.

4.1 Example – vessels used for Thanet windfarm

It is informative to review the range of vessels used in the recent erection of the 300 MW Thanet windfarm, by way of example of the kind of resources necessary in this type of project. Around 35 vessels, ranging from support craft to installation vessels, were involved in the three main elements of the project: turbine installation, the offshore substation and the associated cabling works. In total, 100 foundations, transition pieces and turbines have been installed.

Vattenfall acquired the Thanet Offshore Wind Farm project in November 2008. Construction was completed in September 2010. There are 100 Vestas V90 wind turbines that have a total capacity of 300 MW. This is sufficient to supply more than 200,000 homes per year with clean energy. The largest operational offshore windfarm anywhere in the world, it will make a strong contribution to the UK government's national and regional renewable energy targets. The Thanet project is located approximately 12 km off Foreness Point, the most eastern part of Kent. Some elements of the onshore construction work commenced at the former Richborough power station in January 2008 where the onshore substation is located.

Sea Jack

Commencing in March 2009, A2SEA's jack-up platform *Sea Jack* installed the monopile foundations and navigation markers, transferred from Vlissingen to Ramsgate by Osprey Shipping's tug *Osprey Fighter* shown below and the barges *Osprey Carrier* and *E3501.*

Osprey Fighter

Osprey Carrier/E3501

Stevns Arctic

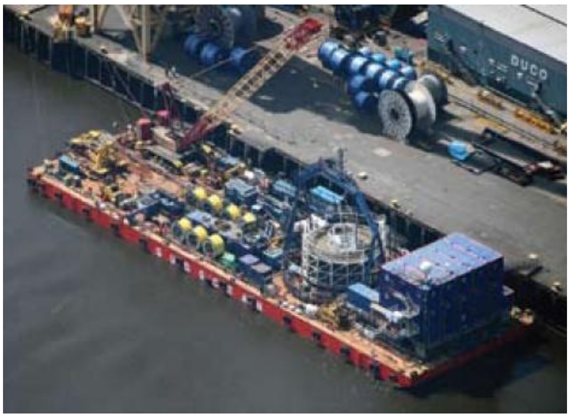
The Danish-owned tug *Stevns Arctic* supported the *Sea Jack* together with, among others, Viegers' Shoalbuster *Bever* and Driemast BV's tug *Meander* providing assistance at Ramsgate.

In May 2009, with around 20 monopiles installed, MPI Offshore's installation vessel *MPI Resolution* began installing the transition pieces, loading out of Vlissingen. By November 2009, with 84 transition pieces in place, the *MPI Resolution* switched to installing the actual turbines, which were by then loading out of Dunkirk.

MPI Resolution

In January 2010 the installation of the 100th monopile by the *Sea Jack* was celebrated. That vessel then took over installing the remaining 14 transition pieces, which were transferred to Ramsgate six at a time from Vlissingen.

A variety of craft, including the cable-lay barge *UR101,* chartered by main cable contractor, Aberdeen-based Subocean Group, laid the inter-array and export cables, supported by craft that included JP Knight's ASD tug *Keverne* and Multraship's ASD tug *Multratug 18*.



UR 101

Keverne

Initially the *UR101* was used on the inter-array element but was later switched to the task of installing the export cable.

Two sophisticated offshore support vessels were mobilised by Subocean to install the inter-array cables. In October 2009 a renewable industry milestone was passed when the Norwegian-owned cable layer *Polar Prince* became the first vessel to install inter-array cables using DP.

Polar Prince

Four cables were buried 1m below the seabed in 30m of water in just 24 hours. The method applied, it is claimed, cut installation time by 50%. In December 2009, just days after the first turbine was installed, the Norwegian-owned, Isle of Man-registered DP2 class support vessel *Normand Mermaid* joined the *Polar Prince* in laying the inter-array cables. The *UR101* meanwhile was busy establishing the shore end of the export cable to the onshore substation at Pegwell Bay south of Ramsgate.

The offshore substation was installed in January 2010. A jacket-style foundation was constructed to support the three-level topside structure. The Russian-owned crane ship *Stanislav Yudin,*

Stanislav Yudin

operated by Dutch company Seaway Heavy Lifting, was mobilised for this operation, supported by the anchor handling tugs *Blizzard* and *Typhoon*

Typhoon

from ITC Holland BV, Harms Bergung Transport's tug *Centaurus,* and the Spanish ASD tug *Red Wolf.* The *Stanislav Yudin* then returned to Rotterdam, while Fugro-Seacore's jack-up *Excalibur* continued with the substation installation work.

Excalibur

Cable mattress installation work was undertaken by Vroon Offshore's *Oil Express,*

Oil Express

supported by various craft including the tugs *DMS Globe, Voe Jarl* and *Red Dolphin*.

The above account gives a flavour of the range of specialised vessels that must be used in the installation of an offshore windfarm. Table 4.1 shows a breakdown of the vessels used during the Thanet offshore windfarm installation.

Table 4.1: Vessels used in Thanet offshore windfarm installation

Vessel type	Names
Jack-up platform	Sea Jack
Jack-up vessel	MPI Resolution, Excalibur
Cable-lay vessel	Polar Prince, Normand Mermaid
Cable-lay barge	UR101
ASD tugs	Keverne, Multratug 18, Red Wolf
Heavy-lift vessel	Stanislav Yudin
Specialist support vessels	Oil Express
Barges	Osprey Carrier, E3501
Tugs	Osprey Fighter, Stevns Arctic, Bever, Meander, Centaurus, DMS Globe, Voe Jarl, Red Dolphin
Anchor handling tugs	Blizzard, Typhoon

4.2 Summary

Thus, for a 100-turbine, 300 MW offshore windfarm, up to 35 assorted vessels would be required over a two-year period. It can be expected that similar resources would be required for a 100 MW tidal array or wave array deployment carried out over a similar period. Wave energy systems bring an additional requirement for the installation of multiple mooring systems for the wave device array. This would involve anchor handling and crane vessels in addition to the vessel types used for the Thanet windfarm. Wave and tidal array deployments might also require the use of specialist support vessels designed exclusively to ease the task of device deployment.

This section has provided an insight into the range of vessels required to deploy and install an offshore windfarm similar in size to the Thanet field. Several such windfarms are planned for installation in Irish waters. Table 4.2 shows a typical deployment fleet for a 300 MW wave energy array.

Table 4.2: Typical fleet needed for 300 MW wave energy array

Vessel type	No.
Jack-up platform	1
Special installation vessel	2
Cable-lay vessel	2
Cable-lay barge	1
ASD tugs	4
Heavy-lift vessel	1
Specialist support vessels	1
Barges	2
Tugs	10
Anchor handling tugs	4
Multi-purpose offshore support vessel	1
Maintenance vessels	2
Total	31

5.0 Offshore Wind/Marine Energy: Status of Irish Vessel Owners

5.1 Irish shipping companies with potential interest in ocean energy

A checklist of Irish vessel owners and brokers has been created. Each organisation has been consulted and assessed separately. Table 5.1 provides contact information for companies. Not all of them are actual shipowners; several have evolved to become shipping specialists without owning their own fleet, including the Burke Shipping Group and ship-brokers Mullock & Sons Ltd.

Table 5.1: Irish vessel owners and brokers

SHIPPING COMPANIES	
ISLAND SHIPPING	Address: Dispensary Lane, Wicklow Tel: +353 (0) 40461623 TD – Simon Greenwood CD – Tim Greenwood
MAINPORT GROUP	Address: Irish Mainport Ltd., Mainport, Monahan Road, Cork Tel: +353 21 5004200 CEO – Capt. Dave Hopkins
SINBAD MARINE SERVICES	Address: Shore Road, Killybegs, Co Donegal Tel: +353 (0) 74 9731417 MD – Jim Parkinson
FASTNET SHIPPING LTD	Address: Bridgewood House, Ballyrobin, Ferrybank, Waterford, Tel: +353 51832946 Contact: fastnetshipping@eircom.net
PACIFIC BLUE LTD	Address: E6 South City Business Park, Tallaght, Dublin 24 Tel: +353 14511791 Contact: Seamus Connolly
BURKE SHIPPING GROUP	Address: Head Office, Berth 32 Ocean Pier, Alexandra Rd, Dublin Tel: +353 (0) 1 8192600 MD – Pat Brennan
ARCTIC SHIPPING AGENCY	Address: Roshine Road, Killybegs, Co. Donegal Tel: +353 74 9741165 MD – John Mitchell Mob: +353 87 6677693
MSV INTERNATIONAL LTD	Address: Ashmore House, Bushypark, Co. Galway Tel: +353 (0)91 583827 CEO – Patrick O'Malley

SHIP BROKERS	
MULLOCK & SONS (SHIPBROKERS) Ltd	Address: The Shipping Office, Dock Road, Limerick Tel: +353 61 315315 MD – John Dundon

Each of these companies and the associated shipping fleet are considered below, in the order in which they appear in Table 5.1.

Island Shipping

Island Shipping has built up a considerable portfolio of experience since 2004, having supplied survey, support, remedial, maintenance and consultancy services to Arklow Bank offshore windfarm. The company is based in Wicklow town. Its sister company Island Maritime is a multidisciplinary marine organisation supplying a variety of construction, engineering, vessel and consultancy services to the marine sector in Ireland and Europe. The companies are led by two well-qualified brothers, Tim and Simon Greenwood. In recent years, the company has specialised in the supply of offshore windfarm support vessels; the latest two additions, Island Tiger and Island Panther, are water-jet-propelled fast catamarans. Island Tiger, a new Wildcat 53 vessel built by Safehaven Marine, was launched in Cork in May 2010.

In March 2010 the new vessel Island Flyer joined the Island Shipping fleet. Powered by twin 420HP Caterpillar diesel engines with a large clear aft deck, the vessel is versatile and has been configured for hydrographic and environmental survey, light sampling and commercial diving. Island Tiger is currently carrying out crew-transfer operations on the SSE and RWE Greater Gabbard offshore windfarm in the North Sea.

Island Shipping is a fine example of a company adapting to the emerging Operations and Management (O&M) opportunities provided by the development of offshore windfarms. It is a relatively small company operating competitively internationally, with modest overheads.

Table 5.2: Island Shipping vessels

Island Shipping: Vessel Type	Name/Number	Functions
Shallow Draft Tug	Husky	21m
Fast Crew Boat	Island Flyer	12m fast survey, dive, crew boat
Multicat	Island Partner	15m Road Transportable, Multicat
Windfarm Support Vessel	Island Tiger	16m Catamaran
Windfarm Support Vessel	Island Panther	16m Catamaran

Table 5.3: Island Shipping summary

Company: Island Shipping	
1. Management and commercial experience in Offshore Deployment and O&M	Yes
2. Years involved in the business	6 years
3. Where is fleet deployed?	Arklow Bank, Greater Gabbard
4. Experience in servicing Irish and UK markets	6 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues
7. Barriers to growth/market impediments	Access to capital

Irish Mainport Holdings

The Mainport Group is an integrated marine services company that provides a full range of marine services to shipowners, exporters, importers, oil companies and others involved in the maritime trades. Its operations are conducted from offices located in Cork, Foynes and Drogheda as well as overseas. Mainport started operations in 1957 as Ronayne Shipping Ltd, based in Cork. In 1964 the business diversified into stevedoring, warehousing, transport and logistics. In 1970 it expanded again after the start of oil exploration in the Celtic Sea. A joint venture was established with Smit International in Rotterdam for the marketing of its offshore service craft; this led to the company becoming Ireland’s largest shipping company providing services to the offshore industry.

In 1976, following continuing growth through acquisition, further expansion took place which involved the state shipping company, Irish Shipping Ltd; a new holding company, Irish Mainport Holdings, was established. In 1979 Mainport became involved in the shipowning business with its first two vessels through a company named Seahorse, which had won a contract from Marathon Petroleum Ireland to provide a platform supply vessel and a safety standby vessel to service the Kinsale gas field. Mainport continued to grow; at the beginning of 1995, Celtic Tugs was launched with the aim of providing towage services in Irish ports and around the Irish coast. In 2000 Mainport was awarded a long-term contract to provide three ASD tugs on the River Shannon.

In 1997 the company invested in a ship-agency business in South Africa, leading to the formation of Mainport Africa Shipping Pty. This agency has continued to develop, with offices in Durban, Cape Town, Richards Bay and Johannesburg. In 2004 a large expansion took place with the setting-up of a joint-venture company in the North Sea with Norwegian partners Sartor Shipping, based in Bergen. Mainport then succeeded in breaking into the offshore oil business in the North Sea with the purchase of eight vessels, and it consolidated its position. In 2007 Ocean Mainport Rescue was formed following the purchase of Havila Rescue in Aberdeen, together with a further eight vessels. Mainport sold back its interests in this sector to Sartor in September 2008.

Caspian Mainport started life in 2006 when a contract was won from Agip to supply two large drill-cutting barges for use in the Kashagan Oil Field in the Caspian Sea. Caspian Mainport has continued to grow and now has seven vessels in operation in the Caspian Sea.

Irish Mainport Holdings represents a success story in Irish shipping. It has continued to grow regardless of fluctuations in local markets through diversification and the identification of new opportunities. The Mainport team includes a diverse range of highly qualified individuals with a broad range of experience, including master mariners and marine engineers though to accountants and administrators. It is well placed to manage any expansion in Ireland’s offshore marine renewable energy developments.

Table 5.4: Irish Mainport Holdings vessels

Mainport Group: Vessel Type	Name/Number	Functions
Irish Mainport Holdings		
ASD Tugs 44tbp	M/V Celtic Rebel, M/V Celtic Isle, M/V Celtic Banner	37.6m Towage, Safety, Firefighting, Salvage
Support Vessel	M/V Mainport Oak, M/V Mainport Elm, M/V Mainport Ash	57m Supply, Seismic Support
Standby/Supply Vessel	M/V Pearl	65.4m Multi-Role Support
Bunker Barge	Blue Marlin	45.3m Bunker Barge
Caspian Mainport Vessels		
Tug 40tbp	2 CM Eagle, CM Annie	29m Towage, Safety
Anchor Handling Tug Support 40tbp	4 CM Heather, CM Italia, CM Cormorant, CM Wulf	29m Towage, Safety, Support
Anchor Handling Tug 44tbp	2 CM Kurik, CM Mehran	26.8m Anchor Handling, Safety
PSV	2 CM Service, CM Supporter	55m Safety, Support
Rescue/Recovery Vessel	M/V Ocean Tern	57m PSV/Stand-by, Rescue
DP-1 Support Vessel	CM Surveyor	44.8m ROV/Diving/Survey
Crew Boat	CM Jet 1, CM Jet 2	32.5m x 36 knots

Table 5.5: Irish Mainport Holdings summary

Company: Irish Mainport Holdings	
1. Management and commercial experience in Offshore Deployment and O&M	Yes
2. Years involved in the business	30 years
3. Where is fleet deployed?	North Sea, Caspian Sea, South Africa
4. Experience in servicing Irish and UK markets	30 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Good – significant fleet owner
7. Barriers to growth/market impediments	Access to capital and market revenues

Sinbad Marine Services

Sinbad Marine Services Ltd was established in 1978 by its current managing director Jim Parkinson. The company is an integrated marine services and leading shipping company operating out of Killybegs in Co Donegal. It provides three main service types:

1. Shipping Agency
2. Offshore Support Services
3. Marine Plant Hire

Sinbad Marine Services provides ship agency services to approximately 650 vessels each year. The typical services include: arranging berths, pilotage, bunkers, provisioning, cargo handling, ferry and tug hire, crew changes, emergency medical evacuations, motor repairs, customs, warehousing and laydown. Its clients include exploration companies, offshore service contractors, fishing vessels, cargo vessels, cruise liners, tankers, break bulk vessels, survey vessels and windfarm developers.

It provides supply base management and onshore logistics support to exploration, seismic and survey companies and other oil and gas service companies, as well as vessel owners and managers. It has worked with many large multinational offshore companies, including Shell E & P, Van Oord, Statoil, Eni, Marathon, Technip, Tideway, Fugro SurveyTransocean, Exxon Mobil and many others.

The company recently completed the purchase of the latest addition to its fleet – the new 47-tonne bollard pull tug SMS Bison. Sinbad intends to operate this vessel throughout Europe and locally in the home port of Killybegs. In March 2010, Sinbad purchased a new 15.5m x 8.5m road-transportable multi-cat service vessel, SMS Meercat.

Sinbad Marine Services is a very well-run family company. Killybegs is ideally geographically situated to service offshore renewable marine energy developments off the north-west coast of Ireland as well as gas developments. The modern port facilities are second to none in this respect and transit distances to likely development areas are not too great. The company continues to grow with the acquisition of flexible, multi-purpose vessels that have relevance to marine renewable energy developments. This expansion has taken advantage of the growing demand from the offshore industry, specifically the Corrib gas project. Several tugs, workboats and barges have been added recently to the fleet, with some of the vessels and barges involved in the Corrib project. Sinbad and Killybegs Harbour Centre have run the supply base in Killybegs for the subsea engineering firms that developed the Corrib gas field, including Allseas, Technip and CTC Marine.

Table 5.6: Sinbad Marine Services vessels

Sinbad Marine Services: Vessel Type	Name/Number	Functions
Azimuth Tractor Drive 44tbp Tug	SMS Bison	Towing, mooring, Firefighting
Damen Shoalbuster 32tbp Tug	Shoalbuster	Towing, mooring, anchor handling
Single-screw steerable nozzle 10tbp	M/V Nomad	Multi-purpose, Firefighting
Multi-purpose Workboat	M/V Ocean Cat	Catamaran, Surveying, Crew Change, Wind Farm Support
Multi-purpose Multicat	SMS Meercat	Surveying, Crew Change, Wind Farm Support
Workboat	M/V Sinbad	11.2m Workboat
Fast Workboat	M/V Sinbad II	5.2m Workboat
Interlocking Pontoons	7	12m x 30t Pontoons

Table 5.7: Sinbad Marine Services summary

Company: Sinbad Marine Services Ltd	
1. Management and commercial experience in Offshore Deployment and O&M	Yes
2. Years involved in the business	32 years
3. Where is fleet deployed?	Corrib, Killybegs
4. Experience in servicing the Irish and UK markets	32 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues
7. Barriers to growth/market impediments	Access to capital

Fastnet Shipping Ltd

Fastnet Shipping Ltd is a marine plant operator and hire specialist based in Waterford. It has more than forty years' experience in the industry. The broad areas of experience include dredging, harbour and coastal towage and the operation of various marine plant. The company has a good portfolio of tugs, pontoons, barges, dredgers, combi-floats and uni-floats, all of which can be modified to suit client requirements. The company is expecting to take delivery of the first of two multi-purpose high-speed catamarans in 2010. These vessels are expected to be suitable for use in the offshore renewable and survey market. All vessels will be licensed by the Maritime & Coastguard Agency (MCA) and Irish Department of Transport.

The company is a major independent towage operator in Ireland, offering clients considerable experience and knowledge in the business. Experience ranges from harbour and coastal towage, berthing assistance and safety standby to salvage and bed levelling. The tugs are Voith Schneider-propelled and include one 25-tonne, one 15-tonne and two six-tonne bollard pull vessels.

Fastnet Shipping is also the largest independent operator of jack-up barges in Ireland, with both modular and mono hull variants. A member of the International Jack-Up Barge Owners Association, it has been involved in many major infrastructure and site investigation projects with its platforms throughout Europe. The current barges include Jakup, with 34m legs which can be extended depending on ground conditions. The barge is a monohull jack-up with full international load-line certification and can operate offshore where modular platforms are not permitted.

In addition, the company has two modular jack-up barges (Fastnet Jack 1 & 2), based on the combi-float C-5 design.

Fastnet Shipping has significant experience in the operation of tugs and jack-up barges which could certainly be deployed to assist with offshore ocean renewable energy deployments.

Table 5.8: Fastnet Shipping vessels

Fastnet Shipping Ltd.: Vessel Type	Name/Number	Functions
Twin Voith Tug 25tbp	Bargarth	28.4m Towage, Safety, Firefighting, Salvage
Twin Voith Tug 15tbp	Ingleby Cross	25.0m Towage, Safety, Salvage
Single Voith Tugs 6tbp	Agile, Adept	17.5m Towage, Safety, Bed levelling, sub-surface jetting
Monohull Jack-up Barge	Jakup	25m x 17.5m, 31m Legs x 4
Flexifloat Modular Pontoon Systems	Combifloat 20 x 5.2m Uniflote	
Pontoon	Ardon	36m x 10m

Table 5.9: Fastnet Shipping summary

Company: Fastnet Shipping Ltd.	
1. Management and commercial experience in Offshore Deployment and O&M	Yes
2. Years involved in the business	20 years
3. Where is fleet deployed?	European and Irish coastal waters
4. Experience in servicing the Irish and UK markets	20 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues
7. Barriers to growth/market impediments	Access to capital

Pacific Blue Ltd

The Pacific Blue fleet of seismic support vessels is not based in Ireland, although the company has an office in Dublin. The fleet uses converted trawlers and is only relevant here in view of the Dublin office address. These vessels would be available for charter in the international market.

Table 5.10: Pacific Blue vessels

Pacific Blue Ltd (Van Laar Maritime): Vessel Type	Name/Number	Functions
Converted Trawlers	20 vessels: Aquarius, Blue Angel, Dolfijn, Eagle, Flaxborg, Fenny, Flamingo, Inge, Jason, Linda C, Marja, Merlin Diver, New Grange, Octopus, Osprey, Shannon, St John, Sursum Corda, Tonijn, Walvis	Seismic Support Vessels, Guard, Utility and Chase Vessels

Figure 5.1: Pacific Blue vessels

Table 5.11: Pacific Blue summary

Company: Pacific Blue Ltd	
1. Management and commercial experience in Offshore Deployment and O&M	Yes
2. Years involved in the business	Not known
3. Where is fleet deployed?	European waters
4. Experience in servicing the Irish and UK markets	Not known
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues
7. Barriers to growth/market impediments	Access to capital

The Burke Shipping Group

The Burke Shipping Group is an Irish-owned shipping and logistics company operating in Ireland since 1895. Owned and operated by the Doyle family, the group has developed from its maritime roots and is now operating on a global platform, offering integrated shipping, logistics and maritime services. It is the market leader in Ireland in these categories, with offices in the major ports, including Dublin, Cork, Limerick, Foynes, Waterford, Fenit and Belfast. It also has an office in China.

The Burke Shipping Group is the principal operating subsidiary of the Doyle Group. In 1886 Denis Francis Doyle established DF Doyle Stevedores in the Port of Cork. The company has passed through three generations of the Doyle family and is now steered by cousins Conor and Frank Doyle, grandchildren of the founder. The Doyle Group has expanded considerably over the last decade, through strategic acquisitions. These acquisitions were focused on the company's core areas of activity in the shipping industry. Since the early 1990s many Irish shipping companies have been acquired, including RA Burke Ltd, SJ Murphy (Foynes & Cork), Express Shipping Ltd, John Burke & Co (Belfast), James Scott and Co, Dublin & Cork Maritime, and Cork Dockyard (previously known as Verolme Dockyard). In 2008 the Doyle Group embarked on a strategic integration programme, consolidating selected members of the group into one principal operating subsidiary, the Burke Shipping Group (BSG).

BSG remains privately owned as a member of the Doyle Shipping Group, DSG. DSG had a turnover in 2009 of €73 million. BSG had a turnover in 2009 of €47 million, with 200 employees and one million square feet of warehousing available. However, DSG shipping operations are now limited to a 50% ownership of Shannon Tugs Ltd and 50% of Cross River Ferries Ltd, so there are limited resources for ocean energy deployment.

DSG and BSG have experience in handling offshore and onshore wind turbines and supporting structures, and are well placed to work with general ocean energy systems. In particular, Cork Dockyard would be suitable as a marshalling area and deployment base.

Table 5.12: Burke Shipping Group summary

Company: Burke Shipping Group	
1. Management and commercial experience in Offshore Deployment and O&M	Some experience in handling onshore wind turbines and offshore special projects
2. Years involved in the business	115 years in shipping and logistics but limited in offshore support
3. Where is fleet deployed?	Shannon
4. Experience in servicing the Irish and UK markets	15 years – Shannon tugs
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Very good, based on other business interests
7. Barriers to growth/market impediments	Access to capital and use of resources (Cork Dockyard)

Arctic Shipping Agency

The Arctic Shipping Agency was established in 1988, primarily to handle its in-house project and vessel requirements. Headquartered in Killybegs, it has developed a range of new facilities. In 2001 it identified opportunities and expanded to cater for a wider range of port and shipping activities. Today its services include ship agency, stevedores and cargo handling, project and shore-based operations, towage, barges and workboats, craneage, crew travel, bunkering, port & customs clearing transport, cargo laydown and uplifting.

Table 5.13: Arctic Shipping Agency summary

Company: Arctic Shipping Agency	
1. Management and commercial experience in Offshore Deployment and O&M	Some special projects including onshore wind turbines and subsea
2. Years involved in the business	9 years
3. Where is fleet deployed?	No fleet, based in Killybegs
4. Experience in servicing the Irish and UK markets	9 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues
7. Barriers to growth/market impediments	Access to capital

MSV International Ltd

MSV International Ltd, a private company founded in Malta, operates marine survey vessels Capital Oir, Capital Ban, Arctic Sun and Meredian. It has an office in Glen Rock Business Park, Ballybane, Co Galway. The vessels, although not based in Ireland, are available for third-party charter for hydrographic, geophysical and environmental survey work. They have previously operated in Irish waters.

Table 5.14: MSV International summary

Company: MSV International Ltd	
1. Management and commercial experience in Offshore Deployment and O&M	Particularly Marine Survey
2. Years involved in the business	10 years
3. Where is fleet deployed?	Based in Malta
4. Experience in servicing the Irish and UK markets	6 years
5. Future plans for investment in the sector	Yes, at appropriate rate to match business opportunities
6. Financial capability to develop in this marketplace	Some, based on internally generated revenues and international investment
7. Barriers to growth/market impediments	Internationally financed

Mullock & Sons (Shipbrokers) Ltd

Mullock & Sons (Shipbrokers) Ltd is a long-established (1778) agency providing ship-broking, stevedoring, and surveying services to vessels visiting Ireland. It has offices in Limerick and Foynes and is well placed to handle onshore and offshore wind turbine marshalling and deployment to sites on and off the west coast of Ireland.

Table 5.15: Mullock & Sons summary

Company: Mullock & Sons (Shipbrokers)	
1. Management and commercial experience in Offshore Deployment and O&M	Yes – some
2. Years involved in the business	200 years as Shipping Agency
3. Where is fleet deployed?	No fleet
4. Experience in servicing the Irish and UK markets	200 years as Shipping Agency
5. Future plans for investment in the sector	No investment, just servicing shipping agency requirements
6. Financial capability to develop in this marketplace	NA
7. Barriers to growth/market impediments	NA

Construction, deployment and O&M vessel owners in Ireland

There are thus just four Irish companies with associated vessel fleets based in Ireland and suitable for marine renewable energy deployments:

1. Island Shipping
2. Irish Mainport Holdings
3. Sinbad Marine Services
4. Fastnet Shipping Ltd

However, there are gaps in the vessel ownership required to service even a small 300 MW offshore wind array deployment (such as the Thanet scheme), as Table 5.16 shows.

Table 5.16: 300 MW offshore wind array deployment – vessels required vs vessels available

Vessel Type	No. required	No. in Ireland
Jack-up platform (large)	1	0
Special installation vessel	2	1
Cable-lay vessel	2	0
Cable-lay barge	1	0
ASD tugs	4	4
Heavy-lift vessel	1	0
Specialist support vessels	1	0
Barges	2	4
Tugs	10	6
Anchor handling tugs	4	2
Multi-purpose offshore support vessel	1	1
Maintenance vessels	2	4

The above figures do not take account of the Caspian Mainport fleet which is currently deployed in the Caspian Sea. It is feasible (but unlikely) that this fleet could be re-deployed to Ireland if a large marine offshore project were to emerge.

Thus, it is apparent that currently Ireland has a significant shortfall in the vessels necessary to undertake a single large-scale (100 MW or more) wind, wave or tidal energy array deployment. This shortfall could be made up relatively quickly and easily in the international market place with appropriate strategic investment, coupled with a significant offshore wind array project in Irish waters to provide the necessary employment. However, chartering vessels at short notice on the open market, at a time of rapid expansion in offshore wind installation in UK and European waters, could prove difficult. The vessels might not be available.

5.2 Conclusions

There are four companies with associated support vessel fleets based in Ireland (as listed above). The combination of vessels from these companies would be insufficient to service a single large offshore windfarm, without chartering additional specialised vessels from abroad. Chartering these vessels would not present any difficulty in a market that has a sufficient supply of vessels to service a declining offshore oil and gas market. However, with the upsurge of offshore wind deployments in Europe, there will be increasing difficulty in sourcing appropriate vessels at reasonable day rates in the future.

All the companies owning offshore support vessels in Ireland have grown through taking advantage of local opportunities to service either offshore oil and gas developments or offshore wind. This growth has been based on internally generated revenues and investment.

There is an international market for specialised deployment and heavy-lift vessels which will always be able to command premium day-rates on the open market. No individual country has the potential work or opportunities for these expensive vessels, which must operate internationally.

6.0 Port Infrastructure Demand Analysis

The Irish Government's aim is to maximise the sustainable economic growth potential of an Irish-based offshore renewables industry that delivers offshore wind, wave and tidal energy with devices that are "made in Ireland". The objective is to make sure that sites are available in the right locations to provide the platform for the growth of this industry. Having suitable locations for the industry is critical if Ireland is to become a home for the offshore renewables supply chain.

A critical requirement for the development of offshore renewables across Ireland is the upgrading of port capacity.

As the processes and resource locations are different for offshore wind, wave and tidal generation, the nature, timing and location of infrastructure required are viewed separately below.

6.1 Port infrastructure requirements

Offshore wind energy

Offshore wind is the most advanced marine renewable industry. Many developments have been brought on line in the past decade. A list of the 25 largest offshore windfarms thus far installed is shown in Table 6.1.

The efficient delivery of offshore wind generation requires port facilities for a number of activities, for which manufacturers and developers have different needs. For the purposes of this report, we have defined these as follows:

Manufacture: the assembly of nacelle components and manufacture of towers and blades. Typically, manufacturers would look to source key large components local to the facility to reduce transport costs. This represents up to 40% of wind farm CAPEX and could have great value for regional businesses.

Construction: the pre-assembly of components supplied by a wind-turbine manufacturer, which typically include all elements of the turbine (blades, rotor, nacelle and tower) except the foundations. This work typically contributes around 1% of CAPEX.

O&M: the provision of services to commissioned windfarms.

Three main sources of structured assessment have been used to identify the port infrastructure needed for offshore wind developments:

- British Department for Energy and Climate Change report, February 2009: UK Ports for the Offshore Wind Industry: Time to Act
- British Department for Energy and Climate Change report, May 2009: UK Offshore Wind Ports Prospectus
- Irish Department of Transport: Draft National Policy Statement for Ports

In addition, further research was carried out to identify experience to date and to investigate the requirements of potential developers.

Table 6.1: The 25 largest offshore windfarms

Wind farm	Capacity (MW)	Country	Turbines and model	Commissioned
Thanet	300	United Kingdom	100 x Vestas V90	2010
Horns Rev II	209	Denmark	91 × Siemens SWP 2.3-93	2009
Lynn and Inner Dowsing	194	United Kingdom	54 × Siemens 3.6-107	2008
Robin Rigg (Solway Firth)	180	United Kingdom	60 × Vestas V90-3MW	2010
Gunfleet Sands	172	United Kingdom	48 × Siemens 3.6-107	2010
Nysted I	166	Denmark	72 × Siemens 2.3	2003
Horns Rev I	160	Denmark	80 × Vestas V80-2MW	2002
Princess Amalia	120	Netherlands	60 × Vestas V80-2MW	2008
Lillgrund	110	Sweden	48 × Siemens 2.3	2007
Egmond aan Zee	108	Netherlands	36 × Vestas V90-3MW	2006
Donghai Bridge	102	China	34x Sinovel SL3000/90	2010
Barrow	90	United Kingdom	30 × Vestas V90-3MW	2006
Burbo Bank	90	United Kingdom	25 × Siemens 3.6-107	2007
Kentish Flats	90	United Kingdom	30 × Vestas V90-3MW	2005
Rhyl Flats	90	United Kingdom	25 × Siemens 3.6-107	2009
Alpha Ventus	60	Germany	6 × REpower 5M, 6 × Multibrid M5000	2009
North Hoyle	60	United Kingdom	30 × Vestas V80-2MW	2003
Scroby Sands	60	United Kingdom	30 × Vestas V80-2MW	2004
Middelgrunden	40	Denmark	20 × Bonus 2MW	2001
Kemi Ajos I + II	30	Finland	10 × WinWinD 3MW	2008
Thornton Bank I	30	Belgium	6 × REpower 5 MW	2008
Vänern (Gässlingegrund)	30	Sweden	10 × Winwind WWD-3-100	2010
Arklow Bank	25	Ireland	7 × 3.6 GE	2004
Samsø	23	Denmark	10 × Siemens 2.3	2003
Sprogø	21	Denmark	Vestas V90-3MW	2009

Manufacture and foundation production

Due to market growth and the large size of turbines, wind-turbine manufacturers have been looking towards European portside turbine assembly facilities. More recently three large port developments at Sheerness, Hull and Belfast have been announced as potential assembly facilities. Road transportation is becoming less viable for completed nacelles, and offshore turbines need to be shipped by sea at some point for installation. It also makes sense to manufacture large components (such as castings) close to turbine manufacture.

Particular requirements will vary depending on the activity being undertaken; however, in general terms, manufacturing facilities at port locations will require substantial areas of development land with good transport links and need to be well served by associated support services including supply industries and research and development.

Whether steel monopiles, concrete gravity bases, or jacket or tripod structures, all offshore wind foundations are very large and once produced can only be transported by water. Much expansion of production capacity will be required to meet future demand; hence it is likely that new coastal locations for foundation manufacture will be established. Compared with set-up times relating to other elements of the value chain, foundation manufacturing facilities can be set up relatively quickly.

Construction and installation

Individual phases of a construction project may be operated by a specialist offshore contractor or windfarm developer, or by the wind-turbine manufacturer offering a turnkey service. Port stevedoring and operation may be managed by the port owner or the site occupier.

Typical activities during the topside installation phase include:

- Unloading in-bound components from supply vessels, such as towers, hubs, blades and nacelles
- Laying down products to ensure their availability when weather and vessel availability allows construction to proceed
- Installing turbines in batches, based on vessel capacity:
  - Assembling of tower sections and loading on to the installation vessel, which may involve vertical and/or horizontal loading, hence the high air-draft requirements
  - Fitting two blades to each nacelle where the ‘bunny ears’ configuration is used, or fitting all three blades to the hub, with rotor horizontal
  - Preparing and loading nacelles on to the installation vessel
  - Preparing and loading remaining blades on to the installation vessel

Typical requirements for port facilities to support an installation of 100 turbines per year would be:

- 24-hour access
- 200–300m length of quayside with high load-bearing capacity and adjacent access
- quay bearing capacity of typically 3 to 6 ton/m^2, but in some cases may be up to 10 ton/m^2

- at least 80,000m^2 (8 hectares) suitable for lay-down and pre-assembly of product; requirement could be much greater. Sites with greater weather restrictions on construction may require an additional lay-down area, up to 300,000m^2 (30 hectares)
- water access to accommodate vessels up to 140m length, 45m beam and 6–8m draft with no tidal or other access restrictions – in some cases water-depth requirements could be up to 10m
- warehouse facilities, 1,000–1,500m^2
- overhead clearance to sea of 100m minimum (to allow vertical shipment of towers)

Requirements relating to cranes and load-bearing points are relatively easily met by local engineering works. Ideally, sites should have good land-side transportation access to facilitate their use also in transportation for onshore windfarm construction.

Many windfarm projects to date have been of relatively modest size; thus, in some cases small local ports have been able to accommodate construction activities. However, as the size of developments increases and there is more potential for concurrent construction activities, it is likely that larger ports further afield may become more attractive to developers, particularly if they can provide the large areas of lay-down space needed.

The example of Bremerhaven, Germany shows how a port can position itself as a major hub for multiple activities associated with the development, construction and installation of offshore windfarms. Alternatively, windfarm construction and installation may be undertaken from a number of different ports for various phases of the operation, as was the case for the Lynn and Inner Dowsing windfarm. Case studies of both of these examples are included in Appendix 2.

Operation & maintenance

Once a windfarm is operating, its maintenance is usually carried out from a nearby port. These ports house the maintenance crew and vessels needed to respond to windfarm faults, plus storage and repair facilities. As windfarms get larger and further out to sea, the use of helicopters and offshore accommodation facilities for this function is likely to become more common.

The requirements of O&M sites may be modelled on recently established locations for Round 2 developments. A typical example would be a base servicing about 150 turbines. Long-term employment at this site in support of such an array is projected at about 100 full-time employees, working for a range of companies within the O&M supply chain.

Key requirements of windfarm operators are likely to be:

- 24 / 7 / 365 – access/egress for service vessels
- 12 / 7 / 365 – access/egress for service helicopters
- water, electricity and fuelling facilities
- safe access/egress for technicians
- loading and unloading facilities

Helicopter transport for O&M

Offshore wave and tidal energy

The offshore wave and tidal energy industry is at a much less advanced stage than offshore wind; there is thus much less experience in the fabrication, marshalling, installation and servicing of offshore devices.

To date, experience is largely based on the installation of demonstration devices of various scales and sizes. Many differing device and foundation concepts are under development and thus a range of differing experience exists.

To estimate the likely requirements for port infrastructure, reference is made to the previous RPS study, *Review of Engineering and Specialist Support Requirements for the Ocean Energy Sector*.

As with the offshore wind industry, port facilities will be required to support offshore wave and tidal installations through the manufacture, construction and O&M stages of development.

Manufacture and foundation production

This involves the manufacturing and assembly of devices, both supporting structures and possibly energy capture components (turbines, etc).

Ocean Energy (OE) devices in general are of a large size and substantial weight. Road transport of assembled devices is likely to be problematic and expensive. It can be expected that developers will aim to manufacture and assemble devices as close to a suitable port as possible. Although specialist manufacturing facilities may not be located within the immediate port area, sufficient land is required close to quays for the final assembly and marshalling of devices.

Requirements for marshalling areas will vary depending on the type of device and number of units to be deployed. Assuming that a minimum of 10 units will need to be handled simultaneously in the port for any particular development, it is estimated that minimum requirements for land in the immediate vicinity of the quay will be in the order of 1–3 ha. Larger areas would be required if developments were to include a greater number of devices. For example, for a development comprising 50 units and assuming 50% capacity for marshalling at any one time, land requirements could be in the order of 2.5–6 ha.

Some devices, particularly those deployed by floating, might be better suited to fabrication and assembly in a dry-dock environment.

It might be possible to assemble and store some floating devices in sheltered waters without the need for extensive port facilities, although some type of port facility will likely be required for the equipment load-out and deployment of components to the water.

Access to nearby manufacturing facilities would be a strong advantage for a suitable port.

Construction/installation

This function involves the transport of components or completed devices to the development site. The principal requirement will be access to suitable water depth either via a quay or other launching facility such as a slipway or syncrolift, etc. Transport of the devices may be by a number of methods:

- towing a floating device
- by work boat
- by barge (self-propelled or unpowered)

Requirements for water depth will vary depending on the type of craft used and the dimensions of particular devices, but it is expected that general requirements for minimum water depth could be in the order of 6m without tidal restrictions for some devices.

It is expected that a quay length in the order of 100–200m will be required with heavy load-bearing capacity immediately behind the quay walls to accommodate heavy-lift cranes. Lifts in excess of 200t can be expected although, if restrictions exist at certain facilities, it may be possible to carry out such lifts using tandem cranes to minimise pad loading on the quay area. The use of large crane barges for deployment may also provide the means to overcome any restrictions on crane loadings which can be imposed on quay working areas, by making the final lift onto the barge using the barge-mounted cranes. The deployment of the devices to the water will require calm sea conditions; it is expected that any suitable port site will provide adequate sheltered berthing for all expected weather conditions.

Given the sensitivity of deployment operations to weather and sea conditions, the geographic location of the deployment site in relation to suitable port facilities or sufficiently sheltered waters will be an important consideration in the planning of OE development installation methodology.

For towed deployment of floating devices, required bollard pulls are likely to be at least 30 tonnes.

Operation & maintenance

O&M requirements are likely to be very similar to those for the offshore wind industry. The early stage of development of the wave and tidal industry means that experience to date has been varied and unique; as yet no emerging trends can be identified in relation to the use of port facilities.

6.2 Other factors influencing choice of port

Due to the reasonably advanced state of the offshore wind industry, several key factors which influence the choice of a port can be identified from past and present experience. Similar factors are likely to influence other OE developments:

- geography and distribution of resource
- proximity to manufacturing locations and other key services
- installation methods and installation vessels
- planning procedure and time to availability

Geography and distribution of resource

The geographic distribution of the resource will have a strong effect on the choice of manufacturing location and installation port. To date in the offshore wind industry, this has been a key factor in choice of port, partly as a result of the limited availability of self-propelled installation vessels and barges and therefore the need to minimise travel distances to development sites. This requirement led to the use of ports in close proximity to development sites, for instance Barrow and Mostyn on the west coast of England.

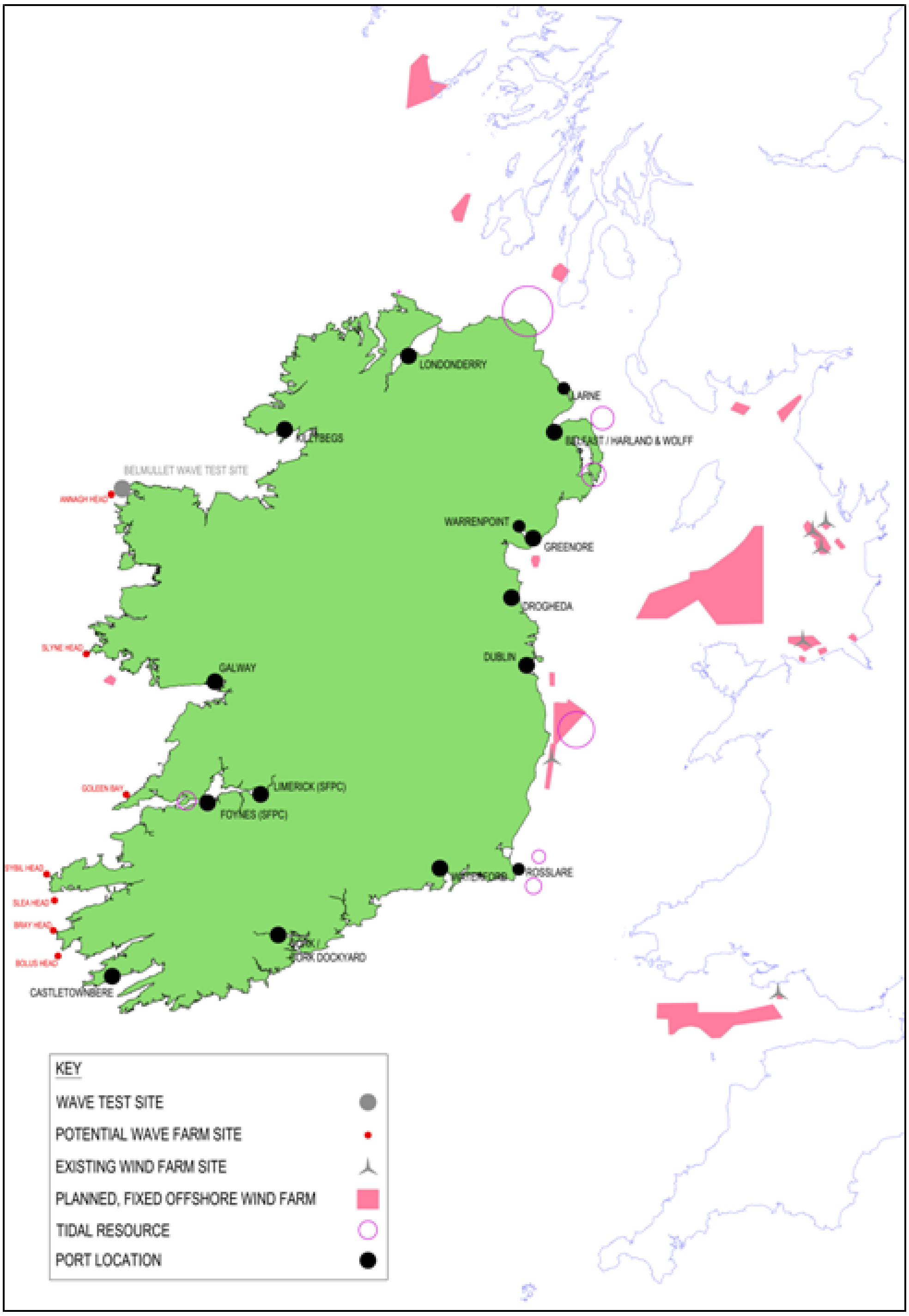
The distribution of main resources has been discussed in detail in Chapters 2 and 3. Figure 6.1 shows the locations of the main Irish ports.

Areas for the development of fixed offshore windfarms are largely located in the Irish Sea and on the south and east coasts of England; it can thus be anticipated that the greatest opportunity in this regard lies with the Irish ports on the east coast. A single development site exists on the west coast of Ireland, which will need a local installation port in that area.

Substantial windfarm development is planned for the east coast of England which may present opportunities for ports on the east and south-east coast of Ireland.

The potential for floating windfarm development is less geographically constrained and may present opportunities for more Irish ports, although this type of development is unlikely to happen on a commercial scale for some time.

Figure 6.1: Resource distribution and main port locations



Ireland's wave resource is largely concentrated on the west coast. Ports in this geographical sector are likely to be best placed to support future construction and installation activities.

Tidal resource is largely concentrated on the east and north-east coasts of the island, presenting opportunities for ports in these locations.

Proximity to manufacturing locations and other key services

While the location of the development site will be an important factor in the choice of port facility, it is not the only consideration. The growing physical size of foundations and devices places considerable constraints on the transport of elements; thus it is best if construction/installation ports can be located close to manufacturing facilities. This is being seen increasingly in the development of windfarms in the English Channel and North Sea.

The proximity of ports in France, Belgium and the Netherlands to UK Round 3 zones makes them viable construction bases, especially with so much of the supply chain concentrated in Germany and Denmark (components can be transported by barge to these ports). A number of these ports – Esbjerg, Bremerhaven and Cuxhaven – have been marketing themselves to the sector. For example, on the recently commissioned Thanet windfarm located off the SE coast of England, the choice of installation port was heavily influenced by the manufacturing locations. Transition Pieces and J-tube assemblies were deployed from the port of Vlissingen after being transported by barge from the fabrication facility in Hoboken, Belgium, while turbine were installed from the port of Dunkirk.

This illustrates the possibility that more than one port may be used for the construction of large offshore windfarms.

Installation methods and installation vessels

Advances in vessel technology may open up further options in offshore windfarm construction methods which in turn will influence port requirements. There are three potential routing options for the supply from a coastal turbine manufacturing site directly to the windfarm or via a construction port. The first option involves transfer of the turbines, etc, from the coastal manufacturing site to a second coastal construction site, in batches. The units are then trans-shipped to the windfarm, again in batches using different vessels.

In the second scenario, the development of high-speed jack-up vessels makes more financially viable the use of construction ports that are further away. This could result in projects being serviced from the turbine manufacturing site and not needing a more local construction port. This model is perhaps more applicable to the English Channel scenario; in the Irish Sea, existing manufacturing facilities are much further away from potential development sites.

Cost-effective solutions are being sought from the oil and gas sector and elsewhere, which will allow lower-cost vessels to be used to transport the components directly to the crane jack-up, which will remain at the windfarm site, and hence be used more efficiently. This involves overcoming the challenge of transferring the components from a 'shuttle' vessel to the crane jack-up while compensating for 'shuttle' vessel heave. This process would negate the need for any construction port. The current trends identified above in specialist high-speed jack-up transfer and installation vessels illustrate this development.

While development of high-speed installation vessels may influence whether or not a local construction port is required, it may also open up opportunities for ports with the required level of infrastructure to compete for work in supporting developments much further afield. Developments in vessel technology are likely to focus developers' attentions more heavily on other requirements such as infrastructure when choosing an installation port. This may in some way reduce the geographical disadvantage of Irish ports in relation to the major Round 3 development planned for the east coast of England, although mainland European ports will also be competitive for sites closer to Ireland.

Planning procedure and time to availability

As the requirements for infrastructure at the construction port increase, so does the likelihood that ports will need to undertake development works to meet the needs of developers. In such a case a key factor will be the confidence of the developer that any required works can be implemented within the required timeframe and that the risk of delay is avoided or minimised.

Consequently the planning framework and the ability of the port to finance infrastructure developments will be a key consideration for any developer when identifying and choosing a construction port. Ports that can demonstrate they are at an advanced stage of planning and that have capital reserves to finance development directly will be at an advantage when engaging with potential developers.

National and local planning procedures will also heavily influence timescales for implementation of development plans.

6.3 Conclusions

Areas for the development of fixed offshore windfarms are largely located in the Irish Sea and on the south and east coasts of England. It can thus be anticipated that the greatest opportunity in this regard lies with the Irish ports on the east coast.

- As windfarm developments continue to grow in scale, there will be an increased demand for large, well-equipped and serviced port facilities from which construction and installation activities can be undertaken.
- A key requirement will be the availability of support lands in close proximity to the quayside.
- Quayside and hinterland load-bearing requirements will continue to increase.
- Developments in installation methodology and equipment mean that geographic location may not be the overriding factor in choice of port. The availability of suitable infrastructure will be an important consideration.

- Choice of port may be made several years in advance of construction work commencing. Port infrastructure will need to be in place in time to meet demand from the offshore wind industry

7.0 Current Status of Irish Ports

The RPS study, *Review of Engineering and Specialist Support Requirements for the Ocean Energy Sector*, identified all the main ports and harbours on the island of Ireland and compared the facilities available to those that would likely be required to support significant offshore development in the wave and tidal energy sectors. Earlier sections of this report have demonstrated that infrastructure requirements for the offshore wind industry will be comparable to or greater than those previously considered.

The report identified that, in general, only the major commercial ports would be able to accommodate the level of activity envisaged in the implementation of a major offshore renewable energy development; even then, it is likely that further development of infrastructure would be required to meet the needs of developers.

The ports identified were:

- Port of Cork/Cork Dockyard
- Drogheda Port
- Dublin Port
- Shannon Foynes Port
- Galway Harbour
- Port of Waterford
- Greenore Port
- Castletownbere
- Killybegs Fishery Harbour Centre
- Belfast Harbour / Harland and Wolff
- Londonderry Port

With the inclusion of offshore wind energy in this current assessment, a number of other ports, located in close proximity to likely areas of development are also considered. These include:

- Rosslare Europort
- Warrenpoint Harbour
- Port of Larne

This further consideration of port capacity has been based on more consultations with the ports, so as to investigate more closely the opportunities from marine renewable energy and how the ports plan to engage in this sector in the future. Consideration has also been given to potential new port developments at Bremore and at the CRH quarry site in Arklow.

7.1 Irish ports' experience in the offshore renewable sector

Offshore wind

Currently Ireland has only one operational offshore windfarm – at Arklow Bank in the Irish Sea. The farm is located about 14km off the coast of Wicklow and comprises seven GE 3.6 MW turbines. It was completed in 2003, with only nine weeks on site.

All major components were staged and assembled at Rosslare Harbour and transported to the project site, approximately 80km away. Installation was carried out from a specialist jack-up barge which had been commissioned for the purposes of offshore windfarm installation. The barge measured 91 x 33m, providing some 2,500 m^2 deck space, with a load capacity of 4000t. It was fitted with a 1,200-tonne crane to enable it to reach the heights required for the placement of the upper parts of the turbine.

Loading of Arklow Wind Farm foundations and turbines from Rosslare Europort

In partnership with Harland & Wolff, Belfast Harbour has been the assembly base for a number of UK Round 1 offshore installation contracts and is due to act as logistics base for the Ormonde offshore field in early 2011. Recently Belfast Harbour has signed a letter of intent for an agreement with Danish firm, DONG Energy. DONG is progressing a number of offshore windfarm projects in the Irish Sea and its intention is to use Belfast Harbour as a base for construction and operation. As part of the proposal Belfast Harbour is to fund and build a new £40m, 450m quay and 50-acre logistics space for the pre-assembly of both turbines and foundations.

Robin Rigg deployment, Belfast

Although offshore windfarm development in Ireland has been limited, many Irish ports have had experience of offloading, marshalling and handling large items of equipment for onshore windfarm developments. Ports that have handled wind turbines and foundation components include Killybegs FHC, Belfast Harbour, Rosslare Europort, Port of Cork, Dublin Port, Waterford Port and Shannon Foynes Port.

Wave and tidal

To date only one full-scale OE device has been deployed in waters off the coast of Ireland – at Strangford, Co Down. The device was installed by Marine Current Turbines Ltd (MCT) in April 2008. The Harland and Wolff yard in the Port of Belfast was used as the base for operations for the installation in 2008. Component parts for the turbine were manufactured in various locations in UK and Europe and were delivered to Harland and Wolff for final system integration and test prior to installation.

Assembly of MCT device at Harland and Wolff, Belfast (*Photos: MCT)*

This device was installed using a large 3,300t capacity crane barge for the initial installation which was mobilised to Ireland from abroad for this particular installation; supplementary work was completed using a smaller crane barge.


Installation of MCT device using crane barge *Rambiz* (*Photos: MCT)*

In addition to the full-scale MCT device a number of smaller scale test devices have also been deployed in Irish Waters.

A quarter-scale Wavebob device was manufactured in Harland & Wolff, Belfast and deployed in Galway Bay from Galway Harbour.


Wavebob device at Galway Harbour and H&W (Belfast) *(Photos: Wavebob)*

An Ocean Energy Ltd quarter-scale device has been deployed in Galway Bay after fabrication in Cork Dockyard. Servicing of scale devices in Galway Bay is being undertaken from Galway Harbour.

Ocean Energy quarter-scale device, manufactured in Cork Dockyard

The H&W yard in Belfast constructed a 3,000 tonne gravity base for a Power Buoy prototype for use in the offshore oil industry. This type of device has similarities to certain OE devices using gravity bases, in terms of fabrication and deployment.

Offshore structure Power Buoy under construction in H&W

7.2 Ports – existing facilities and future plans

The facilities available at the various ports identified are described in the following sections. The ports are listed starting on the north coast and continuing clockwise around the coast.

Port of Londonderry

Proximity to Main Test Beds & Offshore Installation Sites	The Port of Londonderry is located in Lough Foyle and is thus in reasonable proximity to wave and tidal resources in the NE and NW. It is some what removed from the main offshore wind locations.
Quayside Suitability & Storage	The Port of Londonderry operates one main jetty at Lisahally, approx. 440m long. The available water depth at the jetty is 9.5m and the jetty has an extensive working area available, of approx. 105,000m^2. A further working area of approximately 12,140m^2 is also available, 500m from the quay.
General Port Infrastructure	The level of support services available is good, with all the major facilities, such as pilotage, tugs (three tugs available with bollard pulls from 11t to 42t), and stevedoring. There are currently four 45t harbour mobile cranes operating at the port although lifts up to 100t have been carried out in the past and heavier lifts may be able to be accommodated on a case-by-case basis.
Hinterland Access	Road access is reasonable.
Suitability to Facilitate Renewable Development	The port has areas of land available which would be an advantage in servicing renewable development.
Previous Experience in the Offshore Sector	The port has no significant history in the offshore renewable sector.
Future Strategy for developing and supporting OE	The port has no particular plans.
Summary	Londonderry is removed from the main windfarm development sites, although more opportunities may exist in the future to service the wave and tidal sectors. The port has significant lands available and support services are reasonable

Port of Larne

Proximity to Main Test Beds & Offshore Installation Sites	The Port of Larne is close to tidal resources in the NE and offshore wind sites in the north Irish Sea and western Scottish waters.
Quayside Suitability & Storage	The port of Larne is primarily a Ro-Ro facility, with 4 Ro-Ro berths available. It has more than 10,000m^2 of hard standing areas available close to the berths, but this is primarily used for the marshalling and movement of vehicles.
General Port Infrastructure	Infrastructure and services are focused on the Ro-Ro sector.
Hinterland Access	Since it is a Ro-Ro port, road access is reasonably good.
Suitability to Facilitate Renewable Development	The port has limited potential to service major offshore renewable development without a major impact on its core activities.
Previous Experience in the Offshore Sector	The port has no significant history in the offshore renewable sector.
Future Strategy for developing and supporting OE	The port has no particular plans in respect of OE.
Summary	Although in a good location for Scottish and north Irish Sea windfarm sites, Larne is primarily a Ro-Ro port and as such has limited potential to support OE developments without re-organisation of activities or further land development.

Belfast Harbour / Harland & Wolff

Proximity to Main Test Beds & Offshore Installation Sites	Belfast Harbour is close to UK windfarm sites in the north Irish Sea and is reasonably well placed to service sites in Scottish waters and developments planned for the east coast of Ireland.
Quayside Suitability & Storage	Belfast Harbour is Northern Ireland's largest port. It has extensive quay facilities; York Dock (213m with 7.3m water depth and approximately. 10,000m^2 hinterland) and Stormont Wharf (580m with 10.2m water depth and approx.. 30,000m^2 hinterland) are the most likely to be able to support OE developments. Other facilities may be available from time to time depending on other trade requirements. The shipbuilding yard and facilities at Harland & Wolff are located within the greater Belfast Harbour estate. Within this site there are extensive dry dock and quayside facilities. There are two dry docks. The Main Dock is 556m x 93m and Belfast Dock is 335m x 50.3m. In terms of available quayside facilities there is a 432m-long ship-repair quay and a 170m-long outfitting quay, both with water depth of 8.6mCD. The Harland and Wolff site has extensive hinterland available for handling project cargoes, with over 100,000m^2 of area on the main site and additional facilities elsewhere.
General Port Infrastructure	The level of support services offered in the port is good, with all of the major operations available such as pilotage, tugboats (3 companies supplying 5 tugs with bollard pulls from 13.5t to 45t), workboats (3 companies) and stevedoring (5 companies). Heavy lifts are frequently performed in the harbour, often using mobile cranes from external sources. York Dock is restricted in terms of its ground makeup to accommodate heavy lifts, but it is expected that required lifts could be achieved at Stormont Wharf. The H&W site is well served for heavy lifts. At the Main Dock, two 840t Goliath gantry cranes operate in conjunction with two 60t and two 9t support cranes. At the Belfast Dock two cranes operate, one of 40t and one of 80t capacity. Two 40t cranes operate at the ship-repair quay and one 9t crane at the outfitting quay.
Hinterland Access	Hinterland access is good.
Suitability to Facilitate Renewable Development	This location, with a combination of extensive facilities and support services, experience and location, is well placed to facilitate renewable developments.
Previous Experience in the Offshore Sector	In partnership with Harland & Wolff, Belfast Harbour has been the assembly base for a number of UK Round 1 offshore installation contracts and is due to act as logistics base for the Ormonde offshore field in early 2011. H&W was also the mobilisation port for

	the installation of the MCT tidal energy device in Strangford Lough.
Future Strategy for developing and supporting OE	The Port of Belfast is actively focusing on building on its involvement to date in the offshore windfarm sector. The port, in conjunction with Harland and Wolff, has much of the infrastructure in place to facilitate offshore construction. Belfast Harbour has recently signed a letter of intent for an agreement with Danish firm, DONG Energy. DONG is progressing a number of offshore windfarm projects in the Irish Sea and its intention is to use Belfast Harbour as a base for construction and operation. As part of the proposal Belfast Harbour is to fund and build a new £40m, 450m quay and 50-acre logistics space for the pre-assembly of both turbines and foundations.
Summary	The Belfast/Harland and Wolff complex is strategically located for Irish Sea windfarm developments. With a high level of infrastructure and services available, previous experience in this sector and current plans for further related infrastructure developments, this location is very well placed to support OE.

Warrenpoint

Proximity to Main Test Beds & Offshore Installation Sites	The port is close to UK windfarm sites in the north Irish Sea and would also be well placed to service sites planned for the east coast of Ireland.
Quayside Suitability & Storage	Warrenpoint has 7 berths with a total quay length of 750m; 300m of quay are dredged to 7.5m below chart datum and the remainder of the berths are dredged to a depth of 5.45m below chart datum. A 39m long by 27 metres wide RoRo ramp with a design loading of 120 tonnes capable of accommodating vessels up to 25 metres beam is also available. There is a harbour working area immediately adjacent to the quays although this is largely used by core business and for a large area of covered storage.
General Port Infrastructure	Five harbour cranes are available, ranging from 20t to 100t.
Hinterland Access	Road access is reasonably good although some constraints exist in port traffic passing through Newry.
Suitability to Facilitate Renewable Development	The port has indicated it would not consider itself suitable for offshore construction activities but would be available for servicing offshore windfarms.
Previous Experience in the Offshore Sector	The port has no significant history in the offshore renewable sector.
Future Strategy for developing and supporting OE	Although the port acknowledges that opportunities to support the construction of offshore windfarms are likely to be limited, it has identified the O&M servicing of windfarms as a potential source of future business. It considers itself to occupy a key strategic location for servicing Irish Sea windfarms
Summary	Warrenpoint occupies a strategic location in relation to offshore wind but limitations on available area means that opportunities in the construction and installation phases would be limited. The port could have a role to play in O&M activities.

Greenore

Proximity to Main Test Beds & Offshore Installation Sites	Situated on the south side of Carlingford Lough, Greenore is close to UK windfarm sites in the north Irish Sea and would also be well placed to service sites planned for the east coast of Ireland.
Quayside Suitability & Storage	The port currently has approximately 250m of quayside with a water depth of 4.3m. The immediate port lay-down area is relatively confined, but more substantial hinterland is available close by.
General Port Infrastructure	Mobile and fixed craneage is available at the port with capacity up to 100t. Pilotage, tugboats and communications are all readily available.
Hinterland Access	Road access is reasonable.
Suitability to Facilitate Renewable Development	Currently the port has limited suitability but if proposed plans are put in place more opportunities might arise, although it is unlikely the port could provide all facilities to support full-scale developments.
Previous Experience in the Offshore Sector	Greenore port is already supporting OE developments with OpenHydro having established a manufacturing facility for their turbine/generator modules close by. Several turbines are being manufactured at the moment for deployment including dispatch for overseas locations.
Future Strategy for developing and supporting OE	Greenore port is currently progressing plans for a facility adjacent to the existing port. An EIS has been prepared and the port is currently engaged with An Bord Pleanála in working towards lodging an application for planning permission. While such a development will provide significant additional land and quay facilities, these will be focused primarily on the Ro-Ro and Lo-Lo sectors. The port does not necessarily view the offshore wind sector as being a potential core business but, with expanded facilities, it could have a role to play.
Summary	Greenore occupies a strategic location in relation to offshore wind but current limitations on available area means that opportunities in the construction and installation phases would be limited. If current development plans are implemented, facilities would be much improved and this might allow the port to take an active role in OE developments.

Drogheda

Proximity to Main Test Beds & Offshore Installation Sites	Drogheda Port has two locations, in Drogheda Town and at Tom Roes Point in the Boyne Estuary. The port is well located for proposed Irish Sea windfarm locations.
Quayside Suitability & Storage	The Town Quay is 400m with limited water depth. The area behind the Town Quay is significant, with approx. 20,000m^2 available. Tom Roes Point is considered as the port's deepwater quay; it is 210m long with an available water depth of 6.0mCD. The area behind Tom Roes Point is particularly extensive, with approx. 84,000m^2 available. Both quays are available to handle project cargoes. Access to the port is tidally restricted, with the maintained channel having a depth of 2.2mCD.
General Port Infrastructure	The level of support services offered at Drogheda is reasonably good. Although there is no provision for tugboats, other services such as stevedoring, workboats and pilotage are available. Mobile cranes of 90t capacity (Town Quays) and 120t capacity (Tom Roes Point) regularly operate at the two berths. Project lifts greater than these capacities are considered on an individual basis by the port.
Hinterland Access	Road access is reasonable but is constrained by having to pass through Drogheda town.
Suitability to Facilitate Renewable Development	The port has limited suitability for offshore construction activities but could be suitable for servicing facilities..
Previous Experience in the Offshore Sector	None
Future Strategy for developing and supporting OE	Drogheda Port has no plans for expansion of facilities which might be suitable for the offshore wind industry. However it is actively involved in the planning for a new port at Bremore (see discussion under separate heading).
Summary	Drogheda is severely constrained in terms of water depth and would not be able to provide the facilities required to support major OE developments.

Dublin

Proximity to Main Test Beds & Offshore Installation Sites	The Port of Dublin is a large port and is well located for proposed Irish Sea windfarm locations.
Quayside Suitability & Storage	There are a number of jetties available at the Alexandra Basin, Ocean Pier and South Deepwater Quay areas, which could be used for project cargo. The jetty at Alexandra Basin is used for dry bulks and is 247m long with an approximate water depth of 9–10m LAT. There are two berths available at the Alexandra Quay; the west quay is 385m and has an available water depth of 9.8–10.2m LAT, while the east quay is 360m long and has an available water depth of 9.6–10.3m LAT. There are also two berths available in the Ocean Pier area; the western quay is 410m long and has an available water depth of 9.5m LAT and the eastern quay is 242m and has an available water depth of 9.7m LAT. There is a potential storage area behind the western quay which may be available. The South Quay is solely used for the handling of dry bulks. The quay is 357m long and has an available water depth of 11m LAT, with an open quay area available of approximately 42,500m^2.
General Port Infrastructure	The level of support services available at the port is good. Dublin Port owns three diesel tugboats, two of 35t bollard pull and one of 16t bollard pull. A number of stevedoring companies operate within the port. A number of cranes serve the Alexandra Quays, including three 64t mobile cranes and two 104t mobile cranes. Three mobile cranes serve the South Deepwater Quay (one 10t, one 64t and one 84t). In the past the port has handled lifts up to 200t.
Hinterland Access	Road access is good. The Dublin Port Tunnel provides direct access to the national road network. Plans are in place to provide direct rail access into the port area.
Suitability to Facilitate Renewable Development	Extensive facilities are available within the port and sufficient lands are available, making this location very suitable for renewables development.
Previous Experience in the Offshore Sector	Although offshore experience is limited, the port is familiar with handling wind turbine and renewable energy equipment.
Future Strategy for developing and supporting OE	Dublin Port views the offshore windfarm industry as a potential significant source of business in the future. In the short term the port has identified existing lands that could be made available for the storage, marshalling and assembly of wind turbines and has developed plans to reorganise existing operations in order to free up adjacent quay space for the use of developers should the opportunity arise. The port is also actively master-planning potential new facilities which could be constructed to support offshore wind. It understands the likely timeframes associated with obtaining planning

permissions for new developments and has indicated also that the necessary funds for development could be made available within a relatively short time if necessary.

Summary

Dublin is strategically located with respect to Irish Sea windfarm sites and the large range of facilities available would make this an attractive location for windfarm developers. The extensive estate would allow reorganisation of activities to meet the needs of developers, but if new facilities were required the time required to achieve planning permission must be overcome.

Rosslare

Proximity to Main Test Beds & Offshore Installation Sites	Rosslare's location makes it well positioned to service east-coast windfarms and tidal resources and any eventual windfarms off the south-east coast. In addition, it has potential to service UK windfarm developments in the Bristol Channel.
Quayside Suitability & Storage	Rosslare Europort is primarily a RoRo port, with 4 RoRo berths available. The port also has a general-purpose berth with a length of approx.. 150m and a depth alongside of 6.5m. Lands behind the general-purpose quay extend to about 10ha although only 5ha would be available, the remainder being used for core activities.
General Port Infrastructure	The port is primarily RoRo-orientated so support services for general cargo are limited. There is a restriction on quay loading of $2t/m^2$ for 7.5m behind the general-purpose quay, but otherwise loading is unrestricted.
Hinterland Access	Road access is reasonable and the port is rail-connected.
Suitability to Facilitate Renewable Development	The port's location makes it suitable for the support of offshore OE but present limitations on quay length and space would limit the level of support which could be provided.
Previous Experience in the Offshore Sector	All major components for the Arklow windfarm were staged and assembled at Rosslare Harbour and transported to the project site, approximately 80km away.
Future Strategy for developing and supporting OE	Rosslare Europort views the offshore wind industry as being a potential source of business, but acknowledges the limitation in the amount of hinterland that could be made available at the current facility. The port is investigating long-terms plans which could provide greater water depth and more hinterland.
Summary	Rosslare is strategically positioned at the south-east corner of Ireland to handle off-shore wind and tidal developments, as well as possible UK developments in the Bristol Channel. However, quay space and hinterland area presently limit the level of support which could be provided during the construction phase of major offshore developments.

Waterford

Proximity to Main Test Beds & Offshore Installation Sites	The Port of Waterford is located on the River Suir, about 14 miles upstream from the open sea. It is therefore well positioned to service the tidal resources and any eventual windfarms off the south-east coast. In addition, it has potential to service UK windfarm developments in the Bristol Channel.
Quayside Suitability & Storage	The main commercial port complex is at Belview and this is where most recent developments have been focused. Further facilities are available in Waterford City. There is a water depth restriction of 6.5mCD at Duncannon Bar on the approaches to the port. The facilities at Belview comprise over 500m of quay available, with a water depth of 8.5mCD. The extent of quayside hinterland is constrained by the presence of a railway line to the rear of the port area although a land bank is available at locations removed from the immediate quay area.
General Port Infrastructure	The level of support services offered by the port is good. Stevedoring, tugboat and workboat provision are all available and there is also a rail link to the national rail network. It is expected that the modern quays available will be able to accommodate cranes for lifts in excess of 100t. Tugs are available from private operators (1 x 5t, 2 x 6t, 1 x 15t, 1x 17t and 1x30t).
Hinterland Access	The port is very well connected to the main national road network and is also rail-connected.
Suitability to Facilitate Renewable Development	The port has planning permission in place for an additional 800m of quay and 5 acres of reclaimed working area adjacent to the existing facilities at Belview. Having planning permission in place can be considered an advantage in being able to react quickly to the requirements of offshore wind developers, but the presence of the railway line to the rear of the immediate quayside area restricts the amount of lay-off space available. The port has access to a further land bank in the order of 60 acres, but this is somewhat removed from the quay area and as such would likely be of limited value in servicing windfarm construction.
Previous Experience in the Offshore Sector	Although offshore experience is limited, the port is familiar with handling wind-turbine and renewable energy equipment.
Future Strategy for developing and supporting OE	Waterford Port has identified the offshore wind industry as a potential source of business but is at an early stage in its pursuit of this sector.
Summary	Waterford is positioned at the south-east corner of Ireland and is well placed to handle off-shore wind and tidal developments, as well as possible UK developments in the

Bristol Channel. Services available are good.

It currently has quay space available, planning permission for an additional 800m of quays, with 2 hectares of adjoining land. There is also permission for 25 hectares somewhat removed form the quayside area.

However, there is a draft restriction of 6.5m at the entry, and the quay area development is hampered by a railway line.

Port of Cork / Cork Dockyard

Proximity to Main Test Beds & Offshore Installation Sites	The Port of Cork is one of the key seaports on the south coast of Ireland. The location is somewhat removed from the main windfarm sites in the Irish Sea and Bristol Channel but, with developments in installation craft, the port could potentially service these areas. Wave developments in the SW could also potentially be serviced from this location.
Quayside Suitability & Storage	The port controls six main quays located in the city quays and also at Ringaskiddy. Total length of quays available in the city is 952m with depths ranging from 5.6m to 8.8m. Available hinterland in the city is limited to approx.. 15,500m^2, spread throughout the quays. A further 485m of deepwater quay (13.5 mCD) is available at Ringaskiddy where 16,000m^2 of quayside hinterland is available. There is a further land bank available at Oyster Bank, close to the Ringaskiddy quays. Cork Dockyard, close to Ringaskiddy, has 800m of quay with depth of 7m. It has one graving dock (164.4m x 21.3m x 8.2m) and one floating dock available.
General Port Infrastructure	Extensive stevedoring support services are available in the port. Three tugs are also available, privately and from the port company, with bollard pulls of 17t, 46t and 50t. There are no general restrictions relating to cranes operating at the deepwater berth in Ringaskiddy and it is anticipated that heavy lifts could be accommodated. Currently the port has two harbour mobile cranes operating at the deepwater quay, with capacities of 65t and 120t. Facilities are available at Cork Dockyard to erect a 1000t crane on the quay and the floating dock has a lift capacity up to 2,000t. The site also has a machine shop with full engineering services.
Hinterland Access	Ringaskiddy is connected to the national road network by the N28. There are currently plans to upgrade this road to facilitate port traffic but the timescale is uncertain. Road access to Cork Dockyard has some limitations but the site is close to the Cork–Cobh rail line.
Suitability to Facilitate Renewable Development	It is unlikely that Port of Cork quays located in Cork City would be suitable to support OE due to the limitations in respect of available hinterland. However, the combination of Port of Cork and Cork Dockyard facilities at Ringaskiddy and the available land bank at Oyster Bank could be attractive to OE developers, although the distance of Cork from the major planned windfarms in the Irish Sea will be a consideration.

Previous Experience in the Offshore Sector	Although offshore experience at Port of Cork is limited, Ringaskiddy terminal is familiar with handling wind-turbine and renewable energy equipment. Cork Dockyard has serviced the offshore sector for many years.
Future Strategy for developing and supporting OE	Port of Cork is actively pursuing opportunities in the offshore wind sector. It has recently reviewed its strategic development plan for future port infrastructure and has identified Ringaskiddy as the primary location for port-related development. At this location the existing land bank adjacent to Oyster Bank is seen by the port as having potential for the marshalling and assembly of wind turbines, although a new quay would likely be required to service this area. Cork Dockyard is also close to Ringaskiddy, with quay, dry dock and extensive hinterland available, and the port and the dockyard owners are working closely with a view to collaboration in attracting windfarm business to Cork
Summary	The combination of Port of Cork and Cork Dockyard facilities and the potential for new port infrastructure at Ringaskiddy could prove attractive to potential windfarm developers. However, the distance of Cork from the main planned locations would be a disadvantage. Any planned infrastructure developments would need planning permission, so the timescale for this is also a matter to consider.

Castletownbere

Proximity to Main Test Beds & Offshore Installation Sites	Castletownbere is located in the SW and would be well placed geographically for wave energy developments in this area. It is reasonably far removed from the main windfarm locations.
Quayside Suitability & Storage	Castletownbere is primarily a fishery harbour. Facilities include West and East Quays on the mainland and Dinish Wharf on Dinish Island. The mainland quays have a total length of 304m, with an available water depth of 4m MLWS. Recent works have extended Dinish Wharf from 90m to approximately 210m, with an available water depth of 8.0m MLWS. Lay-down space immediately behind Dinish Wharf extends to about 40m, but the area beyond this is widely used by warehouses and other such facilities.
General Port Infrastructure	The level of support services offered at the harbour is reasonable; tugboats, workboats and stevedoring are available. There is a syncrolift facility capable of lifts up to 200t located just north of the wharf on Dinish Island and dry-dock facilities are available on Bere Island.
Hinterland Access	Road access is quite poor.
Suitability to Facilitate Renewable Development	The harbour is primarily focused on fishing. Facilities available would be of limited suitability to facilitate renewable development.
Previous Experience in the Offshore Sector	None
Future Strategy for developing and supporting OE	This is primarily a fishing port and there are no plans with respect to OE.
Summary	Castletownbere is primarily a fishing port. Facilities are unlikely to be suitable to support any significant level of offshore development. The port could potentially have a role to play in supporting early-stage wave-device testing activities.

Shannon Foynes Port Company

Proximity to Main Test Beds & Offshore Installation Sites	Situated on the west coast, in the Shannon Estuary the port is well positioned to service tidal resources in the estuary itself, as well as wave resources off the coasts of Clare and Kerry.
Quayside Suitability & Storage	The main areas of jetty infrastructure are located at Foynes and Limerick although there other, user-dedicated facilities on the estuary. Foynes is the main deepwater facility, catering for vessels up to 198m and with draft up to 10.7m. There are two jetties at Foynes; the west jetty is 265m long and the east jetty 295m long; both have an available water depth of 10.7m. The hinterland area associated with these two jetties is approx. 15,000m^2; 30,000m2 of covered warehouse space is available there. Foynes is used for a variety of cargoes such as liquid, bulk and break bulk. Limerick is further inland than Foynes but its length of available quay space is greater. Limerick can accommodate vessels up to 152m long with a beam of up to 19.8m; available water depth is in the order of 5.0-5.5mCD.
General Port Infrastructure	The level of support services offered at Foynes and Limerick is good, with stevedoring, tugboats and workboats all available. Five 63t harbour mobile cranes operate at Foynes, but vertical loading on the jetties is restricted to 75kN/m2 which might prove to be a limitation for large-capacity lifts. Crane capacity at Limerick is generally limited to 90t, but heavier lifts up to 500t have been accommodated. Three tugs are available, one with 55t bollard pull and two with 45t.
Hinterland Access	Road access to port facilities in Foynes and Limerick is good. The port was rail-connected in the past, and could be reconnected.
Suitability to Facilitate Renewable Development	Due to lack of hinterland available, it is unlikely that the Limerick quays would be capable of supporting OE deployment. The facilities at Foynes would be more suitable. At Foynes the amount of hinterland immediately behind the quays is limited, but further hinterland would be available within a short distance of the quay area.
Previous Experience in the Offshore Sector	Although offshore experience is limited, Foynes terminal is familiar with handling wind turbine and renewable energy equipment.
Future Strategy for developing and supporting OE	The Shannon Foynes Port Company has identified offshore renewables as a potential source of business and is actively pursuing opportunities and marketing the Shannon Estuary as an energy hub location. The port views the main potential for the west coast to be in the wave and offshore wind sectors and recognises the likely timeframe for development in this area. It considers the Shannon Estuary, with both its current and potential future facilities, as attractive to developers in terms of marine location as well

as supporting resources in the region. At its Foynes terminal, the port is progressing plans to develop additional port working area behind the existing east jetty and has a master plan to develop further quay and working areas adjacent to the east jetty should demand arise; it has also identified other sites with longer-term development potential.

Summary

The Shannon Estuary occupies a strategic location in respect of wave energy resource on the west coast and currently can provide sheltered facilities with good water depth and port services. Planned developments to provide additional quayside harbour working areas and possibly additional quay length at Foynes would further enhance the attractiveness of this location for developers.

Galway

Proximity to Main Test Beds & Offshore Installation Sites	Situated centrally on the west coast, Galway is well positioned to service wave resources along the length of the west coast.
Quayside Suitability & Storage	Galway harbour is in the heart of Galway city. There are six quays available, with a total quay length of over 1km: Mulvoy Quay (209m), Breatnach Quay (315m), Dun Aengus North (165m) and South Quays (192m), Folan Quay (89m) and Quirke Quay (80m). Water depth at the Dun Aengus quays is 3.6mCD while in the rest of the harbour it is 2.9mCD. The approach channel into Galway harbour has been maintained at 3.45mCD. The port mainly handles bulk cargo. Folan Quay is exclusively used for liquid bulks.
General Port Infrastructure	The level of support services available is understood to be good, with stevedoring, pilotage and other vessels readily available. A number of cranes operate at the harbour, the maximum capacity of which is 40t. Storage area in the harbour is limited although space is available at the nearby Enterprise Park.
Hinterland Access	Road access to the port is quite good.
Suitability to Facilitate Renewable Development	Facilities in the harbour are limited in terms of depth, tidal restrictions and available quayside lay-off space, but the port company has been preparing a planning application for the development of a new port facility capable of accommodating the future needs of the ocean energy sector and intends to lodge a planning application with An Bord Pleanála.
Previous Experience in the Offshore Sector	The port has had involvement in the wave-energy sector, in the deployment of one-quarter scale prototypes for wave energy in Galway Bay.
Future Strategy for developing and supporting OE	Galway Harbour Company considers itself to occupy a strategic location on the west coast and has identified the wave-energy sector as an area of opportunity for future business development. It has specifically identified the R&D sector and is attracting R&D ocean-energy SMEs to locate at the Harbour Enterprise Park, while planning permission has been granted for a dry dock suitable for testing wave-energy devices.
Summary	Like the Shannon Estuary, Galway occupies a strategic location in respect of wave-energy resource on the west coast, but facilities to support major offshore construction are extremely limited in respect of water depth and available working area. Should plans for a new outer harbour development be realised, current constraints will be removed and Galway would be in a very strong position to support major offshore construction activities in the wave-energy sector.

Killybegs FHC

Proximity to Main Test Beds & Offshore Installation Sites	Killybegs Fishery Harbour Centre in Co Donegal is well positioned in relation to potential wave-energy developments in the NW and is the closest main port to the proposed wave-testing facility at Belmullet.
Quayside Suitability & Storage	The port has been designed to cater for vessels up to 300m long, at 40,000t and with a maximum draft of up to 12m at low water. Two main berths would be available to accommodate project cargoes. The Smooth Point side offers about 150m of quay length at a depth of 9m, while the new pier is 300m in length and has a depth of 12mCD. Extensive hinterland areas are available at both locations.
General Port Infrastructure	The level of support services is good, with tugs (1 x 10t, 1 x 25t and 1 x 32t), workboats and stevedoring all available. There are good ship-repair facilities at the harbour, with a synchrolift capable of lifting vessels up to 37m long and 580t.. Although some crane pad loading restrictions apply, it is anticipated that heavy lifts can be accommodated, particularly at the new pier.
Hinterland Access	Road access to the port is quite good.
Suitability to Facilitate Renewable Development	Facilities are generally good, with significant hinterland and the availability of local marine and engineering services. The port would be very suitable to support offshore wave developments.
Previous Experience in the Offshore Sector	Although offshore experience is limited, the harbour has experience with handling wind-turbine and renewable energy equipment.
Future Strategy for developing and supporting OE	This is primarily a fishing port and there are no specific plans with respect to OE.
Summary	Killybegs is well located for wave development in the NW and facilities available would make this location attractive to developers.

New port planned at Bremore

Drogheda Port Company and Treasury Holdings are jointly planning a new port on the east coast, located at Bremore, between Drogheda and Dublin. The port is intended to provide deepwater facilities for a range of cargo modes, with access to extensive hinterland areas. Bremore Ireland Port considers the offshore wind-energy sector to be a key business opportunity and is actively engaging with developers in relation to Bremore's potential for supporting construction and O&M activities. It expects to apply for planning approval in 2012 and anticipates the port to be in operation in 2016/2017.

Should the proposed port be constructed, it could prove to be very attractively located for windfarm developers in the Irish Sea. The port would be strategically positioned for both Irish and UK windfarms and could be capable of providing all the facilities required by developers or manufacturers.

CRH Arklow

Roadstone Wood Group (RWG) is currently in preliminary discussions with a major European construction contractor to consider the feasibility of jointly developing the quay infrastructure at its Arklow quarry site, to provide facilities to support a manufacturing operation for offshore windfarm foundations. Plans are at an early stage of development but RWG considers the site to be of strategic value in servicing Irish Sea windfarm construction

Arklow is strategically located in relation to planned Irish offshore windfarms and is also accessible for UK locations. Facilities are limited at the moment, but with suitable infrastructure development works the site would be an ideal location for a foundation manufacturing facility.

7.3 OE developments – summary of port facilities

The main constraint, even in the larger ports, concerns the ability to provide the large land areas required immediately adjacent to the load-out quay. Very few ports currently have the required areas of land within working distance of operational quays of sufficient length and depth. Possible exceptions are Belfast, where the combination of the Port of Belfast and Harland and Wolff facilities could provide a good land bank with direct quay access, and Cork Dockyard, which has a large area of land close to quays. This issue has already been a major factor in H&W being able to support the construction of offshore windfarms in UK waters. Such a location with access to significant engineering support services will continue to be attractive to developers.

Commercial ports by their nature concentrate on their core activities, which in Ireland are primarily in the bulk solids, bulk liquids, unitised, Ro-Ro and passenger modes of trade. Port development and operations have historically been focused on these core activities, with other trades being seen as opportunity cargoes.

In running commercial operations, local port managers focus on maximising use of and revenue from their land and quay assets. This includes shipping movements, cargo dues and stevedoring income. Feedback from ports so far is that, except for a few isolated cases, OE is not expected to be a core business and ports are unlikely to invest in infrastructure unless there is a solid business case (commercial viability) for doing so. Ports are unlikely to speculate in this sector given current uncertainties, particularly with respect to timing. However, there is a view in some ports that offshore developments could potentially provide seed capital for general port infrastructure developments in the future.

Several Irish ports have indicated that they could have the potential to make adjustments to their current working arrangements that would allow them to free up sufficient quay and hinterland space to accommodate a significant offshore renewable energy construction project. To make the most of opportunities on this basis, ports would need to have early contact with potential developers in order to persuade them that such arrangements could be put in place effectively. Larger ports with multiple infrastructure facilities would be best placed to capitalise on opportunities on this basis, due to the greater degree of flexibility afforded by scale.

A key consideration in the use of existing facilities is quay and land use. While the current economic climate means that port facilities may be under-used, assessments in this report are based on levels of use in the recent past – on the premise that significant offshore developments are unlikely to take place for a number of years and that it is likely that trade levels will most likely return to past levels. If this is not the case, and normal port trade remains depressed, then additional ports may also be able to accommodate some level of activity in the support of OE developments.

Outside the main commercial ports, there may be opportunities for developers to make use of private facilities that could potentially be handed over entirely for their activities. For instance, Cork Dockyard has extensive quay and landside working areas that are currently under-used. The CRH facility at Arklow could also be a location for OE activities, although at present the facilities are extremely limited.

Facilities available at the main ports under consideration are summarised in Table 7.1, with reference to the likely scale of infrastructure that would be required to service major offshore wind, wave and tidal developments.

Table 7.1: Summary of current port infrastructure

	Depth = > 6 m CD		*Depth = > 8 m CD*		*Quay length up to 200 m*	*Quay length > 200 m*	*Hinterland adjacent quay up to 2.5 ha*	*Hinterland adjacent quay 2.5 –6 ha*	*Hinterland adjacent quay 6–8 ha*	*Crane Lift => 100 t*	*Crane Lift => 150 t*	*Dry Dock*	*Ship Lift*
	At Quay	Channel	At Quay	Channel access									
Londonderry	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	~	x	x
Larne	✔	✔	X	X	✔	x	✔	X	X	~	~	X	X
Belfast/H&W	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	X
Warrenpoint	✔	✔	X	X	✔	✔	✔	X	X	✔	X	X	X
Greenore	X	✔	X	X	✔	✔	✔	X	X	✔	X	X	X
Drogheda Port	✔	X	X	X	✔	✔	✔	✔	X	✔	~	X	X
Dublin Port	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	X	x
Rosslare	✔	✔	X	X	✔	✔	✔	✔	✔	✔	~	X	X
Waterford	✔	✔	✔	X	✔	✔	✔	✔	✔	✔	~	X	X-
Port of Cork/ Cork Dockyard	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	✔	X-
Castletownbere	✔	X	✔	X	✔	✔	✔	X	X	✔	~	X	200t
Shannon Foynes	✔	✔	✔	✔	✔	✔	✔	X	X	✔	~	X	X
Galway	X	X	X	X	✔	✔	X	X	x	X	X	X	X
Killybegs FHC	✔	✔	✔	✔	✔	✔	✔	✔	X	✔	✔	X	580t

The facilities listed in the table are those currently available in the ports. However, it must be noted that, in general, these are extensively used in the ports' day to day business; the full extent of facilities will not be available to service the ocean-energy sector. Overall, even the largest of Irish ports would require some reorganisation of operations to be in a position to accommodate construction and installation activities on the scale that will probably be required.

7.4 Summary of infrastructure requirements

There is an acknowledgement within the ports that current facilities will be a constraint on the extent to which they might benefit from the OE sector. Many of the ports are actively considering how they would accommodate the activities of the offshore renewable industry when considering their master plans and in identifying infrastructure developments for the future. Almost all ports believe that, by engaging with developers and installation contractors, they could develop solutions that would meet the needs of the developer while also maintaining their other core businesses.

Many ports questioned the large amounts of land which developers consider might be required and believed that, through dialogue with developers and installation contractors, solutions could be developed that would meet the needs of a significant offshore construction project.

Ports generally are realistic about the constraints which they currently experience and are looking to actively address these issues in their plans for the future.

For example, Galway Harbour is constrained in terms of access restrictions, both tidally and in vessel beam. Recognising this, the Galway Harbour Company is in the process of making a planning application for a new port facility outside the current harbour basin, which would improve quay length, water depth and adjacent hinterland. The company has identified the wave and tidal energy market as a key potential new source of business at the proposed port and is currently promoting the port within the renewables R&D sector.

A further example is the proposed new deepwater port at Bremore, which is being promoted by Drogheda Port and Treasury Holdings. From discussions with them, it is clear that they consider renewables (particularly windfarm construction in the Irish Sea) as being a key opportunity for the proposed port. A main advantage of such a greenfield port is that it could be planned with the requirements of the wind industry in mind, with due regard to the large areas of hinterland space which will be required.

Waterford Port already has in place planning permission for substantial expansion of its facilities at Belview, which could be used for the offshore renewables sector.

Other ports with current plans for expansion or development of new facilities which could support OE construction and installation include Belfast Port, Dublin Port, Port of Cork and Shannon Foynes. Private operators also actively planning for this sector include Cork Dockyard and CRH in Arklow.

8.0 Opportunities for Irish Ports

A number of opportunities have been identified where Irish ports might be able to benefit from the growing emphasis on the development of renewable energy-business in the marine sector.

8.1 Construction and installation for fixed offshore windfarms

The construction of offshore fixed wind turbines is the most immediate opportunity for Irish ports to have a role in OE development**.**

8.1.1 Scale of planned windfarm development

As a result of the Crown Estate Round 3 and Scottish Territorial Waters (STW) leasing rounds and the UK and Scottish governments' climate-change targets, there is a strong expectation that offshore wind programmes will begin large-scale installation processes by 2014/5. These rounds of installation will build on Round 1 sites and ongoing Round 2 sites. In addition, there is currently in the order of 2.9 GW of planned windfarm capacity in Irish waters.

Developers are currently identifying delivery programmes for the sites they hold under STW and will develop under Round 3 in the UK. As part of this they need to identify construction and installation locations as well as O&M bases. Their potential suppliers are also seeking sites to service these programmes. A quick view of the map of Britain and Ireland illustrates the opportunities for development of construction and installation sites on the east coast of Ireland to service developments located in the Irish Sea, in both British and Irish waters.

The timing of demand for sites to install, manufacture and maintain wind turbines arises from the leasing rounds. Developers have a range of processes to complete prior to the start of installation and operation. Table 8.1 shows the anticipated numbers of offshore wind turbines expected to be installed in UK waters during Rounds 1, 2 and 3 of the Crown Estate's leases from 2010. The regional distribution is based on seabed availability and the relative economic viability of different zones.

Table 8.1: Anticipated numbers of offshore wind turbines

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Irish Sea	10	20	20	90	100	40	50	80	110
Scotland: West Coast	-	-	-	-	-	50	80	150	160
Bristol Channel & Wales	-	-	10	-	-	30	70	100	110
Total	10	20	30	90	100	120	200	330	380

The inclusion of the Bristol Channel and Wales numbers has a strong impact on the totals for the Irish Sea region. These figures exclude prospects in Irish territorial waters, the timing of which is more difficult to predict in the current financial climate.

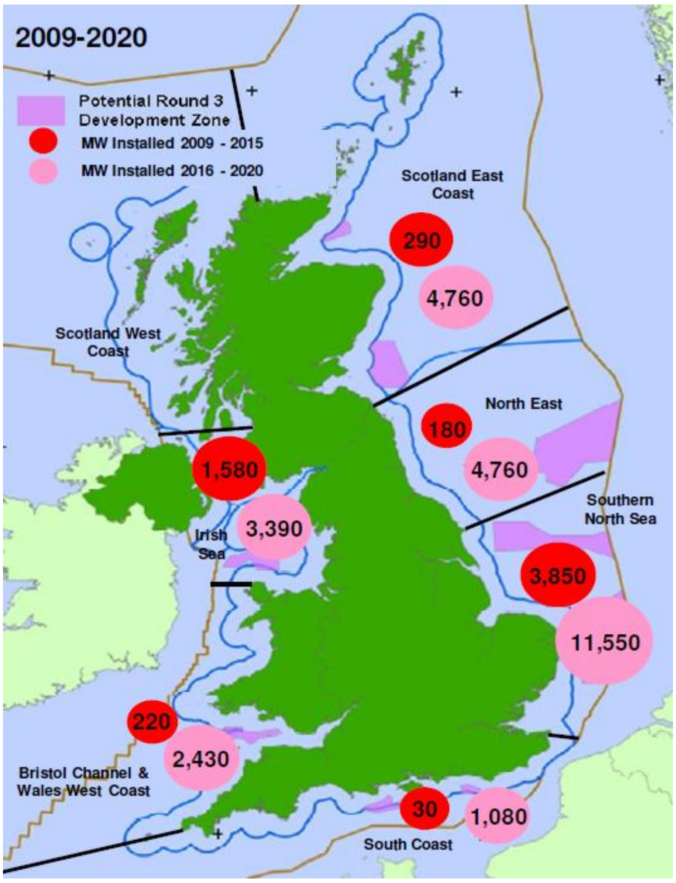
A number of conclusions may be drawn from this indicative turbine installation build-up:

- Irish Sea locations will be accessible from sites on the east coast of Ireland as well as the west coasts of Scotland, England and Wales. They should be viewed as being serviceable from Ireland.
- The start of the scaling-up of installation of sites leased under STW and R3 is expected in 2013/2015. Developers and their supply chains will need to make decisions about locations in 2011/12. This means that Ireland needs to develop investment plans for first-phase sites during 2010 to enable consideration both by the developers and by their supply chains in time for decisions by 2011/2012.

Requirement for construction ports on Irish coasts

The flowing figure illustrates the distribution of potential windfarm developments in UK waters.

Figure 8.1: Potential windfarm developments in the UK



Source: DECC UK Ports for the Offshore Wind Industry: Time to Act 2009

Table 8.2 indicates the number of ports required to meet the demand from Round 1 and Round 2 projects as well as the projected 25 GW from Round 3 by 2020. The forecast build rate for Round 3 has been based on feedback from developers and manufacturers about project timescales and practical construction rates. No provision is incorporated for development within the territorial waters of Scotland; Irish and Continental waters are also excluded. If developments in these areas are progressed concurrently, the demand for port capacity could be considerably higher.

Table 8.2: Indicative number of ports required in the Irish Sea

(based on a typical installation capacity of 100 turbines per year per port)

	2010	2011	2012	2013	2014	2015	2016	2017	2018
Irish Sea	1	1	1	2	2	1	1	1	2
Scotland West Coast	-	-	-	-	-	1	1	2	2
Bristol Channel & Wales	-	-	1	-	-	1	1	1	2
Total	1	1	2	2	2	3	3	4	6

It may thus be concluded that a competitive opportunity does exist for the use of ports on the Irish east coast to service these requirements. The main opportunity would arise in 2017–2018, derived from deployments in Irish waters and the Western Approaches.

8.1.3 Issues for Irish ports

While advances in the development of specialised windfarm installation vessels have expanded the effective geographical limits for the viability of ports in relation to development locations, ports in closer proximity to development sites will still be more attractive to developers – assuming that such ports can provide the required infrastructure support and services.

The distribution of planned fixed windfarm developments means that the ports most likely to benefit will be those on the east and south coasts of Ireland. In terms of location, Dublin Port is particularly well positioned in relation to developments off the Irish east coast and in the north Irish Sea. Belfast Port / Harland and Wolff already has substantial experience in servicing offshore windfarms in the north Irish Sea and thus would be strongly positioned to compete with Dublin for work in this sector, as well as being best placed for developments in the west of Scotland.

Ports in the south-east (Rosslare and Waterford) could also potentially service Irish windfarm developments although they are more distant from the main development area than Dublin and are of a smaller size. Rosslare would be constrained in terms of available quay length and back-up area available, while Waterford is more distant than Rosslare. These ports could potentially challenge for works in the Bristol Channel, although there would be strong competition from UK ports.

Although Port of Cork is further removed from Irish Sea sites, the combination of good land banks at Ringaskiddy and the facilities and experience available at Cork Dockyard could be very attractive to developers. This may allow the port to compete with other Irish ports for projects in the Irish Sea and Bristol Channel, and perhaps further afield.

The above analysis of ports for offshore fixed wind developments would be significantly altered if the planned deepwater port at Bremore was to be constructed. Such a facility, with the anticipated deepwater facilities and adjacent hinterland in a strategic location for both Irish and UK developments, could prove to be very attractive to windfarm developers.

There is a single windfarm development planned for the west coast of Ireland. The closest port is Galway Harbour, but this would require the implementation of its current plans to be attractive to developers. Likewise, Shannon Foynes would need to implement its current expansion plans in order to be suitable for this scale of development. The only port currently available on the west coast which may be able to accommodate a significant offshore construction project is Killybegs FHC, although this is furthest removed from the site of all three main west-coast ports.

Although location and infrastructure provision will be key considerations for any windfarm developer, the commercial aspect cannot be ignored. Ports will compete not only on the facilities they can provide but also on commercial terms for the use of their facilities. This commercial aspect could in cases swing the balance of decisions, perhaps making the use of more distant ports a possibility.

8.2 O&M activities for fixed offshore windfarms

Maintenance of an operating is usually carried out from a nearby port. These ports house the maintenance crew and vessels needed to respond to windfarm faults, plus storage and repair facilities. As windfarms get larger and further out to sea, the use of helicopters and offshore accommodation facilities for this function is likely to become more common.

The requirements of O&M sites may be modelled on recently established locations for Round 2 developments in the UK.. Long-term employment in supporting an array of approximately 150 turbines is projected at about 100 full-time employees, working for a range of companies within the O&M supply chain.

Developers indicate that there will be a need for local bases to service more regular maintenance needs. Since infrastructure requirements for such bases are relatively modest, many small ports, particularly on the east coast of Ireland, could fulfil this function. This presents an opportunity for smaller ports to benefit from the anticipated growth in offshore renewable energy, although larger ports would also be able to perform this function if geographically placed.. By the nature of the activities to be undertaken, the ports most likely to benefit are those closest to the windfarm sites. In the context of Irish windfarms, smaller ports most likely to benefit would be Dun Laoghaire, Wicklow, Arklow, Rosslare and possibly Wexford. In relation to the windfarm planned for the west coast, Rosaveel would be well placed to support O&M activities.

Due to travel distance it would be difficult for Irish ports to be able to compete for O&M work on windfarm sites in UK waters.

8.3 Manufacturing facility associated with fixed offshore windfarms

As well as the need to establish construction bases for offshore turbines for installation in Irish waters, there is potentially also an important opportunity to attract turbine and component manufacturing to Ireland to supply the offshore wind market. The wind industry needs more turbine production and component manufacturing facilities. It is essential that any new facilities set up to service offshore wind are located on the coast. Even for onshore turbines, due to the increasing size of windfarms and the geographical spread of locations, it is advantageous in terms of flexibility and logistics cost to locate new facilities on the coast.

Some turbine manufacturers plan to establish their own turbine assembly facilities alongside key component manufacturing facilities on a single new coastal site. Depending on the range of products and scale of operations, these could employ up to 5,000 people on each site.

The requirements for such sites would be:

- location on the Irish Sea coast to enable export to UK Round 3 projects as well as supplying to Irish offshore projects
- up to 500 hectares of flat area for factory and product storage
- direct access to dedicated high load-bearing deepwater quayside (minimum 500m length)
- ease of landside logistics and access to skilled workforce

This opportunity needs to be considered in the context of competition from England and Scotland. Both the English and Scottish governments have established incentive budgets for the development of ports in the hope of attracting major investment by turbine manufacturers to a port location in the UK.

Figure 8.2: Scottish incentive for port development

£70m upgrade kitty for Scottish ports

Applications are now being taken for a £70m investment pot aimed at upgrading port infrastructure in Scotland over the next five years to meet the demands of the coming offshore renewables boom.

First minister Alex Salmond unveiled the initiative during his keynote address at the Glasgow conference.

Expressions of interest from ports, developers, manufacturers and site owners are due by 10 December.

The fund will target the sites already identified in the National Renewables Infrastructure Plan.

"We are determined to stimulate the market and act decisively to trigger vital capital investment and launch the next phase of Scotland's renewables revolution," said Salmond.

He also detailed plans to bring together expertise from the oil and gas sector and renewables "to drive forward collaboration between the two".

A summit chaired by Wood Group founder Ian Wood and Scottish & Southern Energy chief executive Ian Marchant will be held in Aberdeen on 17 December.

Finally, Salmond recognised the UK's first renewable energy modern apprenticeship programme, a joint effort between Siemens, Repower, Weir Group, City & Guilds, Carnegie College and the National Skills Academy for Power.

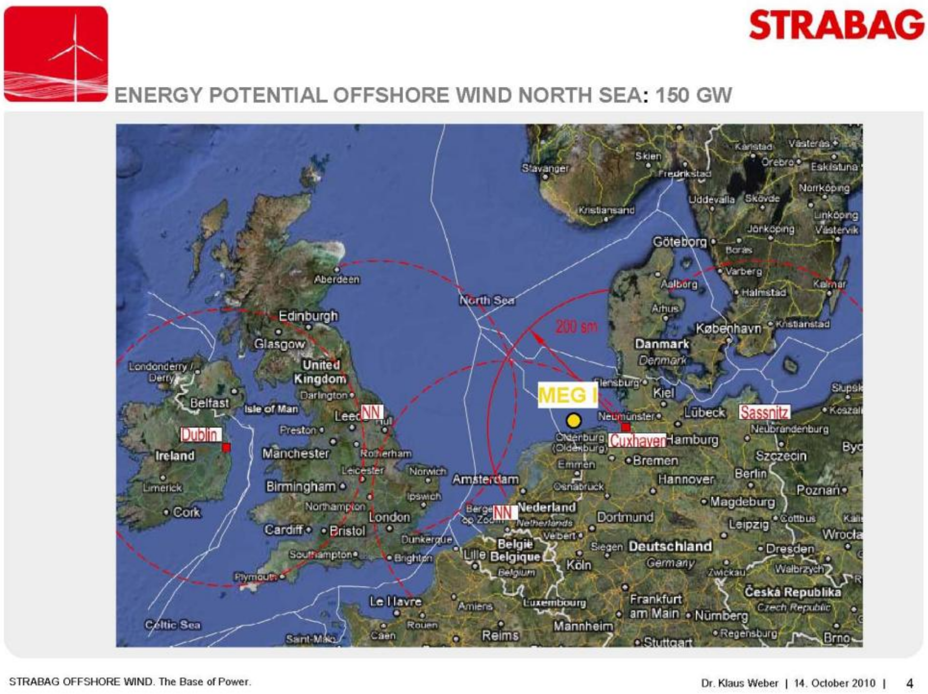
There are a number of potential constraints to the possibility of this type of opportunity being located in Ireland:

- the very large areas of land required for this activity
- the current lack of incentives for manufacturers to locate in Ireland
- geographic location

An alternative opportunity, which may be more realistic in the Irish context, is to establish key component manufacturing facilities where the components can be used directly on offshore windfarms without requiring transportation to the turbine production location. This scenario is relevant for foundations, towers, blades and offshore sub-station support platforms.

As an example, at least one European construction company is investigating the possibility of using Ireland as a base for the establishment of an industrial plant for the large-scale production of foundations for offshore turbines. Strabag is the largest construction group in Germany and Austria, and a leading construction company in central and eastern Europe. It has over 75,000 employees and a turnover of €13 billion. The company is active in offshore construction and foundations for windfarms and has developed a concept for large gravity wind-turbine foundations, with large-scale production and installation. The concept is based around strategically located, highly automated industrial plants at coastal locations. It already has plans in place for a production facility in Cruxhaven, Germany and is actively pursuing other locations in the UK and Ireland to take advantage of the opportunities presented by Round 3 windfarm developments.

Figure 8.3: Map used in Strabag presentation, Dublin (14 Oct 2010)



Such a production facility would require extensive areas of land and access to dry-dock facilities would be advantageous. Given the radii of influence from a production facility, it is likely that locations on the south and east coast of Ireland would be well placed to take advantage of such an opportunity.

The proposed deepwater port at Bremore would be an ideal location for such a facility; as a greenfield site it could be planned most effectively to accommodate a large production facility. However, other locations such as Cork (Ringaskiddy, with nearby Cork Dockyard facilities) with large land banks close to the water's edge could also be a possibility. The ports of Dublin and Rosslare are unlikely to be able to make the necessary land banks available without major reorganisation. This is also the case in Waterford where, although a large development land bank might be available, it is not close to the quay.

The CRH facility at Arklow could also be ideal for this type of operation and infrastructure construction , with appropriate development work.

A high degree of strategic support and an integrated approach by Government will be required in order to identify and capture such an opportunity for Ireland. A project of this kind is beyond the scope of the individual commercial ports to procure, although they will have a key role to play.

8.4 Wave and tidal testing support

The initial needs of the wave and tidal energy sector are different from those of offshore wind. The Crown Estate leases in the Pentland Firth and Orkney Waters area have given Scotland the opportunity to be at the leading edge of development of this new sector although opportunities still exist for Ireland.

To enable this testing phase to succeed, companies will need quayside and port facilities to install and maintain devices. The development of this infrastructure needs to be staged and timed to ensure no delay in the wave and tidal process. Supporting facilities such as buildings for assembly, maintenance and prototyping need to be developed. The current port infrastructure need is focused in Scotland, in the Pentland Firth and Orkney Waters.

However, as this industry develops, the need for infrastructure will be more widespread. In Ireland this focus will be on the western, Atlantic coast.

Discussions with developers indicated interest in a range of locations in Scotland and Ireland:

- For wave devices, key locations could include the north-west coast of Scotland, the west coast of the Western Isles and locations in Shetland. In Ireland locations are focused on the western Atlantic coast.
- For tidal devices, future key locations could include the Kintyre peninsula, the coastal areas of Galloway and locations in Shetland. In Ireland the north-east cost at Torr Head and Rathlin Island as well as the east coast are resource hot spots.

The concentrated geography of the initial testing area means that it will be possible to target support to a small number of locations and to work with the lease-holders to develop infrastructure at these locations that is appropriate and can be scaled up in phases depending on future needs. To service potential future locations, it will be important to ensure that investments made at some locations initially to support the offshore wind industry needs are designed with longer-term shared wave and tidal use in mind.

Fit-for-purpose ports, harbours, vessels and manufacturing facilities will be required to enable and support the growth of a commercial ocean-energy sector. Coupled with the emerging offshore wind opportunities around Ireland, the rewards for Ireland’s economy could be high. Ireland has a relatively modest baseline from which it will be necessary to build a strong infrastructure base to support the marine renewables industry.

The wave test facility at Belmullet is established, and a number of ports and harbours are showing interest in marine renewables, particularly in relation to R&D. These include Galway Port which has plans to develop an energy testing hub, centred on the port. Plans include the construction of a dry dock for device testing and the port is actively engaging with developers and local education institutions. The Shannon Foynes Port Company has also identified the wave and tidal sector as a potential business opportunity and is advancing plans for facilities that would be able to support this sector.

Tidal energy opportunities will be centred mostly in the east and north-east, and similar opportunities could arise for ports in these locations. Greenore port currently supports the activities of Open Hydro, which has established a manufacturing facility close to the port.

The testing phase of wave and tidal technology will involve activities on a relatively small scale. Many ports could thus support the industry during this phase of development. A local manufacturing capability would be a strong advantage for ports positioning themselves in this space.

8.5 Construction and installation activities for commercial wave and tidal

Wave and tidal technology is at a very early stage of development and it will be many years before large-scale commercial deployment will be undertaken.

The development of port facilities in the near and mid-term future will strongly influence their suitability to support large-scale wave and tidal manufacture and deployment. Hence the identification of specific ports is not possible at this time. However, as is the case with current experience in the wind industry, location and proximity to development sites will be a significant factor.

8.6 Construction and installation activities for floating offshore windfarms

The concept of floating offshore windfarms in Irish waters is at an extremely early stage of development. At this point, only very broad estimates of resource and potential development areas have been made. It is thus not possible to identify particular ports that would be suitable for use as deployment bases.

Port requirements for this type of development will likely be broadly similar to those for fixed offshore windfarms in terms of facilities required. However, given that installations will be floating, port location may not be as strong an influencing factor in the developer's choice of port. The extent and nature of facilities and services available may be the more determining factor in ultimate choice of location.

9.0 Port Industry Perspective and the Way Forward

9.1 Irish port industry feedback

Consultations with Irish ports have provided constructive feedback on the ports' views of the opportunities which may be presented by offshore windfarms and ocean energy:

- The ports' level of awareness ranges from those actively engaging with developers to those that are just starting to consider this sector as an opportunity. The current economic situation has focused ports' attention more on alternative sectors.
- Feedback from ports so far is that, except for a few cases, this will not be seen as a core business and ports are unlikely to invest in infrastructure unless there is a solid business case (commercial viability) for doing so. Ports are unlikely to speculate in this sector given current uncertainties. However, offshore developments could potentially provide seed capital for general port infrastructure developments.
- Some ports have been approached by developers investigating facilities, although this is often by an agent who is not particularly knowledgeable – ports would welcome the opportunity to engage directly with developers as solutions are more likely to be bespoke rather than 'off the shelf'.
- The requirements being stated by developers are considered excessive and few ports would have the scale of facilities available for immediate use.
- However, many of the ports are actively considering how they would accommodate offshore energy activities when preparing master plans and in identifying infrastructure developments for the future. Almost all ports believe that, with active engagement with developers and installation contractors, they could develop solutions that would meet the needs of the developer while maintaining their other core businesses. Bespoke solutions are essential.
- Some ports have access to land banks but these are not always immediately adjacent to quays.
- Many ports have experience of handling turbines and towers for onshore wind farms, but only Rosslare has handled turbines for an offshore development. It is acknowledged that the scale of development anticipated is much larger than the ports have generally accommodated in the past.
- It is vital that port development be considered as an integral part of overall policy development focused on ocean energy. Ports cannot make this happen on their own; a combined 'Ireland Inc' approach is needed – a top-down approach, with policy support.
- The likely scale of lifts and facilities required will in many cases be in excess of what the ports have had to provide in the past – aged infrastructure will need to be upgraded.

- The granting of permissions for harbour infrastructure (planning and particularly foreshore) is seen as a major obstacle in reacting quickly to customer demand. Assuming that 'Ireland Inc' is serious about attracting large-scale manufacturing, then – given the relative lack of capacity and the lead-times required to get through planning, etc – it is essential that some form of designation and focus be introduced, such that at least the initial phases of pre-planning could proceed with some financial comfort.
- There is a lack of clarity on timescales for development. Ports would welcome early engagement with decision-makers – particularly from the development side.

9.2 Key learning points for the Irish ports industry

- Geographic location will be a significant factor in choosing a construction/deployment port.
- Early contact with developers is essential to make the most of this opportunity – for wind, the minimum is two years. Developers advised that the construction port is only finally contracted after the relevant prime contractor has been secured.
- Opportunities exist for many ports to be involved at the maintenance and operational stage, but opportunities in the construction phase will be limited mainly to the larger ports.
- Providing suitable large areas of land in close proximity to the quay will be a challenge at most port locations. Ports should identify now how they might make suitable lands available if the opportunity arises and include this in their strategic planning.
- Facilities and experience are key factors – the first port to win contracts will be more attractive to other developers if performance is good. The first mover will have an advantage.
- Ports should consider in their master planning how they might provide suitable facilities for offshore renewables should the need arise.
- There may be a need to react relatively quickly to developer requests. Being at an advanced stage in the planning process for suitable facilities would be an advantage.
- When developing any infrastructure (for any other sector), ports should bear in mind the likely requirements of the offshore renewables industry and ensure that suitable depth and heavy-lift capacity is included. It is likely that a construction facility will end up being multi-use as renewables will not be a full-time business.
- Being able to offer developers exclusivity on quay and land areas will be a major advantage.
- Flexibility to adjust current operations would be an advantage in accommodating the likely intermittent nature of offshore renewable developments. This could favour larger ports where more facilities might be available to contribute to flexibility.
- The availability of development capital would be a considerable advantage in reacting to demand. This will again be an advantage for the larger, more cash-rich ports.

- Ports do not operate in isolation. Developers will see an advantage in ports located in areas well served with other infrastructure (road/air) and businesses (supply chain/services, etc).
- In view of the timescales for offshore wind, Ireland needs to agree and quickly implement its strategy to ensure that our best sites are ready for consideration. To be attractive, these sites need to offer the right combination of water depth, area at quayside for fabrication and assembly, and a suitable labour market.

9.3 The way forward for the port industry

- A key output of the strategic dialogue process has been the fostering of greater understanding of the industry's timescales and needs, and recognition that Ireland faces competition to service this industry from locations in the UK and Europe. However, ports as a group have demonstrated a willingness to engage with the Irish Government and its agencies in pursuing a strategic and focused approach. There is also an appetite to continue dialogue about the evolving needs of the industry.
- The start of the scaling-up of installation of sites leased under STW and R3 is expected in 2013/2015. Developers and their supply chains will need to make decisions about locations in 2011/12. This means that Ireland needs to develop investment plans for first-phase sites during 2011 to enable consideration both by the developers and their supply chains in time for decisions by 2011/2012.
- To ensure that the first-phase locations identified for offshore wind are market-focused, it will be necessary to closely discuss infrastructure needs with developers. Further discussions will be required to ensure port sites are developed to meet the range of initial needs. The locational needs of supply-chain companies hoping to manufacture devices following successful testing are starting to emerge. A co-ordinated approach by Government and all stakeholders is required to attract renewable business to Irish ports and shipping. Workshops should be held involving offshore developers, turbine and foundation manufacturers, offshore contractors, port owners and potential investors.
- Investment now should bring longer-term benefits to the Irish port industry. The action to increase port capacity to meet the requirements of Round 3 developments will equip Irish ports with a capacity to handle all future marine and offshore energy developments, including tidal and wave energy. Investment now should bring longer-term benefits to the Irish port industry.
- Stakeholders also made clear the importance of planning and consenting processes operating in a way that enables sites to be ready in time for use, in line with the overarching installation timelines. A co-ordinated approach to this issue is needed from Government in order to allow

ports to develop infrastructure within the required timeframes if they are to be in a position to make the most of the opportunities presented.

- Government could provide support to ensure that ports capacity is available to meet the requirements to deliver offshore targets. Market forces alone will not deliver capacity in time. Reference can be made to government incentive packages already in place in the UK.

10.0 Conclusions

The following are the conclusions for the shipping and ports sectors:

10.1 Shipping sector

10.1.1 There are four companies with associated support vessel fleets based in Ireland:

- Island Shipping
- Irish Mainport Holdings
- Sinbad Marine Services
- Fastnet Shipping Ltd

The combination of vessels from these four companies would be insufficient to service one large offshore windfarm without chartering additional specialised vessels from abroad. In normal circumstances, the chartering of these vessels would not present any difficulty in a market that has a sufficient supply of vessels servicing a declining offshore oil and gas market. However, with the upsurge of offshore wind deployments in Europe, there will be increasing difficulty in sourcing appropriate vessels at reasonable day-rates in the future.

10.1.2 All the companies owning offshore support vessels in Ireland have grown, taking advantage of local opportunities to service either offshore oil and gas developments or offshore wind. The growth has taken place based on internally generated revenues and investment.

10.1.3 The international market for specialised deployment and heavy-lift vessels will always be able to command premium day-rates on the open market. No individual country has the range of work or opportunities for these expensive vessels, which must operate internationally.

10.2 Ports sector

10.2.1 In general, even the largest of Irish ports would not currently be in a position to accommodate construction and installation activities of the scale anticipated, without some reorganisation of existing operations and development of new facilities. The main constraint, even in the larger ports, would be the ability to provide the land areas required immediately adjacent to the load-out quay.

10.2.2 Commercial ports by their nature concentrate on their core activities, which in Ireland are primarily in the bulk solids, bulk liquids, unitised, Ro-Ro and passenger modes of trade. Port development and operations have historically been focused on these core activities, with other trades being seen as opportunity cargoes. To date, opportunities in the ocean energy sector have been infrequent and generally of a relatively small scale; thus they have not prompted the development of specific facilities to accommodate such works.

10.2.3 This report identifies a spatial framework of first-phase sites for wind, wave and tidal developments. However, the different timescales of demand for infrastructure for offshore wind, compared to wave and tidal generation, mean that further consultations will be required to consolidate views on the choice of sites for wave, tidal and floating offshore wind on other than a broad geographic basis.

10.2.4 Demand from developers and supply-chain companies will drive the ultimate choice and use of sites, so it will be important that the assessment of requirements is reviewed on an ongoing basis.

Appendix 1: Current offshore support fleet and international trends in vessel design for marine renewable projects

The range of vessels supporting the current offshore industry is outlined below:

a. Platform Supply Vessel

A platform supply vessel (often abbreviated as PSV) is a ship specially designed to supply offshore oil platforms. These ships range from 20 to 100 meters in length and accomplish a variety of tasks. The primary function for most of these vessels is transportation of goods and personnel to and from offshore oil platforms and other offshore structures.

In recent years a new generation of PSV entered the market, usually equipped with a Class 1 or Class 2 Dynamic Positioning System to enable fine manoeuvring close to the platforms.

Vos Precious

Vos Express

b. Multi-Purpose Offshore Support

HOS Iron Horse

As an example of a Multi-Purpose Offshore Support vessel, the HOS Iron Horse is a versatile vessel and suitable for worldwide operations. Hornbeck Offshore Services (HOS) has designed the vessel initially for use in the deep waters of the Gulf of Mexico. With her deepwater cranes, deck cranes and moon pool, the vessel can be used in a wide range of offshore construction activities. But it can also be easily adapted to a charterer's specific wishes and requirements.

Subsea operations are facilitated by the moon pool and can be supported by two work-class ROVs housed in a hangar. The vessel is equipped with a 400-tonne heave-compensated mast crane capable of working at a depth of 3,000 metres. It also has a 120-tonne heave-compensated offshore knuckle boom crane, as well as a helicopter platform and accommodation for a crew of one hundred.

c. Oceangoing Tugs

A tug is a vessel that manoeuvres other vessels by pushing or towing. Tugs move vessels that either should not move themselves, such as ships in a crowded harbour or a narrow canal, or those that cannot move themselves alone, such as barges, disabled ships, or oil platforms. Ocean-going tugs specialise in high sea and extended towage voyages.

Smit Komodo

d. Harbour Tugs

Tugs are particularly flexible vessels used extensively in assisting other specialised vessels or directly for towing modular units on barges or under their own buoyancy. It is likely that a small fleet of tugs would be required, with some specialist applications.

Smit Rusland

e. Anchor-Handling Tug Supply Vessels

Anchor-handling tug supply (AHTS) vessels are vessels which supply oil rigs, tow them to location, anchor them up and, in a few cases, serve as an Emergency Rescue and Recovery Vessel (ERRV).

AHTS vessels differ from PSVs in being fitted with winches for towing and anchor handling, having an open stern to allow the decking of anchors, and having more power to increase the bollard pull. The machinery is specifically designed for anchor-handling operations. They also have arrangements for quick anchor release, which is operable from the bridge or other normally manned location in direct communication with the bridge. The reference load used in the design and testing of the towing winch is twice the static bollard pull.

Vos Hippo

f. Emergency Response and Rescue Vessels

Vos Northwind

g. Dive Support Vessels

A diving support vessel is used as a floating base for professional diving projects. Commercial Diving Support Vessels emerged during the 1960s and 1970s when the need arose for diving operations to be performed below and around oil production platforms and associated installations in open water in the North Sea and Gulf of Mexico. Until that point most diving operations were from mobile oil drilling platforms, pipe-lay or crane barges.

The key components of the diving support vessel are:

- Dynamic Positioning – Controlled by a computer with input from position reference systems, it will maintain the ship's position over a dive site by using multi-directional thrusters. Other sensors would compensate for swell, tide and prevailing wind.
- Saturation diving systems – for diving operations below 50m when a mixture of helium and oxygen (heliox) is required to eliminate the narcotic effect of nitrogen under pressure. Saturation diving is the preferred approach for extended diving operations at depth. A saturation system would be installed in the ship. A diving bell would transport the divers between the saturation system and the work site, being lowered through a 'moon pool' in the bottom of the ship, usually with a support structure 'cursor' to support the diving bell through the turbulent waters near the surface. There are a number of support systems for the saturation system on a Diving Support Vessel, usually including a remotely operated vehicle (ROV) and heavy lifting equipment.

Vos Satisfaction

EDT Porter

SMIT Marine Projects is one company that specialises in engineering, management and execution of marine installation and decommissioning projects. SMIT has been actively involved with offshore diving services since the early 1970s. During this time it has earned the reputation of providing quality equipment and personnel to client worksites, with the following core competences:

- Surface demand diving services (air/nitrox/mixed-gas)
- Saturation diving services
- ROV services
- Associated services: project management, subsea engineering, marine services and vessels

h. ROV Support Vessels

Field and Subsea Support vessels are fitted with either sub-sea cranes or A-frames. This type of vessel is very flexible. It is able to perform subsea work as well as conventional supply and anchor-handling duties for the offshore construction industry. Dynamically Positioned DP2 ROV Support Vessels support operations in construction, survey and trenching activities on a global basis.

The most recent addition to the Sonsub fleet, the multipurpose ROV support vessel, is the Bourbon Pearl. The 91m DP Class II vessel, with special features for deepwater intervention, commenced operations in June 2010 after an ROV support and light construction conversion programme. This included installation of a 100Te active heave-compensated crane, helideck and new accommodation module, plus modifications for installation of the heavy-weather Launch and Recovery System (LARS) and a new 250hp ROV.

Bourbon Pearl

i. Construction Vessels

The Resolution was the world's first purpose-built vessel for installing offshore wind turbines, foundations and transition pieces. The Resolution is a unique combination of tested technologies applied in innovative ways to provide a single vessel installation solution for the offshore wind sector. MPI has a track record of installing over 200 wind turbines. The MPI Resolution and her suite of offshore-related equipment can facilitate the transport and installation of offshore projects to exacting standards of quality, safety and project execution.

Resolution

The company will expand its fleet in 2010 and 2011 with the MPI Discovery and the MPI Adventure working in the transport and installation market and also in the access and maintenance sectors.

Sea Power

A2SEA Sea Power is identical to Sea Energy. Both are self-propelled crane vessels equipped with four jack-up legs, enabling them to carry out offshore crane operations with great precision and control. These vessels are ideal for mounting turbines in shallow waters and provide a cost-effective and efficient solution for customers looking to service existing turbines.

Sea Worker

Sea Worker is a modern jack-up barge specially equipped to operate in the offshore wind sector, but also capable of operating in the oil and gas sector.

Equipped with a flexible Favco PC300 HD Offshore crane, Sea Worker can install a wide range of equipment such as monopiles, transition pieces and the latest generation of offshore wind turbines. Sea Worker's 73m-long legs enable this vessel to work at depths of up 40m. Sea Worker is fitted with a state-of-the-art LPS system (Leg Penetration System) and has air-cooled jacking and auxiliary engines to be able to operate on sites that dry out at low tide.

j. Pipe Lay Vessels

CSO Deep Blue

The CSO Deep Blue is the world's largest purpose-built ultra deepwater pipelay and subsea construction vessel. It can lay flowlines and umbilicals, and support developments in water depths ranging from 75m to 2,500m. The vessel is owned and operated by Technip Marine.

The CSO Deep Blue has an overall length of 206.5m and a moulded breadth of 32m. It has a moulded depth of 17.8m and an operating draught of from 7.5m to 8.95m, with a 10m maximum of draught. It has a 55,234t displacement and is 33,791gt.

k. Seismic Survey Support Vessels

Geo Barents

The Geo Barents, registered in Norway, has a gross tonnage of 4,979t, a net tonnage of 1,494t, and a deadweight of 1,293t. The overall length of the ship is 76.95m, the length between the perpendiculars is 61.8m, the load line length is 67.046m, the moulded breadth is 21.034m and the draught is 6.85m.

The Geo Barents has a digital gun system, a 240m² cable-repair facility and an onboard survey instrument room. Other facilities include an aluminium helicopter deck with direct access to the ship's hospital and a high-vision bridge with a full array of navigational and survey equipment. Primary navigation for the vessel uses Fugro Starfix.HP DGPS and secondary navigation uses Fugro Skyfix.XP DGPS.

The ship's six seismic streamers are Sercel Seal oil-filled units with an individual maximum capacity of 9,000m. The primary seismic source is a Sodera G-gun configured to a single source. Recording uses a Sercel Seal 24-bit digital system in conjunction with ARGUS data recording and the online QC Processing Software.

l. Maintenance Vessels

Safehaven Marine has launched Island Tiger, the first of the company's new Wildcat 53/16m GRP Wind Farm Catamarans.

This GRP-built craft is a completely new design, the first of two vessels being built for the Irish company Island Shipping. The hull design is a larger version of Safehaven's respected Wildcat 36/40 design, incorporating the same high buoyancy bow, twin chine catamaran hull form that is well proven for providing exceptional levels of sea-keeping and performance.

The new catamaran design is 16m moulded (17m LOA) with a 6.1m/20ft beam. It has been designed from the outset specifically as a windfarm support vessel. To this end the bow area has been designed to accommodate a specially developed fender system from Ocean 3. The fender design is of high density foam core measuring 300mm by 400mm, with a heavy 50mm-thick rubber wall to cushion impacts and stresses in the bow.

Island Tiger

m. Geotechnical Survey

Geotechnical Survey Vessel

Fugro Seacore's offshore marine drills provide capability to undertake drilling operations from vessels of opportunity in water depths ranging from 15m to 2,500m.

The drills are designed to allow them to be easily transported or shipped to locations worldwide. The drills have been mobilised for locations ranging from the Arctic and Central Europe to the Antarctic.

The drills are motion-compensated, thus providing a 'stationary' drill string in relation to the seabed. Typical operations include geotechnical drilling for downhole testing and sampling, including:

- Rock coring with wireline tools or via piggyback coring techniques
- Support to the oil & gas industry for alternative operations requiring a heave-compensation derrick

n. Hydrographic Survey

A hydrographic survey ship is a vessel designed to conduct hydrographic research and survey. Nautical charts are produced from this information to ensure safe navigation by military and civilian shipping.

Hydrographic survey vessels also conduct seismic surveys of the seabed and the underlying geology. Apart from producing the charts, this information is useful for detecting geological features which are likely to bear oil or gas. These vessels usually mount equipment on a towed structure – for example, air cannons – used to generate a high-pressure shock wave to sound the strata beneath the seabed, or mounted on the keel – for example, a depth sounder.

In practice, hydrographic survey vessels are often equipped to perform multiple roles. Some function also as oceanographic research ships. Naval hydrographic survey vessels often do naval research, for example, on submarine detection.

o. Marine Foundation Installations

Seacore jackup

Seacore jackup

Fugro Seacore has developed some of the largest drill assemblies in the world. Bottom Hole Assemblies (BHAs) are generally shrouded to maintain hole integrity during drilling, and are designed to be container-transportable and quick to construct on-site. Fugro Seacore's Large Diameter Drilling division can drill large diameter holes within a practical range from 0.5m to 7.0m. Holes can be drilled from the vertical to rakes of 45 degrees. A variety of down-hole equipment and tools can be supplied to undertake under-reaming, hole belling and rock socket grooves.

The nature of specialist construction in the nearshore marine environment can vary as much as the coastal margins themselves. The specialist contractor Fugro Seacore designs, manufactures and operates customised equipment to enable site-specific solutions and has a track record of successfully completed projects worldwide.

p. Renewable Project Installation

Seacore jackup

Since Fugro acquired Seacore in 2006, the group provides integrated service packages for all phases of onshore and offshore renewable energy developments. Fugro Seacore's activities revolve around its capabilities as a specialist overwater drilling contractor and include detailed project planning, engineering and client liaison. A large proportion of the projects involve the installation of large diameter monopile foundations, i.e. offshore wind-turbine monopiles, meteorological masts and marine current turbine foundations.

The company's purpose-built equipment has been developed and proven over many years of world-wide use in marine civil engineering contracts. The company provides renewable energy clients with the following services:

- Site investigation
- Boreholes
- Coring
- Soils boring
- Wireline geophysics
- Downhole WISON CPT sampling
- High-pressure dilatometer
- Meteorological mast installations
- Piles
- Large-diameter monopile foundation transition piece installations

The company has recently completed renewable energy contracts, site investigations and monopole installations for the Gunfleet Sands offshore windfarm, North Hoyle offshore windfarm, Gwynt y Mor offshore windfarm, North Hoyle Metmast, Strangford Lough marine turbine, Oyster tidal turbine, and others.

q. Heavy Lift Operations

A crane vessel, crane ship or floating crane is a ship with a crane specialised in lifting heavy loads. The largest crane vessels are used for offshore construction. Conventional monohulls are used, but the largest crane vessels are often catamaran or semi-submersible types as they have increased stability. On a sheerleg crane, the crane is fixed and cannot rotate, and the vessel therefore is manoeuvred to place loads.

Shearleg crane barge

r. Cable-lay Dynamic Positioning Systems

Polar Prince

The Polar Prince is operated by Subocean for the installation of subsea power cable and flexibles. The vessel is specifically dedicated to servicing Subocean's windfarm works and has the flexibility to perform free-laying cable operations as well as the ability to perform simultaneous lay and burial using a cable ploughing system. It is equipped with diesel electric propulsion power controlling two azimuth thrusters and two bow thrusters that complement the vessel's two main engines and propellers. The Polar Prince also has a bollard pull of 150te, enabling her to perform cable ploughing operations in a variety of seabed conditions. The Sea Stallion 4 cable ploughing system allows for the simultaneous lay and burial of the subsea power cable to a maximum depth of three metres. The plough can perform burial operations in very aggressive seabed conditions while minimising residual cable tension and has proven itself to be a very reliable method for the laying and protection of subsea power cable.

Discoverer

The Barge Discoverer has been converted to operate as a cable lay and burial barge in the offshore renewables market. The barge spread includes a tow assist vessel, multicat anchor-handlers and crew-transfer vessel. The barge, when towed onto site, can operate within the installed eight-point mooring system comprising 8 single-drum 80te winches with remote-control operation from a central station.

Operation & maintenance

It is generally agreed that the number of available maintenance vessels needs to increase rapidly to keep up with offshore wind development. Utilities and contractors involved in both windfarms and tidal/wave power projects admit that more purpose-built boats for operations and maintenance (O&M) will be needed in the coming years.

There are two basic types of vessel used for O&M: smaller boats for taking mechanics to and from windfarms – for instance, for routine inspections or light repairs – and crane vessels for removing heavy components such as gearboxes. At the moment these crane vessels tend to be the same as those used in the construction and installation of offshore turbines, which means they are often bigger and more cumbersome than is ideal. The availability of these vessels is currently poor and new boats are expensive to build.

Lighter boats can be hired and built fairly easily, and at no great cost. They are usually fast catamarans. But construction vessels are more of an issue as they can be in short supply. When there is slack in the offshore oil and gas industry, vessels can be redeployed for offshore wind, but the day rates are currently too high.

There are only around 10 jack-up crane vessels working in the offshore wind business, all centred in Northern Europe at present. The build cost for each one will be €57m (£50m) to €114 (£100m), depending on specification.

Vessel build-up

It takes two to three years to build a jack-up vessel, which is conveniently similar to the lead time for an offshore wind farm. The supply of these vessels should rise as offshore windfarms are developed. The number of these vessels probably needs to double in the next five years. It will then need to double again in the following two to three years.

The main providers of offshore wind maintenance vessels include A2SEA, MPI and SMIT. MPI Offshore, based in Yorkshire, UK, currently runs one offshore O&M boat and the company is building two more vessels to keep up with demand. The two new MPI specialist offshore turbine installation vessels, Adventure and Discovery, represent an investment of (€350 million and are due for delivery and commissioning in the first and third quarters of 2011.

Current bottlenecks

Bottlenecks sometimes occur, particularly during summer which is the time of highest demand for maintenance barges because the weather is generally most favourable.

It is likely that today's construction vessels will be too small for installing Round 2 and 3 windfarms over the next 10 years. They probably will be superseded by bigger craft and could therefore be adapted purely for maintenance work on the Round 1 windfarms that are now being developed or are already operational. The relative scarcity of appropriate vessels reflects the fact that offshore renewable energy is a fledgling industry, with a limited number of players and vessels. Vessels that are perfectly designed for offshore maintenance are needed. Some very large ones are currently used to install windfarms but new specialist vessels are needed to change a gearbox on an offshore turbine. It is probable that tailormade maintenance vessels will become widespread in the next five years.

Trends in specialist deployment vessels

Specialist vessels will be increasingly developed to assist in the deployment of renewable marine resources. The OpenHydro Installer vessel falls into this category and already new concepts are being developed to handle the next-generation tidal turbines.

OpenHydro Installer

OpenHydro Installer

OpenHydro Installer

A2SEA's next-generation wind-turbine installation vessel, Sea Installer, is based on practical experience in the field of offshore wind-turbine and foundation installation over the last 10 years. The vessel was designed to operate in the more challenging conditions that will be encountered further offshore and in deeper water.

Sea Installer is a larger vessel with a higher transit speed to improve operational efficiency at sites further offshore. In many cases this will allow direct feed from component production facilities, eliminating the inefficiency of trans-shipment at local logistics harbours.

Longer legs will enable the vessel to work at most deepwater sites planned for the future and the main crane position has been planned to increase available deck space and to allow greater flexibility during lifting operations, both during loading and installation.

Sea Installer will take the installation process to a more efficient and cost-effective level, which will give developers greater confidence that their projects will be delivered on time and with maximum profitability.

Sea Installer

Following in the wake of the success of MPI Resolution, MPI Offshore has invested in two new builds, MPI Adventure and MPI Discovery. Delivery of these is due in spring 2011 and autumn 2011 (available in Europe). Both vessels have enhanced systems which will maintain MPI Offshore at the leading edge of offshore windfarm deployment.

At the point of delivery in 2011, MPI Adventure and MPI Discovery will be the second and third purpose-built vessels for Offshore Wind. Their enhanced design features have been sourced and integrated from designing and operating MPI Resolution. These vessels will transport, lift and install more wind turbines and their foundations than any other solution. This is achieved through improved deck space, lifting capacity and jacking speed, increased power and improved environmental operability.

MPI newbuild Adventure/Discovery

Two other companies have recently placed orders for self-propelled jack-up wind-turbine installation vessels. Fred Olsen Windcarrier has contracted with the Lamprell Group for the design, construction and delivery of two Gusto MSC NG-9000 designed vessels and has options on two more. The aggregated value is US$320m (€224). Both vessels will be constructed at Lamprell's Jebel Ali facility and be delivered in the second and third quarters of 2012. The new vessels will be equipped with dynamic positioning, high-speed jacking systems, an 800t crane and a propulsion system that allows the vessel to sail at a speed of 12 knots. Each unit includes accommodation for 80 personnel and has a payload capacity in excess of 5,000 tonnes.

Fred Olsen newbuild Windcarrier

Similarly, Swire Blue Ocean parent company Swire Pacific Offshore Operations (Pte) Ltd has placed an order for its first windfarm installation vessel with Samsung Heavy Industries (Samsung) in Korea. The vessel is scheduled to be delivered in June 2012. The agreement with Samsung also provides for an optional second vessel, for delivery in 2013. The Swire Blue Ocean vessel design offers an improved operating weather window, crane capability of 1200t, DP2 station-keeping, a transit speed in excess of 13 knots, accommodation for 111 people and the ability to operate in water depths of up to 75m.

Swire Blue Ocean newbuild

The advent of these new specialist shuttle and installation vessels has implications for the location of wind-turbine fabrication and assembly locations. At 12 or 13 knots and at a high day-rate for vessel charter, there will be a maximum economic transfer distance from the port where turbine assembly and trans-shipping takes place to the destination field for the wind turbine array. At 12 knots a vessel can travel 288 nautical miles a day and 576 nautical miles in two days. It is unlikely that economic transit distances will be greater than 200 nautical miles using these specialist vessels. This artificial limit suggests that the new turbine assembly and trans-shipping terminals appearing on the Danish, German and Dutch coasts will be too far removed for servicing Round 3 developments in the Irish Sea; new turbine assembly locations and port developments would thus be needed to offer a more economic alternative. Opportunities exist for such a development on the eastern or southern coast of Ireland.

STRABAG Installation Concept Vessel

The construction company STRABAG has suggested that the east coast of Ireland is the ideal location for a series gravity-base construction plant similar to the current development in Cruxhaven, northern Germany. The 7,000t gravity foundations are produced in series and transported by a special vessel to their final location, where they are lowered to the sea-bed. The entire turbine installation will be shipped as a single unit, the steel mast as well as the rotor blades being mounted on the gravity base on land. Deployment can be at a radius of up to 120 miles.

Offshore substations

Offshore substations are required for collection and conversion of power generated from offshore renewable plants to a form suitable for transmission to shore. A 400 MW HVDC Light offshore substation is being constructed to connect the Borkum 2 offshore windfarm to the onshore network. The substation weighs 3,300 tonnes and will be installed in waters of 30m depth. For comparison, a typical Round 2 offshore windfarm substation platform weighs 700 tonnes.

Substations required for Round 3 offshore windfarms expected to be operational by 2020/2030 may be somewhat larger due to the increased power rating and voltage and potential multi-terminal HVDC operation. However, the development of DC wind-turbine generators currently in progress and the possibility of transformerless operation may reduce this. Redundancy optimisation should also be investigated for weight-reduction opportunities.

With regard to installation, oil platforms of similar or higher tonnage have been installed on foundation towers in 300 to 500m water depth, indicating that foundation design should not be a fundamental technology issue. A number of dedicated crane vessels with a lifting capacity of between 2,000 and 14,000 tonnes are available for offshore substation construction, with transport via heavy-lift ships with capacities in the order of 10,000 tonnes. Floatover topside technology is available where heavy-lift ships are not readily available, but this is more suited to relatively benign marine conditions.

The maximum rating of HVDC collector stations and associated transmission equipment in the UK is currently restricted by the NETS Security and Quality of Supply Standard (NETS SQSS) requirement of no more than 1000 MW in-feed loss for the outage of a single HVDC converter station. This is currently under review, though, and may increase. For the All-Island system, this reduces to 400 MW.

Subsea cabling

Subsea cabling is a complex task involving specialised models and equipment for corridor design, trenching, laying and securing. For a Voltage Source Converter–High-Voltage Direct Current (HVDC–VSC) network, subsea cables are typically in a bipolar configuration where two cables (one circuit) are laid in close proximity, usually bundled in a common trench. Two circuits should be laid per connection to ensure security of supply in case of failure.

HVDC Light cables are constructed of polymeric insulating material with strength and flexibility. This should allow trenching and laying to be performed simultaneously, similarly to HVAC cable operations and in seabed environments that may previously have been considered too hazardous. Existing cable trench ploughs can be modified to match the bending radius of the cables. The industry has recent experience with HVDC cable trenching and laying techniques in deep water for the Troll A oil and gas platform (350m) and the Nor-Ned interconnector (410m), among others.

Large specialised vessels are required to lay subsea HVDC cables. A number of these vessels are available worldwide, with varying capabilities of up to 8,500 tonnes or more. For HVDC Light with 320kV 1400mm^2 bipole cables of 1 GW rating, a capacity of 8,600 tonnes is required for a 100km run, and cable-jointing operations can be difficult in energetic offshore seas. The availability of specialist equipment in the event of cable failure is also a possible technology constraint as suppliers and specialist equipment are limited and this might lead to long delay times. This can be mitigated to an extent through cable redundancy.

Indications from industry are that the cable supply chain is going to be a bottleneck for HVDC offshore developments. The current global manufacturing capacity is somewhat less than expected future demand.

Appendix 2: Port Case Studies

Case Study: Bremerhaven

The port of Bremerhaven in north Germany has established itself as a centre for the offshore wind energy industry.

Faced with a disastrous economic and unemployment situation, in 2001-2002 Bremerhaven city council decided that radical counter-measures were needed to reverse the negative trends the city faced. Among plans developed was a scheme to revitalize the city's port. A strength-weakness assessment showed that the city's strengths included a comprehensive maritime technology know-how base, and a skilled workforce specialised in shipbuilding, heavy-machinery design and manufacture. The assessment results were turned into a comprehensive and detailed plan aimed at merging these maritime strengths, with the building of a strong renewable energy sector in Bremerhaven. The key focus area became (offshore) wind power based on supporting offshore wind developments planned for the next few decades. Germany has already planned at least 23 major windfarms in the North Sea and another nine projects in the Baltic Sea.

Six wind-industry hardware suppliers, as well as two wind-industry R&D organisations, have already decided to establish and/or expand their operations in Bremerhaven. Both REpower Systems and Multibrid have, since 2004, tested and optimised their 5 MW offshore wind turbines. Each company has also established assembly facilities in Bremerhaven. PowerBlades established a rotor-blade manufacturing plant for REpower design RE rotor blades in Bremerhaven. A fourth main offshore wind-industry player in Bremerhaven is WeserWind Offshore Construction Georgsmarienhütte, a company specialising in the design and manufacture of heavy-duty steel offshore foundation structures. WeserWind is currently building giant 45m-high halls destined for manufacturing welded-steel deep-water offshore foundations. The current product portfolio includes tripod support structures for Multibrid turbines, jacket-type foundations for REpower, and Tripiles as applied by BARD Engineering.

All four windfarm equipment suppliers are located together at a newly developed industrial site called Luneort Bremerhaven – Zentrum für Offshore-Windenergie (Centre for Offshore Wind Energy).

The city council has also planned a new additional terminal in the Luneort area which is planned to be operational by 2011. This 'loading' terminal will be capable of directly handling large, heavy and bulky components, and/or complete assemblies – such as nacelles weighing over 250 tonnes and large rotor blades with lengths of 61.5 metres and up.

65,000m² WeserWind offices.

Besides attracting wind equipment suppliers, Bremerhaven accommodates two major research and development facilities. Wind engineering consultancy Deutsche Windguard operates one of the largest wind tunnels in the world, with special acoustical optimisation for rotor blades. The Fraunhofer Centre for Wind Energy and Maritime Technology operates a new rotor-blade test facility for blade lengths up to 70 metres. In future this blade-testing capability will be expanded to 100m-long blades. The centre will in time become a full Fraunhofer Research Institute, with a planned 70 employees.

RWE has recently agreed a two-year lease with Eurogate Container Terminal Bremerhaven GmbH on the use of areas in Bremerhaven container port. The lease agreements cover a 17-hectare area and a directly adjacent 400-meter quay. From this base, 48 six-megawatt wind turbines will be pre-assembled, shipped and assembled at a windfarm site some 35 kilometres north of the island of Helgoland.

Bremerhaven also intends to build a new harbour for the offshore wind industry. The plans are based on the assumption that a terminal can be built at Blexer Bogen to handle up to 150 wind turbines per annum.

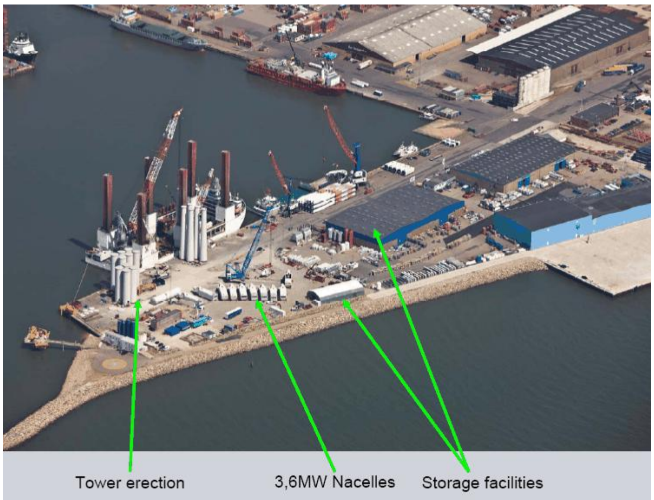
Major contributing factors to Bremerhaven's successful transformation include the city's strategic maritime location, with robust port facilities, the initiating of clever proactive (political) support measures, and a substantial influx of fresh capital. Creating mutual benefits or a win/win situation for the city, as well as potential future partners, is one of the main pillars of Bremerhaven's proactive support mechanisms.

Case Study: Lynn and Inner Dowsing Wind Farm – Ports of Esbjerg and Vlissingen

The foundations were manufactured in Belgium and transported by barge down river to the port of Vlissingen. At the port, Resolution loaded the monopiles and transition pieces from the transport barge, using her 300t crane. For the load-out, Resolution 'jacked' clear of the water to aid crane operations. Five sets of foundation components were loaded per cycle; 11 cycles were used to complete the foundation installation.

The port of Esbjerg was used by Centrica as the load-out port for Lynn and Inner Dowsing windfarm which comprised 54 Siemens 3.6 MW turbines. The port area used was 22,250m² and included a quay length of 220m. MPI Resolution was the installation vessel, capable of carrying seven turbines per voyage, with a sailing distance of approx. 600km from port to windfarm site.

In this case the choice of ports was heavily influenced by the location for foundation fabrication and for the manufacture of turbines and blades.


Tower erection
3,6MW Nacelles
Storage facilities

Appendix 3: Developers and Port Perspectives

The developer's perspective

Based on experience to date, particularly in the UK and European offshore wind industry, the following key points are identified as to how developers view the experience to date in relation to the use of port facilities:

- Ports are unwilling to invest in infrastructure unless there is firm contractual commitment.
- Offshore wind is perceived as a niche market, competing with other, 'mainstream' port activities. Developers would like port owners to understand better the long-term opportunities that offshore wind provides and to be less focused on the trade-off against other port activities.
- Frustration in finding capacity for project construction – this is an issue that arises early in the development of projects, as location selection drives economic assumptions used in the financial modelling. For this reason, construction ports need to be designated, even if not actually contracted, early in the project.
- Developers only plan to use ports they know will be available. Developers include the assessment of a suitable port in their Front End Engineering Development (FEED) feasibility study for the project and make decisions on ports typically two years ahead of construction. Constructors are required to designate the construction port at the time of tendering.
- While each project has unique organisational arrangements, in general turbines are either supplied on a turnkey basis or project contractors manage the installation process. Developers advised that the construction port is only finally contracted after the relevant prime contractor has been secured.
- Smaller Round 1 projects were less hindered by port capacity constraints as they could be accommodated by smaller ports. Such ports are now considered unsuitable for larger projects.
- Lack of availability of additional land area has frequently been a major limitation for operational ports.
- Developers recognise that timescale slippages resulting from past delays in the offshore consenting process discourage port owners from investing.
- Developers advised that operations and maintenance ports have been found without difficulty.

Ports' perspective

From the ports' perspective, the following key points are identified:

- Port owners generally are aware of the wind industry but most have been involved only in importing onshore wind turbines. From this experience, they are familiar with turbines in the range 1 to 2 MW.
- Under-estimation of onshore harbour logistics is a common and serious mistake during project planning. Anticipated requirements for quayside space are large and there are not many ports in Ireland that could currently meet stated needs. Feedback from ports is that it would not be sensible for them to have that sort of area lying waiting, but they could liaise closely with developers to come up with solutions to meet their needs.
- For the onshore logistics, it is important to know that, as long as only a limited number of turbine installations are expected for a harbour, windfarm installation is a second-priority business compared to such long-term activities as container shipping or other continuous marine business.
- In running commercial operations, local port managers focus on maximising use of and revenue from land and quay assets. This includes shipping movements, cargo dues and stevedoring income.
- Historically, port owners have been willing to invest where there is a viable business case – for example, container terminal capacity.
- Many port owners are dismissive of the land area being requested by wind-industry players. Few have this area of land available. They welcomed the opportunity to discuss and understand why such large sites are being requested. It may be that, in time, dialogue may lead to innovative solutions to decrease land requirements.
- Port owners see wind-industry players as reluctant to commit to contracts or tenancies which would allow specific investment in terms of quayside or land development for the long term. Most have so far experienced only Round 1 projects where commitment to ports was project-based only.
- Port owners are keen to engage with the wind industry to understand both the challenges and the opportunities.
- Several possible locations for manufacturing or construction facilities have been found which are not in routine use as ports today. These locations are best characterised as waterside land with development potential. Landowners of these sites do not have the same commercial drivers as port owners and operators.
- Port owners are encouraged by the Department of Transport to maintain master plans for each port location. With a few exceptions, these plans do not yet include consideration of offshore wind construction.