Department of Communications, Energy and Natural Resources
Roinn Cumarsáide, Fuinnimh agus Acmhainní Nádúrtha

DRAFT Offshore Renewable Energy Development Plan (OREDP)

Version 1.3
November 2010

Public Consultation

Table of Contents	
Section	**Page**

Ministerial Foreword

As a country which depends upon imported fossil fuels for over 90% of our energy needs, we have an urgent need to develop our own local energy supplies for our future security. In making such a switch, we must also reduce our greenhouse gas emissions by at least 80% over the next four decades to help avert runaway climate change. The good fortune we have is that our country is so rich in our own renewable resources that making this switch to our own local power supplies also presents a wonderful economic opportunity for our country.

Our assessment is showing the abundance of our ocean resources. We can produce ten times our existing electricity demand without significant environmental effects. Much work needs to be done on the economic modelling to show how we can benefit from that resource. While the plan looks forward to 2030, the key development work will have to be done in the next decade and the plan envisages a review in 2015 and 2020 when we can scale up or amend our plans as we see how our infrastructure and markets develop.

Ireland's renewable electricity consumption has increased from around 5% in 2004 to 14.4% by the end of 2009. We are on track to surpass our 15% 2010 target. With about 90% of our 2020 40% target expected to be sourced from wind power, Ireland and Northern Ireland are set to have one of the highest levels of wind penetration in Europe and the world.

Ireland's ocean territory extends to 89 million hectares and encompasses a wealth of natural resources. The sea area is around 10 times the size of the land area and has one of the best wind and wave resources in Europe. Our marine environment can provide a vast amount of energy through offshore wind, wave and tidal energy technologies.

We must develop the strategic approach needed to marry the delivery of increased renewable energy capacity with other key environmental objectives and obligations. We need to avoid and minimise the potential environmental downsides of renewable energy development. It is also essential that sustainability in the energy sector is managed in a manner that secures the international competitiveness of Irish energy prices.

The continued development of our sustainable energy platform is of vital social and economic importance. If we get this right, and get it right quickly, Ireland can be at the forefront of developments in this area internationally. If the full extent of the marine renewable energy potential is developed and tapped, Ireland could not only harness this electricity for domestic consumption, but also become a net exporter of electricity from renewable sources to the UK and mainland Europe.

I asked for a Strategic Environmental Assessment (SEA) on low, medium and higher marine renewable energy development scenarios to inform policy decisions as we develop this new industry. The SEA Environmental Report on these scenarios has informed this draft plan. It is now open to public consultation so that everyone can give their views on how we should progress this new industry and opportunity for our country.

Eamon Ryan

Minister for Communications, Energy & Natural Resources

October 2010

1 Introduction

Ireland stands at an important juncture in terms of setting an appropriate policy framework within which an offshore marine renewable energy industry can develop. It was for this reason that it was decided to have a Strategic Environmental Assessment (SEA) conducted on our offshore marine environment to examine various development scenarios for offshore wind, wave and tidal energy to ascertain the level of development that appears feasible when environmental considerations are taken on board. The findings of the SEA can be used to feed into evidence-based policy development in taking the sector forward.

The policy setting pertaining to the offshore marine renewable energy sector in Ireland is at a developmental stage and is spread across several ministries and state bodies. One of the key challenges in taking the offshore marine renewable energy sector forward is to develop a mechanism for the enhanced co-ordination and collaboration on the sector between the relevant bodies, while respecting each body's individual statutory remit, function and role in delivering and implementing policy.

The development of the offshore renewable energy sector will occur in the context of the following policies, many of which are still evolving:

- Ireland's overall energy and renewable energy policy
- Co-operation mechanisms under EU Directive 2009/28/EC (Department of Communications, Energy & Natural Resources)
- Reform of the foreshore consenting process for offshore renewable energy projects
- Onshore planning (Department of Environment, Energy & Local Government)
- Renewable Energy Grid connection policy (Commission for Energy Regulation (CER))
- Grid 25 Strategy and national and international offshore grid development plans
- Ongoing economic analysis of offshore renewable energy developments
- Implementation of the Marine Strategy Framework Directive and the development in the near future of a national marine spatial strategy

In order to provide an overview of the policy context in which the SEA on the development scenarios for offshore marine renewable energy was commissioned, this draft OREDP sets out the current state of play on key areas of work that state bodies are involved in that impacts on the sector. The SEA on the development scenarios will help inform development of these policies.

The low and medium development scenarios set out in this plan broadly reflect what is in Ireland's National Renewable Energy Action Plan[1] - a modelled scenario for the achievement of our 2020 target under Directive 2009/28/EC and a non-modelled export scenario in the period to 2020 which assumes the right technical, environmental and economic conditions to be in place. The third scenario is a more ambitious scenario developed during the SEA scoping.

Through the carrying out of the SEA, environmental considerations can be built into the development of this sector at a strategic level. The Environment Report has also outlined project level mitigations strategies that can be built into national guidelines for use by project developers (see Appendix 2). A series of actions have been recommended in the Environmental Report that should be borne in mind in implementing the OREDP and these are outlined in Chapter 10.

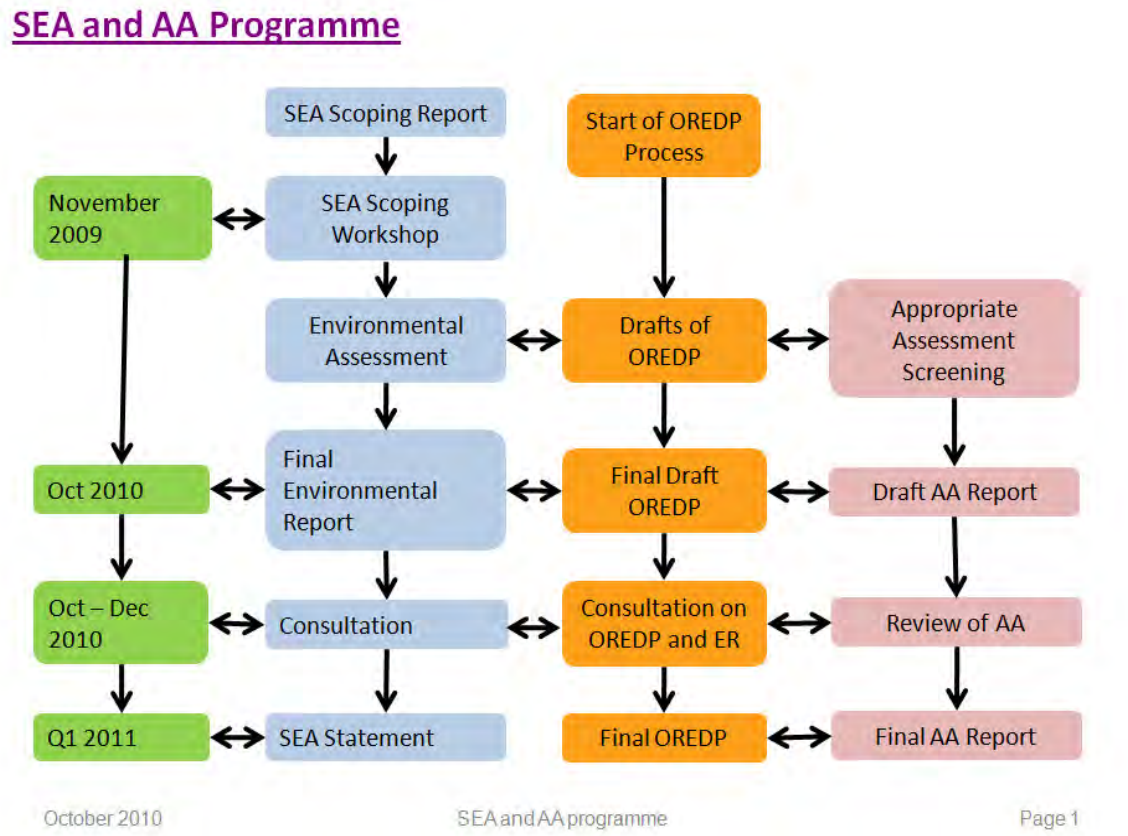
[1] http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/National+Renewable+Energy+Action+Plan.htm

2 Environmental Context

The Department requested that the Sustainable Energy Authority of Ireland (SEAI) have a strategic environmental assessment ('SEA') and Appropriate Assessment carried out to assess the environmental effects of the development scenarios described in this Offshore Renewable Energy Development Plan (OREDP). The SEA provides for strategic environmental consideration at an early stage in the decision making process, and is designed to complement the environmental impact assessment (EIA) process which will have to be undertaken on individual projects. The SEA thus serves to raise awareness of the environmental impacts of the development scenarios.

The process is being carried out in accordance with SEA Directive 2001/42/EC on the assessment of the effects of certain plans and programmes on the environment and in line with the Department of Environment, Heritage & Local Government Regulations and Guidelines on the implementation of the Directive. The SEA, the OREDP and the Appropriate Assessment are part of a mutually reinforcing process set out in the schematic below.

Figure 1: Schematic of the interaction between the OREDP ('the plan'), the SEA Environmental Report and the Appropriate Assessment



The strategic environmental assessment is not intended to cover information in this plan that has been provided as background and context. It has instead been focussed on assessing low, medium and high development scenarios for the production of offshore wind and wave and tidal current energy in Irish waters in the period up to 2030.

The findings of the SEA can assist in guiding development to areas where environmental effects are minimal or can be avoided. One of the outputs of the SEA has been to identify areas off the coast of Ireland where there are potential significant environmental constraints on commercial scale development of marine renewable energy. The SEA has examined how these constraints will influence the potential capacity for development in the areas of greatest resource (see Appendix 4 for environmental constraint maps). The SEA Environmental Report has looked at technical constraints (aquaculture sites; disposal and dredging areas; cables and pipelines; areas where shipping intensity is more than 100 vessels per month; defence danger areas; oil and gas lease areas; existing oil and gas infrastructure other than pipelines). The SEA has also looked at environmental constraints (water and soil(sediment); biodiversity, flora and fauna, cultural heritage including archaeological heritage, ports, shipping and navigation, commercial fisheries, recreation and tourism and seascape).

2.1 Scope of the Strategic Environmental Assessment

Detail on the full scope of the SEA is available on the Sustainable Energy Authority of Ireland's (SEAI) website[2] and in addition a scoping summary can be found at Chapter 4 of the SEA Environmental Report published simultaneously with this document. The timescale for the SEA and OREDP is a 2030 horizon. The assessment scenarios are for up to 4,500MW of offshore wind and 1,500MW of wave/tidal.

The assessment has considered potential impacts of scenarios for developing up to 4,500MW of offshore wind and 1,500MW of wave and tidal energy irrespective of commercial viability or other constraints and independently of the existing onshore power transmission grid.

The SEA study area includes all Irish waters from the Mean High Water Mark out to the 200m water depth contour off the west and south west coast of Ireland and the Irish Exclusive Economic Zone off the north, east and south east coast of Ireland. The study area excludes all areas within 500m off existing offshore pipelines and cables and sites licensed for aquaculture, designated as shellfish beds and subject to a fisheries order.

The study area included a number of Assessment Areas, which focus on the main areas of resource identified for offshore wind, wave and tidal energy (see Chapter 8). Maps showing the Assessment Areas can be found in the same chapter.

The SEA Assessment Areas include:

- Areas below Mean High Water Mark that encompass the main areas of resource for offshore wind (fixed and floating), wave and tidal energy, although potential effects above the Mean High Water Mark have been considered for particular SEA issues/subjects e.g. seascape.
- Fixed foundation structures (offshore wind, wave and tidal) to 60m depth
- Floating wind structures to a distance of 100km from the shoreline – this distance reflects the upper length limit of Alternating Current (AC) cable technology (for greater distances (beyond 100km) Direct Current (DC) cables would be required with convertor stations on land to convert to AC)
- Tidal stream velocities of1.2m/s or greater.

The SEA has looked at identifying and assessing the potential environmental effects of the development scenarios in the OREDP. In line with the SEA Directive, the following have been examined: soil and water; biodiversity, flora and fauna; cultural heritage including archaeological heritage; population and human health; material assets; seascape/landscape and climatic factors.

2.2 Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA) processes

The SEA process is focussed on the assessment of development scenarios covering the larger geographic area. The SEA does not obviate the need for project level environmental impact assessments required under Environmental Impact Assessment (EIA) legislation. The SEA focuses on identifying the likely significance of potential effects, whereas an Environmental Impact Assessment (EIA) deals with precise effects and evaluated actual significance. The SEA Environmental Report highlights that more detailed surveys and assessments will continue to be required for individual projects. This is built into the current foreshore consenting process and will remain a requirement going forward. The SEA does not replace the need for developers to collect detailed project specific baseline data.

Project level mitigation measures are specific measures implemented at the project design/development stage to reduce or avoid the risk of any significant adverse effects from occurring. Project specific mitigation measures were identified in the SEA Environmental report. National EIA Guidance for individual offshore renewable energy developments could consider the work done on project level mitigation measures included in the SEA Environmental Report. By way of reference the project level mitigation measures recommended in the Environmental Report are attached at Appendix 2.

[2] http://www.seai.ie/Renewables/Ocean_Energy/Offshore_Renewable_SEA/Scoping_Report/

3 Overall Context for the development of electricity from renewable sources

The purpose of this chapter is to set the overall context for the development of renewable energy in Ireland. This information is provided as background and context information as this plan is formulated within the wider policy context that exists.

Table 1: EU and National Renewable Energy Policy Developments 2007-2020

EU Level Policy Developments	National Level Policy Developments
2007 **Political Agreement in EU on "20-20-20 by 2020"** ↓ • **20% energy efficiency** • **20% reduction in carbon emissions** • **20% of Europe's energy consumption to be from renewable energy sources** • **By 2020** ↓	**2007** **Government's White Paper on Energy Policy = All Energy Policy** ↓ **Government's White Paper included national renewable targets for Ireland: 33% electricity, 12% heat, 10% transport.** ↓ **Government's White Paper included initial ambition of 500MW of installed ocean capacity by 2020** ↓ **2007 Programme for Government – establish Ocean Energy Development Unit in SEAI to work to a target of at least 500 MW of wave and tidal energy by 2020 and aim to create an export-oriented Ocean Energy sector focused on the technologies through R&D supports and grant funding for start-up production in the sector** ↓
2008 **EU climate package proposing Directives to achieve renewable energy and carbon emissions reduction targets** ↓	**2008** **Building Ireland's Smart Economy – A Framework for Sustainable Economic Renewal.'** ↓ **All Island Grid Study finds that a 40% renewable penetration is technically feasible, subject to upgrading our electricity grid and ensuring the development of flexible generating plant on the electricity system.** ↓
2009 - **Directive 2009/28/EC (to achieve 20% Renewables in EU by 2020) set Individual Member State Targets in Annex 1** - **Ireland's target set by EU = 16% of all energy [up from 3.1% in 2005]** - **To be met across electricity, heat & transport** - **Directive 2001/77/EC repealed** ↓	**2009** **Revised Programme for Govt transfer foreshore licensing to the Department of Environment and integrate it with the planning system to assist the development of our ocean energy resources.** ↓ **2009 Carbon Budget set a 40% renewable electricity target** ↓

2010	2010
Directive 2009/28/EC requires each MS to publish a National Renewable Energy Action Plan showing how their legally binding target will be achieved	**Ireland's National Renewable Energy Action Plan published. Ireland's overall 16% target (under Directive 2009/28/EC) will be achieved with 10% renewables in transport, 12% renewables in heat and 42.5% renewables in electricity.**
2010	**2010**
Directive 2009/28/EC provides for 'co-operation mechanisms' between Member States to be agreed at Government level – statistical transfer, joint projects, joint projects with 3rd countries, joint support schemes	**In Ireland's National Renewable Energy Action Plan, it is noted that our target is not predicated on the use of the co-operation mechanisms. Ireland notes significant offshore resources which hold electricity export potential and could potentially be available for joint projects with other MS given the right circumstances.**

3.1 European Union Renewable Energy Policy 2007-2010

In 2007, the European Union agreed new climate and energy targets- 20-20-20 by 2020 – 20% reduction in greenhouse gas emissions by 2020; 20% energy efficiency by 2020 and 20% of the EU's energy consumption to be from renewable sources by 2020.

Directive 2009/28/EC on the promotion of the use of energy from renewable sources establishes the basis for the achievement of the EU's 20% renewable energy target (across the electricity, transport and heat sectors) by 2020. Under the terms of the Directive, each Member State is set an individually binding renewable energy target, which will contribute to the achievement of the overall EU goal.

Ireland's target set out in Annex 1 of the Directive is that 16% of all energy consumed across the 3 sectors is to be from renewable sources by 2020, up from 3.1% in 2005. Achieving this scale of increase will be challenging in the time period.

It is worth noting that a previous EU Directive 2001/77/EC, which concerned renewable consumption in the electricity sector only, had set a 13.2% target for Ireland. This Directive is repealed with the introduction of Directive 2009/28/EC which deals with renewables in the electricity, heat and transport sectors under one Directive.

3.2 National renewable policy context 2007-2010

The 2007 Government White Paper[3] sets the overall framework for energy policy in Ireland including for the renewable energy sector. The White Paper underlines how renewable energy will be a critical and growing component of Irish energy supply to 2020 and beyond. Renewable energy is an integral part of our climate change strategy and sustainability objectives. The additional diversity which renewable energy brings to Ireland's energy demand will also make a direct contribution to our goal of ensuring secure and reliable energy supplies. The Programme for Government provided for the establishment of an Ocean Energy Development Unit (set up in SEAI) to work towards delivery of 500MW of ocean (wave and tidal) energy by 2020.

3.3 Electricity from Renewable Sources (RES-E) Target – Progress to date

Table 2: Renewable Electricity as a percentage of all electricity consumption in Ireland

Year	2003	2004	2005	2006	2007	2008	2009 (provisional)
%renewable electricity	4%	5%	6.8%	8.6%	9.4%	11.9%	14.4%

There is currently 1772 MW of renewable generation connected to the Irish grid, 1459 MW of which is wind generation. The level of installed wind capacity is expected to increase by approximately 244 MW

[3] http://www.dcenr.gov.ie/Energy/Energy+Planning+Division/Energy+White+Paper.htm

by the end of 2010, bringing the total wind energy to almost over 1700 MW and the total renewable energy on the system to 1975MW. More information can be found on the TSO's website: www.eirgrid.com[4]

3.4 National Renewable Energy Action Plan

Under Directive 2009/28/EC each Member State is required to submit to the European Commission a 'National Renewable Energy Action Plan' (NREAP) setting out how it plans to reach its overall individual target. Ireland's NREAP was published in July 2010.

http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/National+Renewable+Energy+Action+Plan.htm

Ireland's National Renewable Energy Action Plan (NREAP) figures are broadly in line with targets previously set in the Government's White Paper and Programme for Government. The overall 16% target is to be achieved from 12% heat from renewable sources (RES-H), 10% transport from renewable sources (RES-T) and 42.5% electricity from renewable sources (RES-E). As set out in the NREAP, the Gate 3 process provides for sufficient grid connections for renewable generators for the achievement of the renewable electricity element of the NREAP. The NREAP contains a renewable electricity modelled scenario as well as a non modelled export scenario.

3.5 Co-operation Mechanisms under the Renewable Energy Directive and Export Potential

Under Directive 2009/28/EC ('the Renewables Directive'), Member States can make use of co-operation mechanisms between countries that are provided for in the Directive. All use of the co-operation mechanisms must be the subject of a political inter-governmental agreement between the Member States or third countries concerned. These mechanisms introduce flexibility for Member States on a voluntary co-operation basis in terms of how they meet their binding national targets.[5]

Co-operation mechanisms refer to statistical transfers between Member States (Article 6); joint projects between Member States (Articles 7, 8); joint projects between Member States and third countries (Articles 9, 10) and joint support schemes between Member States (Article 11). The Member States can use statistical transfers and develop joint projects and joint support schemes in bilateral or multilateral ways.
Under the Intelligent Energy Europe Programme, the co-operation mechanisms in the Directive are the subject of concerted action ('CA-RES') by Member States who will look more closely and in-depth at the co-operation mechanisms including practicalities, procedures and conditions and issues to be addressed for the successful implementation of the mechanisms etc.

Ireland's National Renewable Energy Action Plan states that the reaching of our national target is not predicated on the use of the co-operation mechanisms under the Directive. We have however also noted that Ireland has significant offshore resources which hold electricity export potential and could potentially be available for joint projects with other MS.

The NREAP contains a Table 10 RES-E non modelled 'export scenario.' The table illustrates Ireland's potential to become an exporter of RES-E to other EU Member States between now and 2020. In order for this export scenario to be realised, significant further infrastructural investment in the period to 2020 would be needed, including build of additional interconnectors and offshore grid and deep reinforcement onshore.

[4] http://www.eirgrid.com/customers/connectedandcontractedgenerators/

[5] http://www.dcenr.gov.ie/NR/rdonlyres/D3487583-0979-49E7-9DEC-9BFB7AF9AA06/0/Newrenewablesdirective.pdf

4 Grid Development

This chapter provides background and context information on the development of electricity grid in Ireland. Grid Connection for renewable generation is under the statutory remit of the Energy Regulator (Commission for Energy Regulation [CER]). There are several aspects of grid development policy in Ireland such as offshore grid matters that are policy in development and on which final decisions have not been taken.

In terms of grid connection for renewable generation and the achievement of our RES-E target, a 'Gate' process was put in place by the regulator, the Commission for Energy Regulation, following public consultation. It is a group processing approach (GPA) towards the processing and issuance of grid connection offers to renewable generators.

Under the GPA or 'Gate' process, applications for connections are processed in batches rather than sequentially. Within these gates, applications are further divided into groups and sub-groups based on the optimal network required to connect them.

To date there have been 3 'Gates.' Under Gate 1 and Gate 2, 1,755MW of connection offers to renewable generators were made and accepted. Under Gate 3, 3,900MW of offers are currently in the process of being issued to renewable generators.

A Gate 3 liaison group involving the TSO, DSO, regulator and industry representatives meets on a regular basis and all parties are committed to the full roll-out of the Gate. This amount of renewable generation is sufficient for the achievement of Ireland's RES-E target. It is noted that there is 800MW of offshore wind projects to receive a grid connection offer under Gate 3.

Furthermore, the regulator has put in place a new policy, CER 09/099, which sets out how small, renewable, low carbon generation can access the grid outside the Gate 3 process. It is expected that early wave and tidal devices will be able to obtain grid connections outside the Gate through this option.

There is recognition amongst the various bodies with responsibilities for the different aspects of renewable energy policy and implementation of the need for increased co-ordination at national level in future and the adoption of a fully plan led approach.

Recently, there has been significantly increased cross departmental/agency co-operation through meetings and sharing of information to ensure a more coherent and integrated match between energy policy, planning and regulation.

It is recognised that this co-ordination and co-operation needs to be enhanced and strengthened. There are opportunities to make significant progress on this in the marine renewable area, through greater future synergy between the offshore energy leasing function and onshore and offshore grid connections.

The Irish Transmission System Operator (TSO), EirGrid, published a grid development strategy (Grid 25) in 2008 and has been conducting a number of studies around the case for further interconnection and the development of an offshore grid.

Ireland is involved in several initiatives which are considering the infrastructure requirements of the development of this sector. The context for grid development in Ireland includes the following: the All Island Grid Study; Grid 25; EirGrid's Interconnection Economic Feasibility Report and Offshore Grid studies; the ISLES project; the North Seas Offshore Grid Initiative, ERGEG and ENTSO-E work.

What follows is a description of most of the ongoing grid initiatives that Ireland is involved in. It is provided by way of information and in terms of describing the ongoing work in this area. It is not intended that the strategic environmental assessment relating to this plan would assess these matters. Indeed a separate SEA is being undertaken on the implementation programme for Grid25. The particulars of the strategic environmental assessment being undertaken by EirGrid on Gird25 will be dependent on the build programme/line section to be constructed and will vary.

4.1 All Island Grid Study

An All Island Grid Study[6] was published in 2008. It was commissioned jointly by the Department of Communications, Energy and Natural Resources (Ireland) and the Department of Enterprise, Trade and Investment (Northern Ireland). This comprehensive study examined the way in which the electrical

[6] http://www.dcenr.gov.ie/Energy/North-South+Co-operation+in+the+Energy+Sector/All+Island+Electricity+Grid+Study.htm

network on the island might be cost effectively developed to the period to 2020 so as to facilitate the addition of further levels of renewable energy.

Workstream 1 consisted of a renewable energy resource assessment – the key resources focussed upon were wind, biomass and ocean energy and their associated costs. Workstream 2 investigated the extent to which RES-E can be accommodated onto the grid system with regard to variability and predictability. Workstream 3 looked at the engineering implications for the grid and Workstream 4 looked at the outputs of the first 3 workstreams to investigate the relative impact and benefits of various renewable generation levels.

4.2 Grid25

In 2009 EirGrid released Grid25, a fifteen year plan for developing Ireland's electricity transmission network. The plan envisages the doubling of Ireland's grid capacity over the period to 2025, and will involve investment of €4 billion in this critical national infrastructure. The strengthening of Ireland's transmission system is essential to allow increased integration of renewable energy in the Irish electricity system, facilitating the growth of secure indigenous energy resources and ensuring the capacity to export electricity generated in Ireland from renewable resources. An SEA on the implementation plan relating to the Grid 25 strategy is being undertaken by EirGrid, including on the 3 offshore wind projects included in Gate 3.

4.3 Further Interconnection Study

EirGrid has recently undertaken a study to look at the economic case for further interconnection (after the East-West Interconnector (EWIC) is built in 2012), to Britain and potentially France, based on a number of potential future scenarios. This includes a high-renewable scenario with 80% of electricity generation from renewable resources. The study looks at the economic benefit and relies on general information and experience from EWIC in respect of the cost of interconnection.[7]

4.4 EirGrid Offshore Grid Study

The aim of the EirGrid Offshore Grid study has been to examine how if a number of different levels of wind were to develop off the east coast of Ireland, how it should be integrated into the Irish transmission system e.g. whether it would be connected by a series of radial connections to the onshore transmission grid, or whether it is likely that a complementary offshore grid would develop. Questions underpinning include:

- What would be the offshore grid structure?
- Which technology would be more technically and economically viable for offshore connections?
- Are there synergies between the offshore and onshore systems?

Indications from the study at this stage are that the development of a complementary offshore grid is likely, though this is dependent on assumptions relating to cost and reliability performance of the offshore assets. The work done to date on the offshore grid study, and the methodology adopted for it, lends itself well to the consideration of how an offshore grid and interconnection would work together.

The study is aiming to provide a long term vision for a future off-shore grid network and offer answers to the many challenges posed over the shorter term by the 3 offshore wind projects shortly due to receive a grid connection offer. The research is mindful of the need to promote a co-ordinated development of offshore networks in the medium term with the possibility of more renewable energy being sourced offshore in the long term – including wave and tidal energy.

The first part of the study deals with the penetration of off-shore wind into the Irish transmission system. The second part - which is currently in progress - is dealing with a more comprehensive Europe-wide scenario where enhancements of interconnection with the United Kingdom and other European countries will be considered.

A number of preliminary results suggest that:

- The off-shore grid structure depends on the amount of wind power to be accommodated and the reciprocal distances of the gathering platform; for the Irish Sea, a meshed structure is envisaged.
- An AC Technology strategy is technically viable for offshore connections; this preliminary conclusion requires further investigation, but based on similar studies undertaken in EirGrid early in 2009, the amount of undersea cables, the HV voltage level and the distances to offshore gathering platforms do not justify the use of DC technology.

[7] http://www.eirgrid.com/media/47958_EG_Summary09.pdf

- Preliminary results show synergies between the onshore and offshore system; that is an offshore strategy may be further developed to solve congestions onshore by moving infrastructure development from onshore to offshore. This is particularly evident in the Dublin Bay area.

4.5 ISLES Project

The Irish Scottish Links on Energy Study (The 'ISLES' project) is a feasibility study currently being carried out on behalf of the Irish Government, the Northern Ireland Executive and the Scottish Executive on the development of an offshore transmission network linking potential offshore sites for the future generation of renewable energy (wind, wave and tidal) in the waters of Ireland, Northern Ireland and Scotland. The feasibility study will examine the business case for the construction of offshore grid and will examine technology and infrastructure; environment and planning; regulatory and finance and construction and deployment.

The two-year study is due to finish by the end of 2011.The study is co-funded by the three governments and by INTERREG. ISLES will incorporate information on engineering, economic, social, environmental and financial challenges associated with the development of such an offshore electricity transmission network.

The study will contribute to the evidence-based understanding of offshore grid potential. Each region involved in the ISLES project faces common challenges in that the electricity grid infrastructure, to date, has not been developed to exploit the capacity of the major marine renewable resource to generate electricity in these regions.

There is a wide range of economic opportunities associated with renewable generation such as engineering, construction, supply chain opportunities and manufacturing and support services for the grid. Linked to this there is the opportunity for the partner countries to lead on the research and development of cutting edge technologies with global market potential. The outcomes of the study, which will be owned by the study partners, will help influence the development of offshore grid, and the intention is to share learning with other EU Member States. The work is seen as a key part in developing thinking on the EU's concept of a European offshore 'Supergrid' for electricity interconnection.

4.6 North Seas Offshore Grid Initiative

Following a political declaration at the December 2009 Energy Council in Brussels, the North Seas Offshore Grid initiative was established and Ireland is one of the participating countries (which consists of 9 EU Member States and Norway). The ministers concerned declared their interest in discussing the development of an offshore grid in a common and co-ordinated way, given that many of the issues to be tackled are common across several countries. The intention is that the ministers involved with sign a Memorandum of Understanding in December 2010.

The North Seas Offshore Grid Initiative complements the work being carried out in the EU on the development of offshore grids in Europe. This includes the work of ENTSO-E (European TSOs); ERGEG (European electricity regulators) and the Adamowitsch group (on which industry and other interested parties are represented. CER represents Ireland on this group).

4.7 European Network of Transmission System Operators in Electricity (ENTSO-E)

EirGrid fully participates in ENTSO-E which is now fully established. Among the roles of ENTSO-E is the bringing forward of 2-year Regional Development Plans, and also a Ten Year Network Development Plan (TYNDP) every two years. The first TYNDP will be primarily a statement of current transmission development plans. For the purpose of system development ENTSO-E is organised in a number of regional groupings. EirGrid participates in the North Sea Regional Group, which will in due course be an important contributor to the development of proposals for an offshore grid in this region.

5 Planning and Foreshore Leasing

Planning and foreshore lease policies are central to creating a platform for renewable energy development, both onshore and offshore.

Offshore marine renewable energy projects are governed by the Foreshore Acts 1933 to 2009. The Foreshore Acts require that a lease or licence must be obtained from the relevant Minister prior to undertaking any works or placing structures or material on, or for the occupation of, or removal of material from state-owned foreshore (including any offshore renewable energy projects such as wind, wave or tidal technologies).

In addition, the consent of the relevant Minister is also required for development on privately owned foreshore. The Foreshore Acts apply to the seabed and shore below the line of high water of ordinary or medium tides and extending outwards to the limit of the territorial seas by 12 nautical miles (22.224 kilometers). Leases and licences are granted subject to the payment of fees.

Regulatory functions in relation to developments in the offshore environment transferred to the Minister for the Environment, Heritage and Local Government in 2010. It is the intention of the Minister to streamline and modernise the consent process for certain developments in the offshore environment, including offshore renewable energy projects such as wave, wind and tidal technologies on a phased basis.

In the future the foreshore consent system will be much closer aligned to the existing land planning system in order to provide for a more streamlined consent process. It should be noted that most renewable energy projects have to go through the onshore planning process in addition to any other consent needed.

The new model for the foreshores is expected to:

- Operate within a plan-led policy framework for the approval of activities and developments in the marine environment
- Fully integrate and streamline estate management on the state owned foreshore within the wider planning system.
- Provide where possible for a single stage consent process for project approval and give greater certainty of timeframes, including mandatory pre-application consultations, a rigorous assessment of environmental impacts, and full public participation.

Work is well underway in the Department of Environment, Heritage & Local Government on preparing a General Scheme of the necessary legislation, and scoping out the requirements for the development of a Marine Spatial Plan to strategically plan development on the State foreshore and to manage the competing and often conflicting sectoral demands. Meanwhile, short-term administrative and regulatory measures to improve throughput of foreshore applications are being introduced by the Department of Environment.

The foreshore consenting process clearly plays a central role in offshore marine renewable energy developments. The current process is widely considered inadequate and the need for significant reform is acknowledged. The modernised foreshore consenting process is expected to be developed with greater coherence between grid, onshore planning and foreshore consenting in mind. While this may prove arduous, ultimately it would be expected to provide more certainty and satisfaction to developers.

This draft plan and the strategic environmental assessment of the low, medium and high offshore marine development scenarios can provide the Department of Environment, Heritage & Local Government with a significant body of useful information that can assist them in the introduction of a better planning framework.

The conclusions from the testing of the OREDP development scenarios in the different assessment areas can provide a useful input on the potential for development of offshore wind, wave and tidal, taking into account environmental constraints and other marine activities and users. Constraint maps and the cumulative assessment of each of the areas will provide a wealth of information at a strategic level that can assist the decision making process.

6 Offshore Wind

The purpose of this chapter is to provide a brief description of the current state of play as regards offshore wind in Europe and in Ireland. It is provided as background and context information.

6.1 Offshore wind in Europe

Offshore wind is a rapidly maturing technology around the world. According to the European Wind Energy Association (EWEA)[8], in 2009 there were 830 offshore wind turbines installed and grid connected in 9 European countries, totalling 2,063 MW in 39 wind farms. During 2010 a further 1,000 MW of offshore wind is expected to be installed. Currently there are 16 offshore wind farms under construction.

6.2 Offshore wind in Ireland

In terms of full load-hour potential, Ireland has one of the best wind energy climates in Europe.[9] 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 strategic environmental assessment on the development scenarios in the plan provides useful information as to development potential for offshore wind in the different resource assessment areas when environmental effects are taken on board.

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.

There are currently 2 proposed offshore wind developments that have already secured a foreshore lease and, separate to this, there are 3 offshore wind projects that are due to receive a grid connection offer under the Gate 3 process described in chapter 4 on grid. Both a grid connection and a foreshore lease are necessary for projects to be developed. These projects have been shown in the strategic environmental assessment as 'already existing renewable infrastructure.' It is recalled that thus far only 25MW has actually been constructed.

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

Approximately 800MW 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) (364MW); Oriel (Dundalk Bay, Co Louth – in the Irish Sea) (330MW) and Fuinnemah Sceirde Teo[11](" Sceirde "on the map)(Outer Galway Bay, Atlantic coast) (100.8MW).

As noted in Chapter 4 on grid, there are many developments underway on grid (e.g. offshore grid) which might influence grid connections and the development of the offshore renewable energy industry in future. In the meantime and pending any decisions on such issues, grid connection applications for renewable generation are processed through the Gate system and the Gate 3 Direction by the Commission for Energy Regulation has provided for grid connection offers to issue for sufficient renewable capacity to meet our 2020 targets.

The 2 projects that have already secured foreshore leases (Arklow and Codling), did not meet the cut-off date that the CER set out in the Gate 3 Direction and are consequently not in line to receive a grid connection offer. Thus while they are consented 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, there may be other opportunities in future that could provide for development on these sites e.g. as outlined in Chapter 4, there are several offshore grid initiatives that could potentially lead to offshore grid connection possibilities or as outlined in Chapter 3, the Renewable Energy Directive also provides for various 'co-operation mechanisms' which subject to agreement between the Governments concerned, could provide joint project opportunities.

---

[8] "Oceans of Opportunity – Harnessing Europe's largest domestic energy resource" EWEA 2009
[9] "Europe's onshore and offshore wind energy potential" – EEA Report 2009
[10] Dublin Array is called Kish Banks in the Gate 3 Direction
[11] Fuinneamh Sceirde Teo is called Doolick 'Doolick' in the Gate 3 Direction

A summary of the current state of play is provided in the Table 3. An illustrative map follows that has been taken from the Environmental Report and shows these developments. It is noted the map also references the 2 wave test facilities (the existing Galway Bay test site and the planned grid connected Belmullet wave test site off Co. Mayo).

In addition to the offshore developments in this chapter, 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). However these applications have not yet been processed and are currently also without a grid connection offer. As set out in Chapter 5, the Department of Environment, Heritage & Local Government plans to reform the foreshore consenting process and will also be using the findings of this SEA /OREDP to assist them in moving forward.

Table 3: Offshore Wind Developments with either a foreshore lease or grid connection offer

	Location	**MW**	**Grid Connection Offer**	**Foreshore Lease**
Arklow Bank	Irish Sea	520 MW	No grid connection offer. Application post cut off date for Gate 3	YES
Codling Bank	Irish Sea	1100 MW	No grid connection offer. Application post cut off date for Gate 3	YES
Dublin Array (called 'Kish Banks' in the Gate 3 Direction)[12]	Irish Sea	364 MW	In Gate 3	Foreshore Lease application being processed by DEHLG
Oriel	Irish Sea	330 MW	In Gate 3	Foreshore Lease application being processed by DEHLG
Sceirde or 'Fuinneamh Sceirde Teo' (called Doolick in the Gate 3 Direction)	Atlantic	100.8 MW	In Gate 3	Foreshore Lease application being processed by DEHLG

[12] What is shown is the MW concretely due to receive a Grid Connection under Gate 3. The project developers have applied for a foreshore lease of a greater size than this, however grid connection is for the amount shown above.

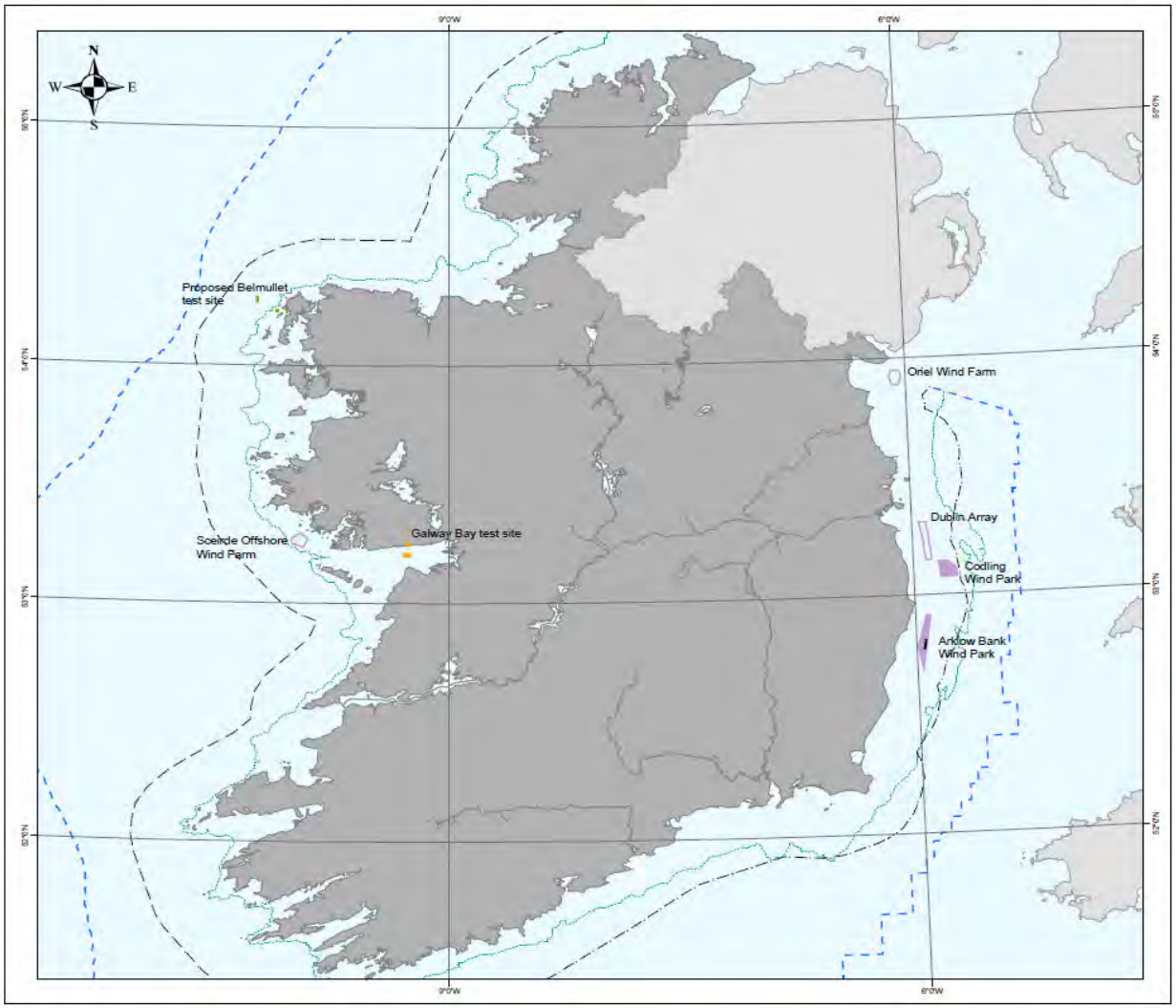


Figure 2: Existing Renewable Infrastructure

Legend

Background

- Ireland
- United Kingdom
- Study area
- 12nm limit
- 60m contour

Renewable Infrastructure

- Wind farm in operation
- Windfarm lease area
- Winfarm lease area under application
- Proposed Belmullet wave energy test site
- Wave energy test site

Note 1: Not to be used for navigation

Note 2: Full study area not shown. There is no existing renewable infrastructure relevant to this figure outside of the map extent.

0 15 30 60 90 120 km

Date	Friday, February 26, 2010 14:14:21	
Projection	WGS_1984_UTM_Zone_29N	
Spheroid	WGS_1984	
Datum	D_WGS_1984	
Data Source	Marine Institute, SEI, Petroleum Affairs Division, GEBCO, UKHO, Saorgus Energy Ltd	
File Reference	J:\P1304\Mxd\Final Figures\ 9.5.3 Existing Renewable Infrastructure.mxd	
Checked	Produced By	Anna Place
	Reviewed By	Sally Holroyd

seai AECOM METOC

7 Wave and Tidal Development in Ireland

The purpose of this chapter is to provide a brief description of the current state of play as regards wave and tidal energy in Ireland. It is provided as background and context information. 'An Ocean Energy Strategy for Ireland' published in 2005 was aimed at advancing Ireland's research and development capabilities and the speed at which ocean energy technologies would be deployed in Ireland.

The Ocean Energy Development Unit (OEDU) in the Sustainable Energy Authority of Ireland[13] (SEAI) was established to take forward the ocean energy strategy. Activities of the OEDU include running a prototype development funding scheme for ocean energy devices; establishing a grid connected wave testing facility offshore; enhancing the national wave tank test facility in the HMRC, Cork and initiating other measures to promote and develop the sector.

Wave energy technology is still at research, development and pilot deployment stages. The commercial and technical feasibility of the technology is therefore not proven and will require a considerable level of research and testing. On a global basis, there are currently only a small number of pilot-scale tidal and wave devices that have developed to the level of generating electricity output. While these devices are all at pre-commercial stages, there is a rapid acceleration of effort taking place internationally.

In recent years a number of indigenous developers in Ireland have developed some promising wave technology devices. While there is no wave or tidal energy device as yet connected to the Irish grid, there is, however, a demonstration tidal device connected to the grid in Northern Ireland at Strangford Lough.

An early study of the European wave energy resource was performed which indicated that the average wave power in Europe is highest near the west of Ireland with an average wave power of 76kW occurring of the Irish coast. A more detailed assessment of Ireland's wave energy resource was performed in 2005. This study looked at the theoretical and accessible levels of wave energy in Irish waters. The study indicated that a theoretical wave energy resource of up to 525TWh exists within the total limit of Irish waters. For comparison, in 2006 the Total Electricity Requirement for the Republic of Ireland (ROI) was 27.8TWh of electricity. Further information on Ireland's wave resource can be found on the SEAI website at:

http://www.seai.ie/Renewables/Ocean_Energy/Ireland's_Wave_Energy_Resource/

There is now an opportunity to develop, over time, an indigenous wave and tidal energy sector, both on the manufacture and development of the devices themselves and also on the downstream services with resultant economic benefits to the ports and engineering sectors.

A key function of the OEDU in SEAI is the provision of funding to industry to stimulate the development and deployment of a range of robust ocean energy devices and systems with emphasis on wave and tidal energy capture devices, monitoring of technologies, integration of ocean energy into the electricity grid, and data monitoring, forecasting, and control of ocean energy systems.

The overall objective, in addition to enabling achievement of Ireland's wave and tidal production target, is to support the development, in Ireland, of a cluster of indigenous and overseas companies, involved in the manufacture, deployment and operation of marine renewable technologies, which could have significant employment and economic benefits for Ireland.

Under the Prototype Development Funding scheme, for industry-led projects in the field of wave and tidal technology, a total of €4.3 million was committed by the OEDU during 2009 to 12 industry-led projects with a value of €10.6 million.

The Hydraulics and Maritime Research Centre (HMRC) at University College Cork is a centre of excellence for ocean renewables and coastal engineering. The HMRC houses the National Ocean Test Facility and has facilities for wave simulation with a wave flume and an ocean wave basin. The facilities provide a testing environment for all phases of wave energy device development. These have been enhanced with funding from the OEDU.

The MERC3 (Maritime & Energy Research Campus and Commercial Cluster) in Cork, which is currently under development, will incorporate the National Ocean Test Facility and aims to establish a Flagship Cluster to produce innovative technical solutions to support the development of the Irish maritime and energy sectors

[13] http://www.seai.ie/Renewables/Ocean_Energy/

In 2006, the Marine Institute, in association with the Sustainable Energy Authority of Ireland, established an Ocean Energy Test Site for scaled prototypes of wave energy devices in Galway Bay which provides real time wave information. The Galway Bay Test Site is available to all developers of wave energy devices that have a prototype that is built for open water testing in a relatively sheltered location. In 2010 2 ocean energy device companies are scheduled to continue testing on the site and the OEDU are funding enhancements to the facility.

The OEDU is continuing work on the establishment of a full scale grid connected wave energy test facility off County Mayo. A foreshore licence was awarded in late 2009 to support the Site Investigation works at the proposed test site location off Annagh Head, Belmullet, Co. Mayo. This project involves a phased development, from Site Investigation with a Foreshore Licence, to Design and Grid Application, to Planning and Foreshore Lease and finally procurement and construction. At the moment the project is in Site Investigation and Design phase. The site is expected to be operational in 2012. It will be connected to the national electricity grid and will provide facilities for the testing of full scale devices in development by Irish and multi-national companies and will be able to accommodate up to 3 devices at any one time.

The SmartBay Pilot Project in Galway Bay which is supported by the Marine Institute and the Environmental Protection Agency (EPA) is designed to be a research, test and demonstration platform and innovation test bed for new ocean technologies developed by research institutes and companies e.g. communications, informatics, instrumentation and sensors. The core infrastructure comprises a suite of commercially available technology. This includes a network of buoys, sensor hardware and communications systems against which prototype products or services can be validated.

The Marine Institute (MI) has recently published a consultation document on ‘Harnessing Ireland’s Potential as a European and Global Centre for Ocean Technologies.’ The aim of the consultation is to outline a vision and strategy to create a smart ocean innovation cluster in Ireland. This embraces, also, the Maritime and Energy Research Centre which is planned for development in Cork Harbour.

The Geological Survey of Ireland is developing the INFOMAR system – INFOMAR is a project to develop ”Integrated mapping for the sustainable development of Ireland's Marine Resource ” Infomar is examining the availability of appropriate baseline data to underpin resource evaluation, including mapping and measurements. “

Further developments include the completion of a study commissioned by SEAI entitled ‘A Review of Engineering and Specialist Support Requirements for the Ocean Energy Sector’. The study is intended to serve as a starting point for consideration of how the private and public sector can mobilise the delivery of the infrastructure and industry supply-chain capabilities that are necessary to enable the large-scale development of renewable energy resources. A further commissioned study is being finalised to measure the overall economic costs and benefits of a variety of scenarios for deployment of ocean energy and the implications for public sector finance and support.

The Government has announced plans (subject to state aid clearance) for a Renewable Energy Feed in Tariff (REFIT) of €220 per megawatt hour for electricity produced from wave and tidal energy.

8 Development Scenarios

It was decided that the strategic environmental assessment should be carried out on three Development Scenarios (low, medium and high) in the period to 2030. While the SEA period is up to the medium term (2030), the focus of development is particularly in the period to 2020 with the initial aim of getting industry up and running, underway and generating electricity in the offshore environment. For this reason, there will be an interim review of the SEA and Plan in 2015 and a full review in 2020.

Table 4 – SEA Development Scenarios

	Low Scenario (MW)	Medium Scenario (MW)	High Scenario (MW)
Offshore Wind	**800**	**2,300**	**4,500**
Wave & Tidal Current	**75**	**500**	**1,500**

Low Scenario
The low development scenario consists of the 800MW of offshore wind to receive a grid connection offer under Gate 3 (see Table 3 in Chapter 6 for further information). It also includes 75 MW of wave and tidal development, which is included in the Table 10 modelled scenario in the National Renewable Energy Action Plan (NREAP).

Medium Scenario
The medium development scenario consists of 2300MW of offshore wind, which comes from the Table 10 non-modelled scenario of the NREAP (broadly based on the combination of offshore wind projects with either foreshore lease or grid connection) and the 500MW of wave and tidal energy in the same table (the Government's 2020 ocean energy target).

High Scenario
The high development scenario consists of 4,500MW of offshore wind and 1,500MW of wave and tidal current. These figures come from the SEA Scoping document.

8.1 Resource data

The following data sources have been used to establish the offshore wind resource in the study area:

- Republic of Ireland Wind Atlas, (SEAI 2003 as updated in 2010)
- UK Marine Resource Atlas, (BERR 2008)

The following data sources have been used to establish the wave resource in the study area:

- Accessible Wave Energy Resource Atlas Ireland, (Irish Marine Institute or, IMI, 2005)
- UK Marine Resource Atlas, (BERR, 2008)

This SEA has made reference to the following sources of data for tidal resource:

- Tidal & Marine Current Energy Resource in Ireland, (SEAI 2004)
- Review of engineering & specialist support requirements for ocean energy sector, (SEAI 2009)
- UK Marine Resource Atlas, (BERR 2008)

8.2 Assessment Areas

The study area was split into 6 assessment areas around the Irish coastline for the purposes of the Environmental Report and OREDP. Dividing the offshore area around Ireland into 6 assessment areas as outlined made it easier to analyse the resources, to organise the assessment and to provide feedback. The division into assessment areas means that the SEA can focus on the areas that are most likely for development, while still ensuring that all the areas that are a possibility for development within the SEA timescale are included.

The assessment areas reflect the distribution of wave, wind and tidal resource in Ireland's waters. Some assessment areas only contain a single resource type, whilst others contain a combination. The scoping document[14] sets out the geographic criteria covered in the assessment and includes the following (a) Below MHW mark (b) Fixed structures up to 60m (c) Floating structures up to 200m (d)

[14] http://www.seai.ie/Renewables/Ocean_Energy/Offshore_Renewable_SEA/Scoping_Report/

Maximum distance of 100km from shore. The scoping document also sets out the energy / resource requirements. The 100 km buffer zone was chosen because this is considered to be the upper length limit of AC cable technology (i.e. for greater distances DC cables will be required, with converter stations on land to convert to AC).

Each SEA topic has been considered within each of the assessment areas at a strategic level. While the SEA has focussed on these assessment areas, the Environmental Report makes clear that this doesn't preclude development outside these assessment areas as all Irish waters were covered in the generic assessment. The cumulative assessment has considered a number of possible future development scenarios and reviewed the cumulative effects of different levels of development within each of the assessment areas, as well as having considered the cumulative effects of other plans and programmes.

Table 5 –Technologies Covered in each Assessment area

Assessment Area	Location	Tidal	Wave	Offshore Wind
1	East Coast (North)	Not Covered	Not Covered	Covered
2	East Coast (South)	Covered	Not Covered	Covered
3	South Coast	Not Covered	Not Covered	Covered
4	West Coast (South)	Not Covered	Covered	Covered
5	West Coast	Not Covered	Covered	Covered
5a	Shannon Estuary	Covered	Not Covered	Not Covered
6	West Coast (North)	Covered	Covered	Covered

Three maps follow illustrating the assessment areas and resource covered. It is noted that there may be transboundary issues that fall to be considered by the relevant authorities. It is noted that planned developments in offshore wind involve the utilisation of relatively established technology in water depths not exceeding 60m. Future growth and expansion of the offshore wind sector will utilise floating technologies that are under development in a number of jurisdictions. Wave and tidal technologies are not yet developed to deployment stage and will continue to evolve over the remainder of this decade.

Offshore Wind
Offshore wind is available around the whole coastline (apart from in the Shannon Estuary).

Wave
Wave is not considered in Assessment Area 3 as although there is some technical resource here it was decided to only consider wave in the higher resource and more accessible wave assessment areas on the west and northwest coast (Areas 4, 5, 6).

Tidal
Tidal development is only considered where the larger areas of technical resource occur in Areas 2, 5a and Area 6. Tidal Barrage was excluded from the scope of the SEA and only the development of tidal stream energy has been assessed. From the available datasets, three significant areas of technical tidal resource have been identified - Southern Irish Sea coast through the St Georges Channel, including Codling & Arklow Banks; the Shannon Estuary; and Tuskar Rock & Carnsore Point and Inishtrahull Sound. A number of other smaller areas were identified as having sufficient current speed and water depth available- Lough Foyle; Gascanane Sound; Dursey Sound and Bulls Mouth & Achill Island. The literature highlighted another two sites, Ballysadare Bay and Carlingford Lough, based on high current speed only. However, no analysis of sufficient water depth has been undertaken as this is below the resolution of the bathymetry data available.

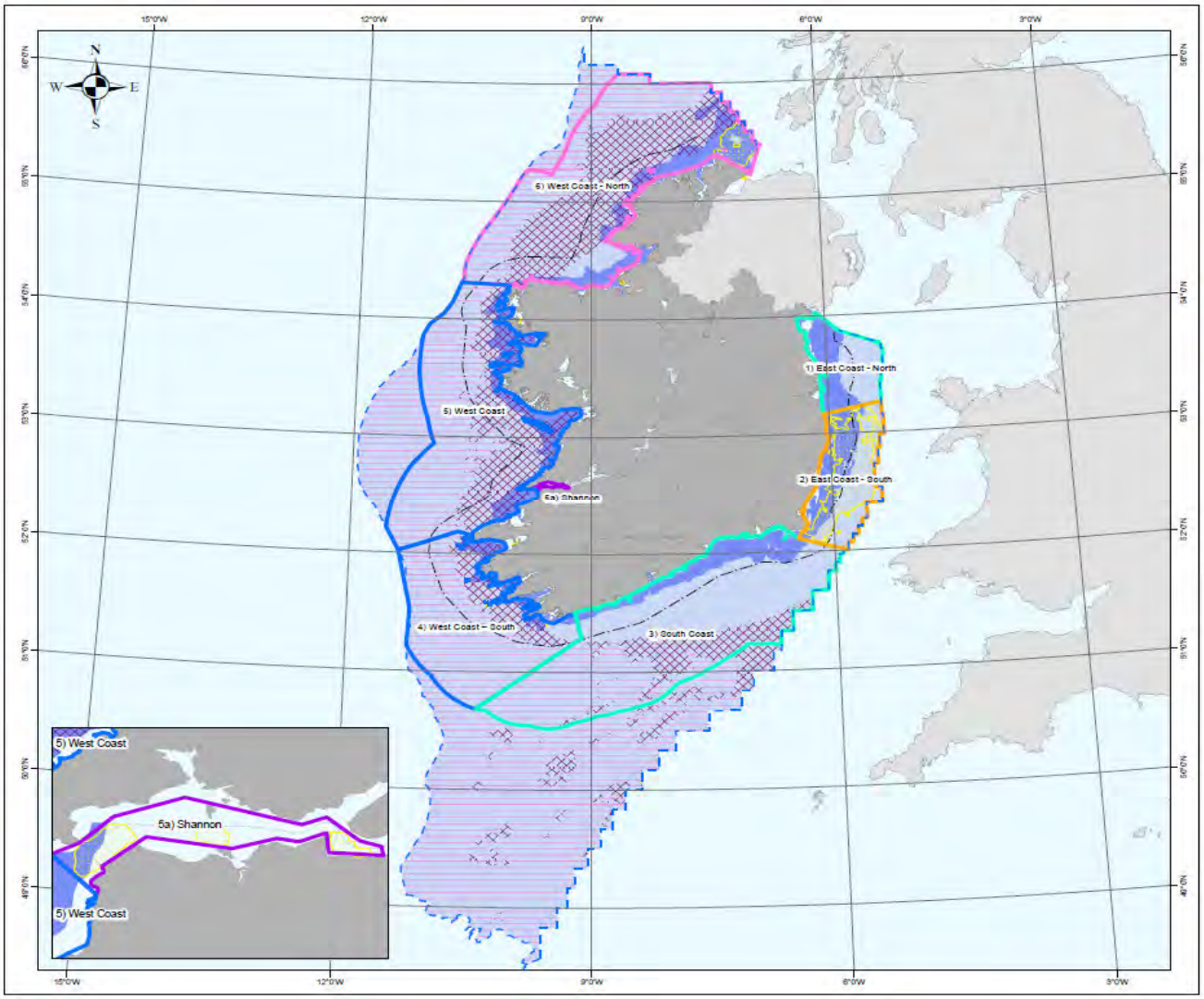


Figure 3: Assessment areas – All Resource

Legend

Background
- Ireland
- United Kingdom
- Study area
- 12nm limit

Assessment Areas
- Wind
- Tidal
- Wind and Wave
- Wind and Tidal
- Wind, Wave and Tidal

Tidal Technical Resource
- >1.2m/s Peak Spring Current Speed & Water Depth 20m to 80m

Wave Technical Resource
- >=20kW/m/WC Wave Power & Water Depth 10m to 100m
- >=20kW/m/WC Wave Power & Water Depth 100m to 200m

Wind Technical Resource
- >=7m/s Wind Speed & Water Depth 10m to 60m
- >=7m/s Wind Speed & Water Depth 60m to 200m

Note 1: Assessment Areas extend from the coast (Mean High Water) to a distance of 100km, within the boundary of the Irish Exclusive Economic Zone only

Note 2: Not to be used for navigation

0 35 70 140 210 280 km

Date	Wednesday, October 6, 2010 15:41:07	
Projection	WGS_1984_UTM_Zone_29N	
Spheroid	WGS_1984	
Datum	D_WGS_1984	
Data Source	Marine Institute, SEI, Petroleum Affairs Division, GEBCO, UKHO	
File Reference	J:\P1304\Mxd\Final Figures\.mxd 11.4 Assessment Area_All	
Checked	Produced By	Anna Place
	Reviewed By	Sam Franklin

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND AECOM METOC

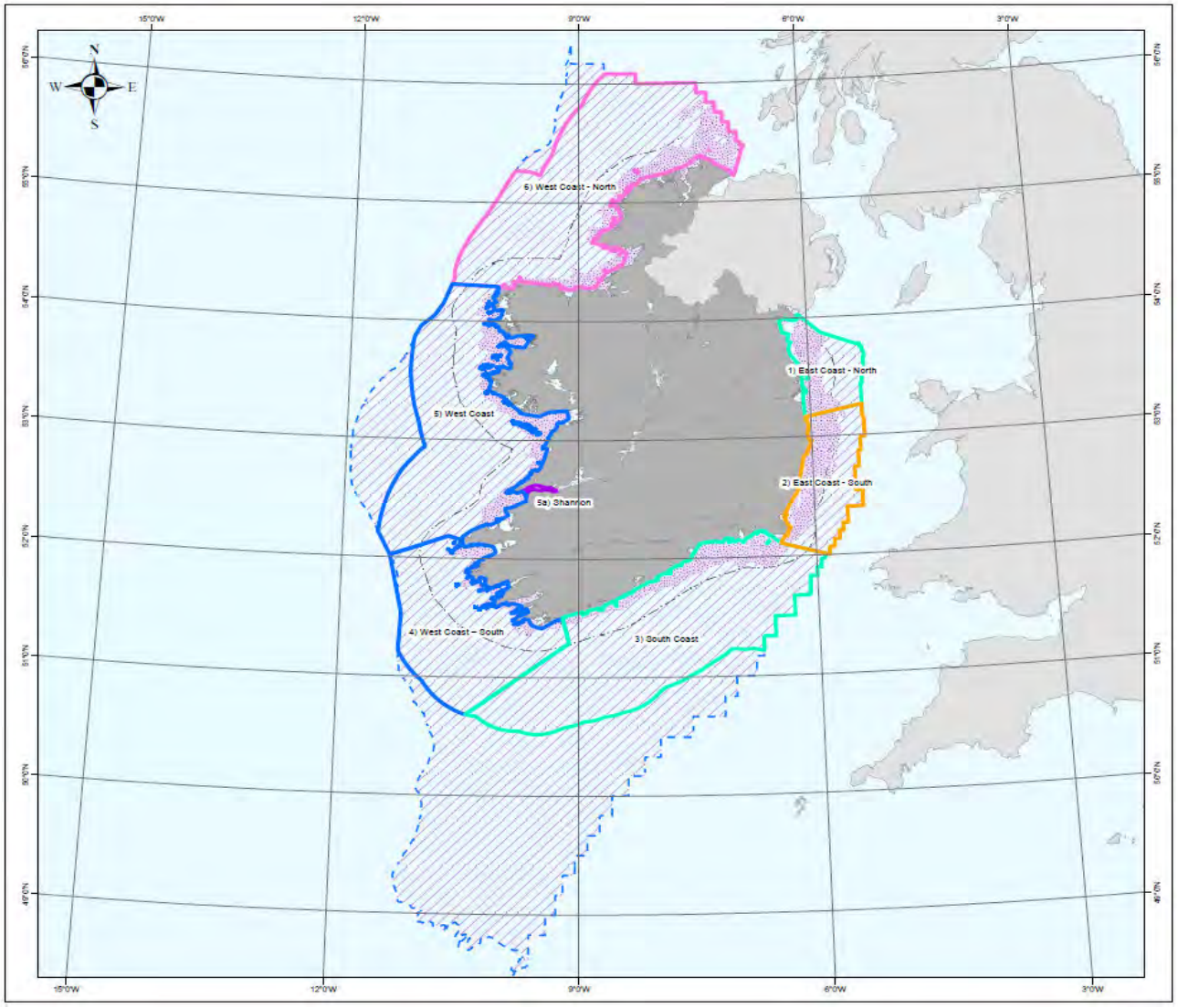


Figure 4: Assessment areas – Offshore Wind Resource

Legend

Background
- Ireland
- United Kingdom
- Study area
- 12nm limit

Assessment Areas

Resource
- Wind
- Tidal
- Wind and Wave
- Wind and Tidal
- Wind, Wave and Tidal

Wind Technical Resource
- >=7m/s Wind Speed & Water Depth 10m to 60m
- >=7m/s Wind Speed & Water Depth 60m to 200m

Note 1: Assessment Areas extend from the coast (Mean High Water) to a distance of 100km, within the boundary of the Irish Exclusive Economic Zone only

Note 2: Not to be used for navigation

Technical Constraint Notes:
- Two technical wind resource areas are been mapped. Both areas satisfy the requirement for a mean annual wind speed of > 7 metres/second at an 100m altitude above mean sea level.
- The two areas have been defined for the following water depths:
10m to 60m water depth
60m to 200m water depth (study area limit)

0 35 70 140 210 280 km

Date	Wednesday, October 6, 2010 15:23:43	
Projection	WGS_1984_UTM_Zone_29N	
Spheroid	WGS_1984	
Datum	D_WGS_1984	
Data Source	Marine Institute, SEI, Petroleum Affairs Division, GEBCO, UKHO	
File Reference	J:\P1304\Mxd\Final Figures\.mxd 11.1 Assessment Area_Wind Resource	
Checked	Produced By	Anna Place
	Reviewed By	Sam Franklin

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND AECOM METOC

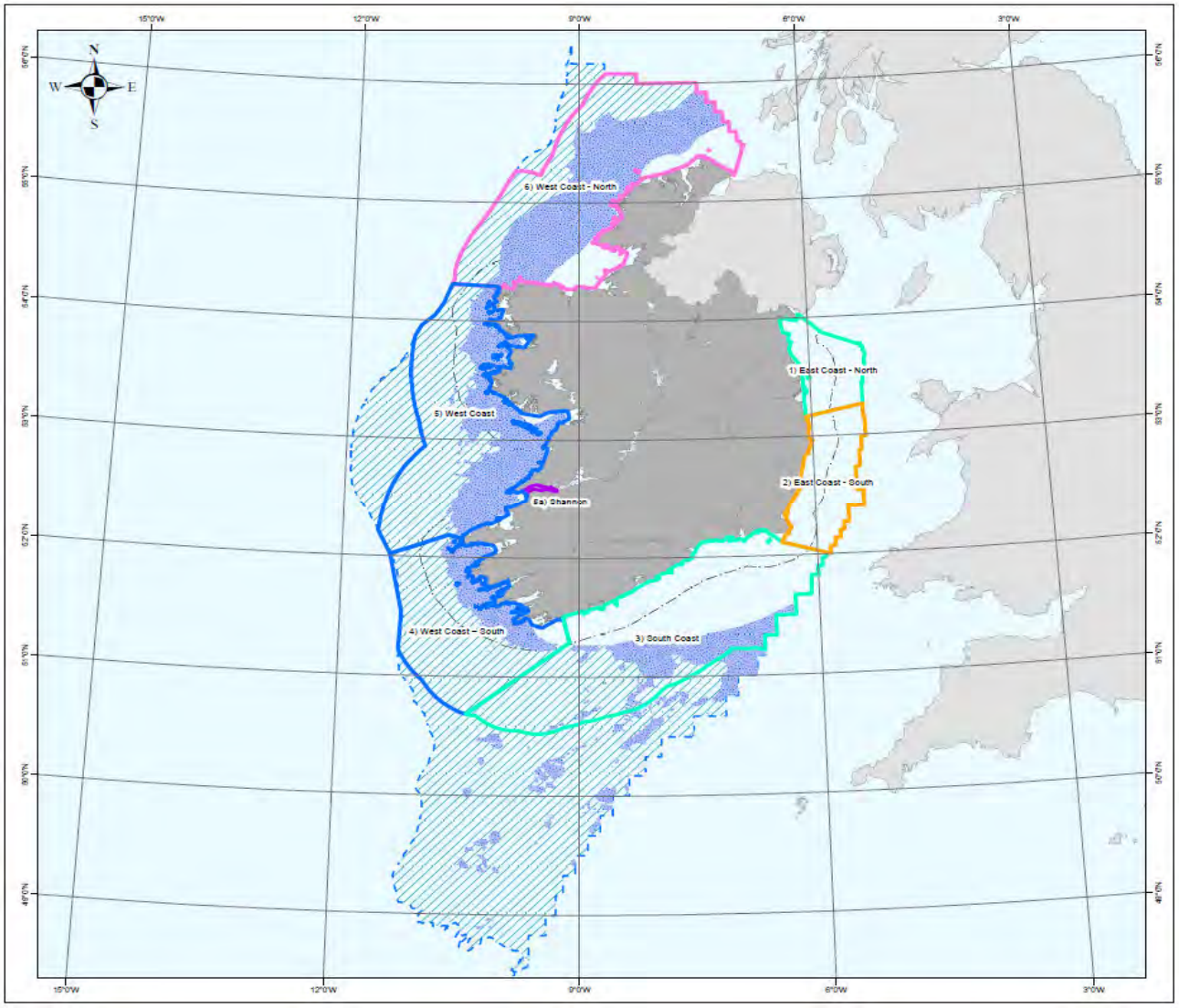


Figure 5: Assessment area – Wave Resource

Legend

Background
- Ireland
- United Kingdom
- Study area
- 12nm limit

Assessment Areas

Resource
- Wind
- Tidal
- Wind and Wave
- Wind and Tidal
- Wind, Wave and Tidal

Wave Technical Resource
- >=20kW/mWC Wave Power & Water Depth 10m to 100m
- >=20kW/mWC Wave Power & Water Depth 100m to 200m

Note 1: Assessment Areas extend from the coast (Mean High Water) to a distance of 100km, within the boundary of the Irish Exclusive Economic Zone only

Note 2: Not to be used for navigation

Technical Constraint Notes:
Wave technical energy resource has been divided into two polygons, that satisfy the following criteria:
- mean annual wave power of > 20 kilowatts per metre of wave crest (kW/mWC) and water depths between 10m and 100m
- mean annual wave power of > 20 kilowatts per metre of wave crest (kW/mWC) and water depths between 100m and 200m

0 35 70 140 210 280 km

Date	Wednesday, October 6, 2010 15:31:52	
Projection	WGS_1984_UTM_Zone_29N	
Spheroid	WGS_1984	
Datum	D_WGS_1984	
Data Source	Marine Institute, SEI, Petroleum Affairs Division, GEBCO, UKHO	
File Reference	J:\P1304\Mxd\Final Figures\.mxd 11.2 Assessment Area_Wave Resource	
Checked	Produced By	Anna Place
	Reviewed By	Sam Franklin

seai AECOM METOC

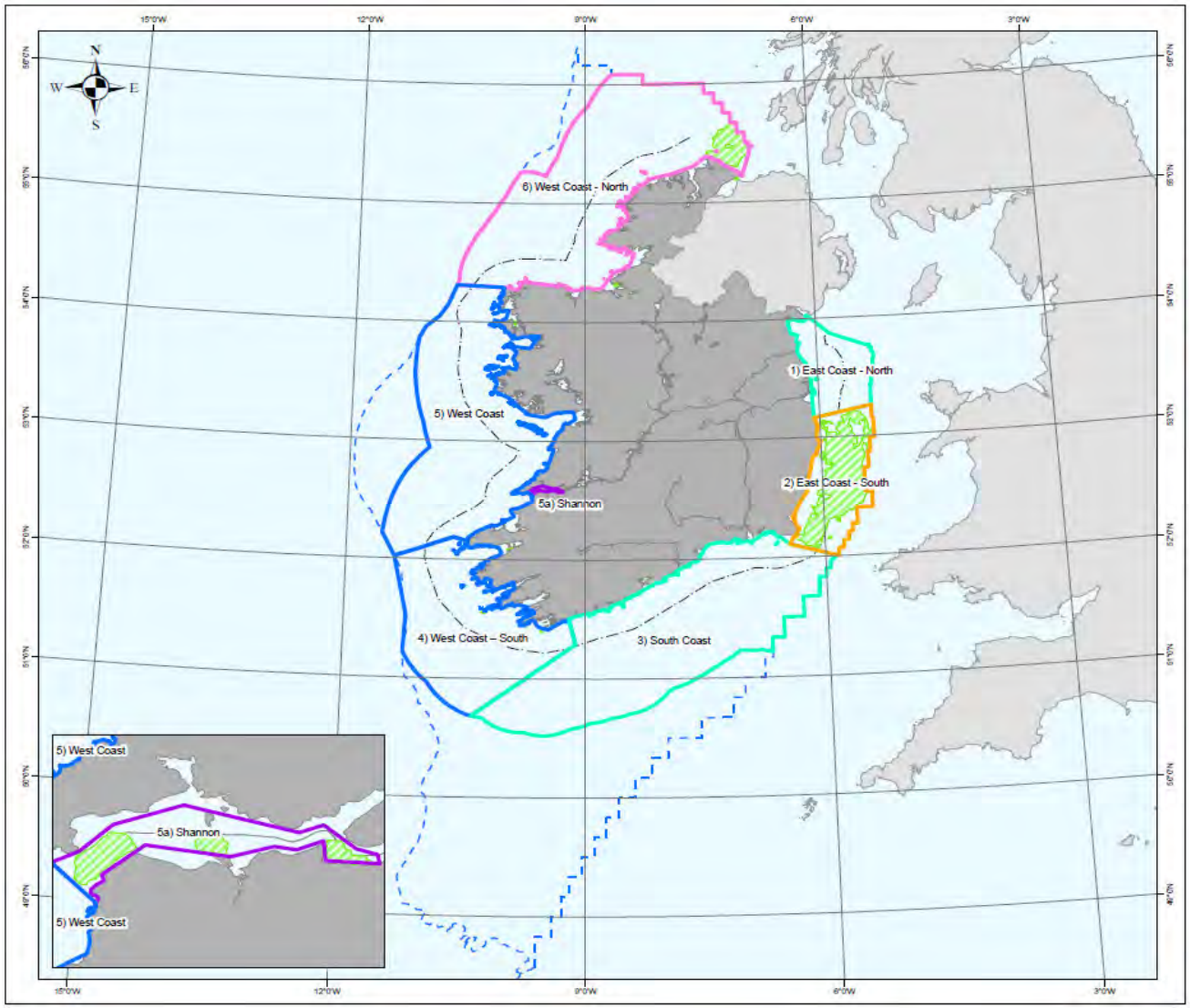


Figure 6: Assessment area – Tidal Resource

Legend

Background
- Ireland
- United Kingdom
- Study area
- 12nm limit

Assessment Areas

Resource
- Wind
- Tidal
- Wind and Wave
- Wind and Tidal
- Wind, Wave and Tidal

Tidal Technical Resource
- >1.2m/s Peak Spring Current Speed & Water Depth 20m to 80m

Note 1: Assessment Areas extend from the coast (Mean High Water) to a distance of 100km, within the boundary of the Irish Exclusive Economic Zone only

Note 2: Not to be used for navigation

Technical Constraint Notes:
- The technical resources polygons are based only on peak spring tidal current speeds of > 1.2 metres/second, within the study area
- A constraining water depth polygon layer is presented that represents an area between 20m and 80m water depth.

0 37.5 75 150 225

Date	Wednesday, October 6, 2010 15:39:06	
Projection	WGS_1984_UTM_Zone_29N	
Spheroid	WGS_1984	
Datum	D_WGS_1984	
Data Source	Marine Institute, SEI, Petroleum Affairs Division, GEBCO, UKHO	
File Reference	J:\P1304\Mxd\Final Figures\.mxd 11.3 Assessment Area_Tidal Resource	
Checked	Produced By	Anna Place
	Reviewed By	Sam Franklin

seai SUSTAINABLE ENERGY AUTHORITY OF IRELAND AECOM METOC

9 Data Gaps and other Uncertainties

The Environmental Report (ER) of the SEA highlights that "data, knowledge and information gaps are a key limitation" of the assessment that has been undertaken. The SEA ER acknowledges that the data gaps are "very difficult to fill at a strategic level due to the geographical scale of the study area and the relative inaccessibility of the marine environment."

Furthermore it notes that the assessment is also necessarily limited because it has been based on the development of a relatively new and emerging industry where the longer term environmental effects are not yet fully understood. In general the effects of offshore wind developments on the environment are better known and understood than wave or tidal developments. This reflects how the information, experience and knowledge gained from the onshore wind industry helped to inform and enable the deployment of a number of the initial offshore wind farms, which subsequently helped to inform further offshore wind developments and the successful growth and expansion of this industry.

In comparison, the wave and tidal industry is still at the testing and demonstration stage. There is still a relatively high level of uncertainty surrounding offshore renewable energy developments, in particular the potential effects that certain device types (mainly wave and tidal) have on the environment

The Environmental Report notes the impact of these data and knowledge gaps in terms of the knock on effect on consenting and licensing processes which in light of data gaps could be expected to impose a requirement for developers of individual projects to undertake significant amounts of survey work and monitoring to either inform consent or as a condition of consent. In an industry where financial margins are tight, additional survey and monitoring work can place significant financial pressure on developers and influence them to seek to locate in areas where additional monitoring or surveying has already been carried out.

Data and information gaps generally relate to the environmental baseline information. While there are have been improvements in data gathering in recent years, there are still significant gaps in the data and information that we have about the marine environment, in particular in relation to the abundance and distribution of certain species and habitats. This is mainly due to the sheer geographical scale, harsh conditions and relative inaccessibility of the marine environment making data collection very challenging, costly and time consuming. Consequently, data and information has historically been collected on a site by site basis in relation to specific coastal and marine developments and tends to contain gaps in geographic coverage.

An objective of the OREDP and the SEA is to set the strategic framework for offshore renewable energy and increase confidence amongst developers, decision makers and all stakeholders by identifying key environmental constraints or considerations that need to be taken into account in certain locations.

In this regard, the constraint maps that have been drawn up during the SEA process are attached at Appendix 4 so that all stakeholders can bear these in mind in their decision making.

The Environmental Report proposes 3 options for how the issue of data gaps can be addressed.

(a) At a strategic level by Government Departments or other state bodies through identifying options for carrying out certain surveys or monitoring, data sharing etc.

(b) Filling data and knowledge gaps at an individual project level. The nature and types of surveys and monitoring required would depend upon the potential site specific constraints identified through consultation and as part of EIA screening and scoping.

(c) Filling data gaps through the 'deploy and monitor' process. This approach may be required where knowledge gaps require the deployment of devices to enable their interaction and any associated effects on the marine environment and key receptors to be identified through monitoring.

It would appear that in taking forward the issue of data gaps, it will be necessary that a combination of the three options will be required going forward. Notwithstanding that the SEA ER acknowledges that it is "very difficult to fill data gaps at a strategic level due to the geographical scale of the study area and the relative inaccessibility of the marine environment," it is noted that in the context of the Marine Framework Strategy Directive, the lead authorities on the implementation of the Directive are already having work carried out which will improve data gathering in the marine area. It should be ensured by the mechanism through which implementation of the OREDP is being taken forward, that the new data

being compiled under that process is made available for the benefit of the offshore marine renewable energy sector.

Given the challenges with collection of data at a strategic level, it would appear necessary to have data and knowledge gaps filled insofar as possible at an individual project level. The nature and types of surveys and monitoring required will depend upon the potential site specific constraints identified through consultation and as part of EIA screening and scoping.

There would be obvious merit in using the deploy and monitor approach to developments so that necessary data (evidence) in relation to potential effects on the environment can be obtained in early phases of developments before they are extended to full commercial scale. Information from the Environmental Report on the Deploy and Monitor Approach is contained in Appendix 3

9.1 Uncertainties and Unknowns

In addition to the Data Gaps, the Environmental Report also highlights a variety of uncertainties and unknown effects to be borne in mind in the development of the sector. The main areas of uncertainty/unknown effects identified in the SEA Environmental Report are summarised in Table 6 below

Table 6: Summary of Uncertainties and Unknown Effects

SEA Issues/Subject	Potential significant adverse/unknown effect	Technology/device types	Reason for Uncertainty/Unknown Effect
Protected Sites	Potential effects on the integrity and the conservation objectives of the site where qualifying features are mobile species that are not constrained to the boundaries of the site.	All technologies	See below in relation to birds, marine mammals, marine reptiles and fish.
Benthic Ecology	Potential for loss/disturbance to Annex I habitats and communities.	All devices with piled foundations or gravity bases.	Unknown distribution/presence of Annex I habitats/communities outside protected sites.
Birds **Marine mammals** **Marine reptiles**	Habitat loss/disturbance – mainly in relation to offshore feeding, loafing (birds) and breeding areas.	All devices that occupy large areas of the water surface or protrude above the water surface.	Unknown/limited information on the location of key offshore feeding, loafing (birds) and breeding areas.
Fish	Collision risk – above surface. Mainly effecting migratory bird species.	Offshore wind developments.	Limited information on bird migratory routes.

SEA Issues/Subject	Potential significant adverse/unknown effect	Technology/device types	Reason for Uncertainty/Unknown Effect
	Collision risk - below and on surface. Potential significant effects in relation to collision with operational devices (mainly tidal).	Mainly tidal devices. Also potential effects with piled foundations and wave devices that occupy large parts of the water surface or have submerged moving parts.	Limited knowledge/information in relation to interactions between tidal and wave devices and key sensitive receptors (in particular diving and pursuit feeder birds, marine mammals and large fish) and these species respond to these devices.
	Noise generated during installation. Temporary effects in terms of habitat exclusion/species displacement. Effects likely to be of significance during breeding/spawning seasons – could have longer term effects.	All devices with piled foundations.	Limited information on distribution and abundance of key species that could be affected by noise (diving birds and pursuit feeders, marine mammals, marine reptiles and fish e.g. cod)
Birds **Marine mammals** **Marine reptiles** **Fish**	Noise generated during operation of devices. Long term effects in terms of habitat loss and species displacement. Effects more significant where effect key breeding/spawning and feeding habitats.	All devices with submerged moving parts (mainly tidal devices)	Limited information on distribution and abundance of key species that could be affected by noise (diving birds and pursuit feeders, marine mammals, marine reptiles and fish e.g. cod)
	Barriers to movement along migratory routes and between feeding and breeding area due to noise and risk of collision.	All devices with piled foundation and submerged moving parts.	Limited information/data on key migratory routes for certain species (in particular cetaceans), marine reptiles and basking sharks
Commercial fisheries	Long term displacement from traditional fishing grounds (inshore and offshore areas)	All device types	Limited information on location of key traditional fishing grounds, in particular for inshore fishing grounds due to a lack of data on the movement of vessels that are less than 15m length.
Seascape	Potential adverse	All device types but	The seascape character

SEA Issues/Subject	Potential significant adverse/unknown effect	Technology/device types	Reason for Uncertainty/Unknown Effect
	effects on seascape character.	effects are likely to be more significant for offshore wind where a greater proportion of the development is visible above the water.	around the coast of Ireland is very complex. The seascape assessment has only been able to identify seascape types and their relative sensitivity to different types of development at a very high level. However, there are likely to be significant local variations in seascape sensitivity along the entire coast that can only be identified at a project level.

10 SEA Environmental Report Conclusions; Cumulative Effects and recommended actions following testing of the OREDP Development Scenarios

10.1 Conclusions

Overall, the assessment concluded that, based on the extent of the available offshore renewable energy resource within Irish waters, in particular offshore wind and wave energy, and the geographical scale of the overall study area, that it would be possible to achieve the high scenario of 4,500MW from offshore wind and 1,500MW from wave and tidal energy without likely significant adverse effects on the environment.

However, this is subject to a number of qualifications and caveats which include:

- The potential areas identified for development exclude all known technical constraints (aquaculture sites (fish farms), oil and gas infrastructure, pipelines and cables, disposal sites (active and closed) and dredging areas).

- The conclusion that it is possible to achieve the high scenario of 4,500MW from offshore wind and 1,500MW from wave and tidal energy is based on developing areas outside all designated nature conservation sites (Natura 2000 (SACs and SPAs), Ramsar sites, world network of Biosphere Reserves, Marine Nature Reserves (MNRs), National Nature Reserves (NNRs), Natural Heritage Areas (NHAs), Potential Natural Heritage Areas (pNHAs) and National Parks. This approach was taken in order to avoid, at a strategic level, the potential for any significant adverse effects on designated sites. This does not necessarily infer that development would actually have a significant adverse effect on these sites, as the potential for a significant adverse effect to occur depends on whether the qualifying features within a certain site are sensitive to a particular development or features of that development, and therefore does not exclude *per se* these sites from development in the future. However, the results from the SEA and the Appropriate Assessment do conclude that should a developer be interested in developing within a designated site it is highly likely that a number of surveys would be required, in addition to extensive monitoring and research in order to provide sufficient evidence that a particular development would not have a significant adverse effect on the integrity of that site.

- The conclusions recognise that there are number of potential unknowns and potential uncertainty, with regard to the potential for likely significant adverse effects to occur in some areas, in particular relating to the distribution of key benthic habitats and species outside designated sites, and interactions between offshore renewable energy developments on mobile species such as marine mammals, seabirds, reptiles and fish. It is identified that further surveys/monitoring is likely to be required in certain locations in order to determine whether there would be a significant adverse effect on these receptors. However, the conclusions of the assessment also confirm that, due to the scale of offshore renewable energy resource that is available within the assessment areas, where likely significant adverse effects are identified from surveys and monitoring it is likely to be possible to identify alternative sites for development where, with appropriate mitigation, significant adverse effects can be avoided/reduced.

The main objective of the SEA has been to identify where development is most likely to occur, identify the potential environmental constraints in those areas and, taking potential environmental effects/constraints into account, assess the levels of development that could occur in the various Assessment Areas.

Table 7 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. It should be noted that these refer to the levels of development potential that the assessment shows could take place without significant environmental effects. The SEA Environmental Report, for example, notes significant data gaps as outlined in Chapter 9. In future, the scenarios could be revised upwards or downwards depending on the information available.

Table 7: Assessment Results of the Development Potential for the different technologies by Assessment Area

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.

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**

* = 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 therefore unlikely that this technology would be developed at a commercial scale by 2020

*** = The development potential in Assessment Area 1 takes into account the proposed Oriel Windfarm (330MW) and the northern section of Dublin Array (approx 150MW).

**** = The development potential in Assessment Area 2 takes into account the approved Arklow Bank Windfarm (520MW) and Codling Bank (1,100MW) and the southern part of the proposed Dublin Array windfarm (approx 214MW) which is due to receive a grid connection offer in the Gate 3 process

(-) = Limited technical resource available. These areas may contain potential resource for each of the technologies. However, the resource assessment has concluded that for technical reasons e.g. water depths/distances from shore etc, the resource that is available is unlikely to be developed in the timescale of the OREDP (e.g. by 2030).

[15] The Shannon Estuary was assessed for tidal stream energy, but not for tidal barrage which was outside the scope of the SEA.

Wave energy was split between the shallower (10m to 100m depth) and deeper water resource (100m to 200m depth). It is likely that initial wave development which would occur in the main timeframe of the OREDP e.g. 2015 to 2025 is likely to occur in the shallower areas which tend to be located closer, with deeper waters being exploited in the longer term e.g. 2025 to 2030 and beyond.

The figures (MW) included in the table indicate the amounts of development that could potentially be accommodated within an area without likely significant adverse effects on the environment. These figures are not 'caps' on the total level of development that could occur. They simply reflect the results from the assessment of cumulative effects. There are still a number of uncertainties/unknowns. Consequently there is potential that with increased certainty e.g. filling of data and information gaps that these levels of development (MW) in an area could increase or decrease.

Table 7 should provide a high level strategic basis that can helpfully inform the foreshore consenting process. An appropriate Environmental Impact Assessment will still be required for each individual project and the foreshore consenting process can be expected to encompass this requirement (as it does today) going forward.

Table 8 following summarises the assessment of potential cumulative effects with mitigation.

Table 8 Assessment of Potential Cumulative Effects with Mitigation

<table>
<tr><th>Assessment Area</th><th colspan="3">Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="2">Assessment Areas</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="3">Cumulative effects across all receptors for the development of 1200MW are generally negligible to negative. Installation of five or more arrays in this zone may cause significant adverse effects primarily associated with the potential presence of wind farm constraints either side of a very busy shipping channel and commercial fisheries. Effects associated with collision risk and habitat exclusion on birds, and possible barrier effects to marine mammals moving along the coast could also be of likely adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Based on the general seascape character in this area it is likely developments within 0 to 15km from the coast would have moderate cumulative effects on seascape, these effects reducing to slight with increased distance from shore.</td></tr>
<tr><td>600 MW</td><td>1200 MW</td><td>1800 MW</td></tr>
<tr><td>Assessment Area 1: East Coast (North)</td><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
<tr><td rowspan="5">Assessment Area 2: East Coast (South)</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="3">Cumulative effects across receptors for development of up to 1800MW are generally negligible to negative. Installation of seven or more arrays in this area may cause significant adverse effects primarily in relation to effects on protected sites and birds located on the adjacent coastline, and commercial fisheries. Effects relating to collision risk and habitat exclusion on birds could also be of adverse significance. Possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of likely adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Potential effects on seascape are likely to be of moderate significance within 15km of the coast, reducing to slight further offshore.</td></tr>
<tr><td>900 MW</td><td>1800 MW</td><td>2700 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Tidal Developments</td><td rowspan="3">Cumulative effects across receptors for development of up to 15 arrays are generally negligible to negative. Installation of 15 or more arrays in this zone may cause negative effects primarily associated with the potential impacts on marine mammals, commercial fisheries and navigation. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Potential effects on seascape are likely to be of moderate significance within 5km of the coast, reducing to slight within increased distance offshore.</td></tr>
<tr><td>100 MW</td><td>750 MW</td><td>1500 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
</table>

<table>
<tr><th>Assessment Area</th><th colspan="3">Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="5">Assessment Area 3: South Coast</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of between 300MW and 900MW are generally negligible to negative. Further development of up to 1800MW is generally negative to significant adverse. The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 20 – 25m from the coastline. This area overlaps with the area of highest shipping intensity running adjacent to the coastline, and some of it also overlaps with marine SACs at Hook Head, and Saltee Islands, therefore limiting the available area for offshore wind deployment without significant environmental effects.

Installation of between 2100MW and 2700MW in this area is likely to have significant adverse effects on protected sites and birds located on the adjacent coastline, and commercial fisheries. Potential effects in relation to collision risk and habitat exclusion on birds and possible barrier effects to marine mammals moving along the coast are also likely to be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology. Given that most developments would be located very close to the coast, potential cumulative effects on seascape are likely to range from moderate to substantial, particularly where developments affect sensitive seascape types such as large bays which are prominent along the eastern section of the coast in this area.</td></tr>
<tr><td>900 MW</td><td>1800 MW</td><td>2700 MW</td></tr>
<tr><td>Negligible to Negative</td><td>Unknown/ Significant adverse</td><td>Unknown/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Floating Wind Developments</td><td rowspan="3">Cumulative effects across receptors for development of 6000 MW are generally negligible - negative. The potential for adverse effects increases as the size of the area exploited increases. The most significant potential effects are associated with commercial fisheries in terms of exclusion from traditional fishing grounds and marine wildlife due to habitat exclusion and possible barriers to movement, many of which require further work and site specific survey in order to better understand the level of potential effect. In terms of seascape, potential effects reduce from moderate to slight between 24km and 35km from the coast and are generally considered to be negligible beyond 35km as it is difficult to see anything beyond this distance. Providing that the floating wind developments are located in offshore areas (more than 24km from the coast and ideally 35km) potential cumulative effects on seascape character will be slight to negligible.</td></tr>
<tr><td>3000 MW</td><td>6000 MW</td><td>9000 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
</table>

<table>
<tr><th>Assessment Area</th><th colspan="3">Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="11">Assessment Area 4: West Coast (South)</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="3">The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 15m from the coastline, and there is therefore very limited potential to site devices away from sensitive receptors. Potential effects in relation to collision and habitat exclusion on birds and possible barrier effects to marine mammals moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology.

Seascape character throughout in this area is highly sensitive to offshore wind developments. Any development within 15km of the coast is likely to have a substantial effect on seascape, in particular the Skellig Micheal WHS. These effects are also likely to be of substantial to moderate significance up to 24km from the shore, reducing to slight/moderate further offshore e.g. more than 24km and slight/negligible at 35km. There are also likely to be significant adverse impacts on tourism and recreation where devices are sited within Dingle Bay, which is one of the few areas where shallow waters extend far enough to accommodate commercial scale arrays outside of the main shipping lanes.</td></tr>
<tr><td>2 (600 MW)</td><td>4 (1200 MW)</td><td>6 (1800 MW)</td></tr>
<tr><td>Negative</td><td>Unknown/ Significant adverse</td><td>Unknown/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Wave Developments</td><td rowspan="3">Cumulative impacts across receptors for development of up to 3000 MW is generally negligible – negative (although potential adverse affects are greater in the inshore areas). Potential effects in relation to wave arrays relate mainly to potential effects on protected sites and mammals located on the adjacent coastline, navigation and commercial fisheries. Potential effects in terms of collision risk and habitat exclusion impacts on birds, marine mammals, fish and reptiles further offshore, and possible barrier effects to marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential impacts on marine mammals, fish, birds, turtles and benthic ecology.
Wave developments are likely to have less of an effect on seascape character than fixed offshore wind developments. However, the seascape character along the south west coast is considered to be highly sensitive to all forms of development, particularly in regard to potential effects on the Skellig Michael WHS. Although potential effects on seascape can be reduced by increasing the distance of development from the shore, it is likely that even at a distance of up to 15km from the coast a large number of wave developments could have a moderate effect on seascape.</td></tr>
<tr><td>300MW to 600W</td><td>3000MW</td><td>4500MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Negative/ Significant Adverse</td></tr>
<tr><td colspan="3">Number of Commercial Floating wind Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of 5400 MW are generally negligible - negative. Potential adverse effects are likely to increase with larger areas exploited and the most significant potential impacts are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significance of any potential effect. Potential seascape effects can be minimised by developing beyond 24km from shore.</td></tr>
<tr><td>2700 MW</td><td>5400 MW</td><td>8400 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/ Significant adverse</td></tr>
</table>

<table>
<tr><th>Assessment Area</th><th colspan="3">Technology Type and Amounts (MW)</th><th>Summary of Cumulative Effects (Including Mitigation)</th></tr>
<tr><td rowspan="8">Assessment Area 5: West Coast (Centre)</td><td colspan="3">Number of Commercial Fixed Wind Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of up to 300MW are generally negligible. Further development of between 600MW and 900MW is generally negative to significant adverse. The area where water depths are suitable for deployment of fixed wind structures in this area is very narrow, extending out to a maximum of up to 15 - 25 km from the coastline. Installation of up to three arrays in this area could potentially have significant adverse effects on protected sites and birds located on the adjacent coastline. Potential effects on terms of collision risk and habitat exclusion impacts on birds, and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the likely significance of any potential effects on marine mammals, fish, birds, turtles and benthic ecology. Seascape character throughout in this area is generally highly sensitive to offshore wind developments. Any development within 15km of the coast is likely to have a substantial effect on seascape. Any potential effects are also likely to be of substantial to moderate significance up to 24km from the shore. These effects would reduce to slight further offshore e.g. more than 24km, with effects becoming negligible at 35km.</td></tr>
<tr><td>300 MW</td><td>600 MW</td><td>900 MW</td></tr>
<tr><td>Negligible</td><td>Negative/ Significant adverse</td><td>Unknown/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Wave Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of between 1000MW to 3000 MW are generally negligible - negative. Potential effects up to 6000MW are generally negative although effects are likely to be more significant in the inshore areas. Potential effects are primarily associated with protected sites and mammals located on the adjacent coastline, navigation and commercial fisheries. Potential effects in terms of collision risk and habitat exclusion on birds, marine mammals, reptiles and fish, and possible barrier effects to marine mammals moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the likely significance of any potential effects on marine mammals, fish, birds, turtles and benthic ecology. In terms of seascape effects, there are a number of sections of the coastline in this assessment area where seascape character is considered to be sensitive to wave developments. It is therefore likely that, a large number of developments located within 0km to 5km of the coast could potentially have moderate to substantial effects on seascape character. However, these potential effects could be avoided or reduced to slight/negligible by siting developments more than 15km from the coast.</td></tr>
<tr><td>1000 to 3000MW</td><td>3000 to 6000MW</td><td>More than 7000MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Negative/ Significant adverse</td></tr>
<tr><td colspan="3">Number of Commercial Floating Wind Developments</td><td rowspan="3">Potential cumulative effects across receptors for development of 7200 MW are generally negligible - negative. The likely significance of potential effects increase with larger areas exploited and the most significant potential effects are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significant of any effect. Potential moderate to substantial effect on seascape can be reduced by siting developments more than 24km from the coast. However, it is likely that moderate to substantial effects could occur at this distance where the overall number of developments increases. Where there are large numbers of developments any moderate to substantial effects can be further reduced/avoided by siting developments more than 35km from the coast.</td></tr>
<tr><td>3600 MW</td><td>7200 MW</td><td>10,800 MW</td></tr>
<tr><td>Negligible</td><td>Negative</td><td>Unknown/Significant adverse</td></tr>
</table>

Assessment Area	Technology Type and Amounts (MW)			Summary of Cumulative Effects (Including Mitigation)
Assessment Area 5a: Shannon Estuary	Number of Commercial Tidal Developments			It is likely that any commercial scale tidal development in the Shannon Estuary is likely to have a significant adverse effect on the Lower Shannon Estuary SAC and a number of SPA sites that are also associated with the estuary. There are also likely to be significant adverse effects on shipping and navigation due to the high intensity of vessels within the estuary. Potential effects on seascape are likely to moderate to slight, particularly for tidal devices that can be fully submerged. There are also likely to be adverse effects on commercial fisheries within the estuary.
	50 MW	100 MW	150 MW	
	Unknown/ Significant adverse	Unknown/ Significant adverse	Unknown Significant adverse	
Assessment Area 6: West Coast (North)	Number of Commercial Fixed Wind Developments			Water depths within this area allow more potential for development further offshore away from the most sensitive areas, particularly to the north of the area. Potential cumulative effects across receptors for development of 3000MW are generally negligible to negative. Installation of 4500MW in this area may cause negative effects primarily associated with the potential impacts on shipping, commercial fishing and nature conservation. Potential effects associated with collision risk and habitat exclusion on birds, and possible barrier effects to birds, marine mammals and reptiles moving along the coast could also be of adverse significance. Further information is needed to fully understand and quantify the potential effects on marine mammals, fish, birds, turtles and benthic ecology. Moderate to substantial seascape effects could be reduced/avoided by increasing the distance of developments from shore e.g. beyond 24km.
	1500 MW	3000 MW	4500 MW	
	Negligible	Negative	Negative	
	Number of Commercial Wave Developments			Potential cumulative effects across receptors for development of between 1500MW and 7000MW are generally negligible to negative as there is more flexibility for siting developments further offshore. More studies are needed to understand effects on marine wildlife. A large number of developments within 0 to 5km of the coast are likely to have moderate to substantial effects on the main sensitive seascape types in this area. These potential effects can be reduced to slight/negligible by increasing the distance of developments from shore (e.g. beyond 15km from the coast).
	1500MW	3000 to 6000MW	7000 to 8000MW	
	Negligible	Negative	Negative	
	Number of Commercial Tidal Developments			Potential cumulative effects across receptors for development of up to 750MW are generally negligible to negative. Installation of up to 1500MW in this area may have negative effects on shipping, commercial fishing and nature conservation. Potential effects in relation to collision risk and habitat exclusion impacts on birds, marine mammals, fish and reptiles and possible barrier effects to marine mammals and reptiles moving along the coast could also be of adverse significance. Clustering of a large number of tidal developments within 0km to 5km of the coast could have moderate to substantial effects on seascape character. These effects could be reduced by installing developments further offshore (10km/15km) or installing fully submerged devices.
	100 MW	750 MW	1500 MW	
	Negligible	Negative	Negative	
	Number of Commercial Floating Wind Developments			Potential cumulative effects across receptors for development of 7200 MW are generally negligible - negative. The likely significance of effects increase with larger areas exploited and the most significant potential effects are associated with commercial fisheries and marine wildlife, many of which require further work and site specific survey in order to better understand the likely significance of any potential effects. Potential effects on seascape can be reduced by siting developments more than 24km from the coast, preferably 35km offshore.
	3600 MW	7200 MW	10,800 MW	
	Negligible	Negative	Unknown/ Significant adverse	

10.2 Summary of Results from the Cumulative Assessment

Based on the findings of the cumulative assessment as set out in Table 8 above, this section summarises the opportunities for the development (development potential) for the different technologies (fixed and floating wind, wave and tidal energy). The development potential reflects the amounts of development (MW) that could potentially be accommodated in each area without likely significant adverse effects on the environment or other marine activities/users. The SEA also looked at potential cumulative effects that could occur as a result of implementing the OREDP simultaneously with other plans, programmes and legislation. This includes the Habitats Directive, OSPAR, the Marine Strategy Framework Directive, marine spatial planning and Grid 25 implementation.

10.3 Overview of Development Potential (MW) for Fixed and Floating Offshore Wind

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

- Opportunities for offshore wind off the south and west coast (Assessment Areas 3, 4, and 5) are significantly 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 4,500MW scenario identified in the OREDP would have to be met with fixed wind developments in Assessment Areas 1, 2 and 6.

- There is potential for the 4,500MW scenario to be met entirely with development in Assessment Area 6. However, availability of grid connections and grid capacity in this area is currently unknown and could therefore prove to be a limiting factor in developing off the North West coast

- The 4,500MW 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 4,200MW and 4,800MW) providing no significant adverse effects are identified at the project stage for example in terms of shipping and navigation and nature conservation.

- Of the potential 4,200MW to 4,800MW, there is already 2,314MW either consented or due to receive a grid connection offer in the Gate 3 process. It is therefore likely that there would be limited additional development required in this area to achieve the 4,500MW scenario.

10.4 Achieving Development Scenarios for Wave and Tidal Energy

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

Based on these figures, it would appear that the development scenario for 1,500MW for wave and tidal energy could be achieved entirely from wave energy, with a contribution from tidal energy. However there are a number of factors to take into consideration:

- 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 1,500MW will not only depend on industry developing this technology to a commercial scale by 2020 with significant progress by 2030, but will also depend on the provision and availability of necessary onshore infrastructure such as grid connections and capacity.
- There is no tidal potential in the Shannon Estuary due to environment constraints.
- There is potential for tidal energy to contribute towards achieving the scenarios of 1,500MW for wave and tidal energy, although potential environmental constraints associated with this technology are generally greater than wave developments due to the close 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.

10.5 Recommended Actions

Overall the SEA Environmental Report concludes that it would be possible to achieve the scenario for the development of 4,500MW from offshore wind and 1,500MW from wave and tidal. However, there are a number of uncertainties and unknowns associated with this conclusion where there is still potential for significant adverse effects to occur. This conclusion is also based on a number of factors that were taken into consideration in the assessment of potential cumulative effects and identification of the overall amount of development (MW) that could be accommodated within each of the assessment areas without significant adverse effects on the marine environment or other marine activities and users.

These factors included:

- Siting developments outside all known protected areas (MPAs, Ramsar Sites, SPAs, SACs (including candidate and proposed sites)).
- Maximising distance from shore where possible to reduce potential significant effects on seascape character.
- Avoiding all technical constraints e.g. oil and gas infrastructure, telecommunications, electricity cables, aggregate, dredging and disposal areas and aquaculture sites.

Natura Sites and Marine Protected Areas

The Assessment of the Assessment Areas (Chapter 11 of the SEA Environmental Report) identifies that development within Natura sites is likely to have significant adverse effects on the integrity and conservation objectives of those sites. These conclusions reflect the fact that, at the strategic level, the type and nature of development that could occur in a certain area is unknown and that there are still a number of data and knowledge gaps relating to the potential effects of offshore renewable energy developments on marine wildlife in general.

The objective of Chapter 12 of the SEA Environmental Report was to test whether it is possible, based on a number of assumptions, to achieve the development scenarios set out in the OREDP without likely significant adverse effects on the environment. One of these assumptions was that development would not occur within Natura sites. This reflects the findings of Chapter 11 of the SEA ER and the necessity of avoiding likely significant effects. This was not to scope out Natura sites from the assessment, but to identify if and how development could occur without resulting in adverse effects.

Given that there are a number of uncertainties surrounding potential development within Natura sites (relating to data and knowledge gaps) it should be recognised that whilst it is possible to achieve the development scenarios set out in the OREDP without developing in these sites, individual developers may still seek to develop within these protected sites. Where this is the case it would be the responsibility of the individual developer as part of the Foreshore Lease Consenting Process and in accordance with the Habitats Directive to provide the necessary evidence to the regulatory authorities to demonstrate that a specific project or number of projects in a certain location would not have a significant adverse effect on the integrity or conservation objectives of a given site.

The SEA Environmental Report therefore concludes that development should not take place within Natura sites unless it can be comprehensively demonstrated to the authorities, at the project level, that significant adverse effects on the integrity and conservation objectives of the site are unlikely.

10.6 Recommended Actions

Arising out of the strategic environmental assessment, the following actions have been recommended for integration into the OREDP to be taken forward to minimise or reduce the potential for significant adverse effects to occur from offshore wind and marine renewable energy developments in Irish waters. It is noted that additional information on project level mitigation and the deploy and monitor approach can be found in Appendices 2 and 3.

Collaboration and Coordination:

- **Action 1:** Development of a mechanism for greater coordination between all state bodies concerned to improve the effectiveness of the delivery of the OREDP as policy develops. This could include an enhanced role for the existing multi-body Ocean Energy Steering Committee.

- **Action 2:** Collaborative working with the existing Ocean Energy Advisory Group to assist/advise SEAI and DCENR with taking forward the OREDP.

SEA Monitoring Requirements:

- **Action 3:** In accordance with Article 17 of the SEA Regulations 2004, the group identified in the mechanism for enhanced co-ordination in Action 1 shall ensure the significant environmental effects of the implementation of the plan are monitored. This will ensure that unforeseen adverse effects are identified at an early stage and that appropriate remedial action is taken as required.

Addressing Data, Information and Knowledge Gaps:

- **Action 4:** DCENR and SEAI, in the context of the offshore renewable energy sector, should collaborate with the lead authorities on the MSFD and other statutory requirements that are taking forward requirements relating to collation, management and dissemination of data and information collected for the marine environment so that data is made publicly available so that it may be taken into account by those developers and bodies involved in the siting, design, consenting and permitting of individual projects.

Consenting and Permitting:

- **Action 5:** Future foreshore consenting processes should take into account the broad findings and assessment of this SEA and AA in terms of location and constraints.

- **Action 6:** The foreshore consent process should require developers to put in place appropriate monitoring programmes to assess the effects of their development.

- **Action 7:** The foreshore consenting process should consider the application of an incremental (the 'deploy and monitor') approach as part of the scaling up of offshore renewable energy developments.

Guidance and Advice:

- **Action 8:** The project level mitigation measures/EIA Guidance prepared as part of the SEA Environmental Report could be incorporated into National EIA Guidance for offshore renewable energy developments.

- **Action 9:** Development and maintenance of a GIS database tool to inform the Foreshore Consenting process, led by the Marine Institute.

11 Potential for Offshore Renewable Industry Development

In addition to the development scenarios for the resource (which have been the subject of the strategic environmental assessment), the sustainable development of the sector would embrace the enterprise dimension including offshore grid, port infrastructure and the offshore supply chain. This chapter is looking forward as to how the industry might develop and is not the subject of the SEA. As stated, the SEA aimed to assess the scenarios set out for offshore wind, wave and tidal development. A key to finalising overall policy for the development of the offshore renewable energy sector is to quantify and assess the economic costs and benefits. This work is underway.

In the period up to 2020, the challenge will be to deliver the first phase of large scale offshore wind, and to get the first grid connected developments of wave and tidal in the water. A planned approach to delivery of marine renewable energy projects, including developing the appropriate synergies between the foreshore leasing and grid connection processes will be required. Future developments will be shaped by a wide variety of economic, technical, infrastructure and environmental factors.

Wave

1. A grid connected test facility is being developed at Belmullet, County Mayo and, subject to continuing success in developing technologies, will be used as the platform for testing of full scale prototypes.

2. The amount of MW of wave and tidal that can be connected in the period to 2020 will depend to a large degree on technology development, and whether a technological breakthrough is achieved. Wave and tidal current technology is currently at the research, development and deployment stage globally. Another significant factor will be the establishment of an appropriate grid connection process for wave and tidal devices. Wave and tidal devices are not currently included in the group processing approach to grid connection (Gate) by the regulator although the regulator does have a separate process (CER 09/099) which provides for connection outside the Gate for small, low carbon generators and it specifically includes wave and tidal devices. Initial discussions have taken place between the relevant bodies on taking this matter forward.

3. In the period to 2020, the location of wave devices, and project sizes, will be influenced by the findings of the SEA as well as the availability of grid connection nodes and foreshore leases.

Tidal

4. Locations and project sizes for tidal stream energy will be influenced by the recommendations of the SEA and the developing policy framework.

Offshore Wind

5. The 3 projects in Gate 3 totalling 800MW are expected to develop up to 2020. Subject to a variety of factors, including grid developments, there may be further development of additional projects that are already consented in the period to 2020. In the period to 2030, it could be anticipated that there could be significant development off the west coast.

Offshore Grid

6. In the upcoming period, work with our partners on the ISLES project and in the British Irish Council will continue.
7. Ireland is committed to in the North Seas Offshore Grid Initiative and the workstreams arising from it.
8. The TSO, EirGrid, will progress the potential for further interconnection both between Ireland and the UK and Ireland and mainland Europe and will continue its groundbreaking studies on the development of offshore grid.
9. Ireland will give active consideration to use of the co-operation mechanisms under Directive 2009/28 in the context of Ireland's potential to become an exporter of electricity from renewable sources.

Ports/Logistics

10. The growth of the offshore renewable energy sector could lead to new infrastructure and supply chain opportunities. Areas of supply chain opportunity could include servicing the assembly of towers and turbines, their transport to off-shore sites, installation and decommissioning engineering services, the provision of operations and maintenance services and on-shore back-up services. Offshore maritime services could be looked at in the context of port development.

Regulatory Framework

As noted above, it is the intention that planning relating to the offshore function will be improved and streamlined.

In the period 2030-2050, the full potential of the offshore wind, wave and tidal current could expect to be developed with the continuing expansion of projects, as technology develops to cope with more arduous conditions. The development of engineering and port facilities and of onshore and offshore grid is critical to realising that potential. By 2030, an export industry for electricity from renewable sources could be flourishing.

12. Public Consultation and Transboundary Consultation

12.1 Responding to the Public Consultation

In this public consultation phase, the draft OREDP and the draft SEA Environmental Report are being made available to the public on the Department of Communications, Energy & Natural Resources (DCENR) website www.dcenr.gov.ie as well as on the Sustainable Energy Authority of Ireland's website at www.seai.ie.

Four public consultation seminars/workshops are scheduled to take place as follows (Venues and times will be confirmed on the DCENR and SEAI websites and through public advertisements)
Cork – 15th November 2010
Galway – 16th November 2010
Dublin – 18th November 2010
Bundoran – Date to be confirmed

Representatives from DCENR who have been involved in the drafting of this draft plan will attend the public consultation along with representatives from the Ocean Energy Development Unit in SEAI and the consultants involved in compiling the Environmental Report.

Written submissions on the draft OREDP and the SEA Environmental Report may be submitted up to 18 January 2011 either by email to oreseaconsultation@seai.ie or by post to SEA Consultation, Sustainable Energy Authority of Ireland, Wilton Park House, Wilton Place, Dublin 2.

The provisions of the Freedom of Information Acts 1997 to 2003 apply to any submissions received. Information provided in response to the public consultation, may be subject to publication or disclosure in accordance with the legislation. If you regard any information provided as confidential, please indicate this clearly.

12.2 Next Steps following the public consultation

The Sustainable Energy Authority of Ireland will ensure that all comments received on this draft Plan are provided to the DCENR for review, along with the comments on the SEA Environmental Report. A post consultation report will be compiled in Quarter 1, 2011.

Following the public consultation, DCENR will review the feedback received prior to finalising the OREDP. The final version of the OREDP will be adopted and published in the first quarter of 2011 and a Ministerial SEA Statement will be published simultaneously which will reflect how environmental considerations have been integrated into the plan and how the feedback from the public consultation has been considered.

12.3 Transboundary Consultation

The SEA Environmental Report has identified that potential transboundary and in-combination effects are most likely to occur in relation to Northern Ireland. In terms of cross border consultation, the Department of Enterprise, Trade & Investment, Northern Ireland is being formally sent both the draft OREDP and SEA Environmental Report for views.

The SEA Environmental Report also identified transboundary effects relating to the Irish Sea. In light of the longer term potential of the offshore marine sector in an export context, we will also be formally consulting with the UK and French administrations on this draft Plan/SEA Environmental Report.

12.4 Questions for Consideration during the Public Consultation

Do you think that the recommended actions in Chapter 10 are appropriate and achievable?

What are your views on the 'deploy and monitor' approach (see Appendix 3)?

Table 7 provides a high level strategic overview of the level of development that the assessment has shown is possible for the various technologies without significant adverse effects on the environment in the different resource assessment areas. What are your views on the levels of potential development identified?

13. Reviews and Monitoring

2030 is the time horizon of this plan. There will be regular reviews, including an initial review in 2015 and a full review in 2020 to take into account policy development and whether the potential for Ireland to develop as a large scale exporter of clean renewable energy from our marine resources is pursued. Following the reviews, the plan may be modified in light of technology advancements and other developments in the intervening period.

As noted in the Actions a mechanism will be developed for greater coordination between all state bodies concerned to improve the effectiveness of the delivery of the OREDP as policy develops. This could include an enhanced role for the existing multi-body Ocean Energy Steering Committee. In accordance with Article 17 of the SEA Regulations 2004, the mechanism identified for greater co-ordination shall ensure the significant environmental effects of the implementation of the plan are monitored so that unforeseen adverse effects are identified at an early stage and appropriate remedial action is taken as required.

Appendices

Appendix 1
Common Terms /Acronyms used in the draft OREDP

AA – Appropriate Assessment

CER - the Commission for Energy Regulation – the energy regulator for the electricity and gas sectors in Ireland

DCENR - Department of Communications, Energy and Natural Resources (the Irish ministry for Energy)

DEHLG - Department of Environment, Heritage and Local Government (the Irish ministry for Environment)

EIA – Environmental Impact Assessment

EirGrid – the Irish Transmission System Operator (TSO)

ENTSO-E - European Network of Transmission System Operators in Electricity

EPA – Environmental Protection Agency

ER – Environmental Report (one of the main outputs of the SEA process)

ERGEG – European Energy Regulators

ESB Networks /**ESBN** – the Irish Distribution System Operator (DSO)

GSI – Geological Survey of Ireland

ISLES – Irish Scottish Links On Energy Study [Project examining offshore grid part funded by Interreg]

MI – the Marine Institute

NREAP – National Renewable Energy Action Plan [submitted to the European Commission in July 2010 under Article 4 of Directive 2009/28/EC and available at www.dcenr.gov.ie]

OREDP – Offshore Renewable Energy Development Plan

REFIT – Renewable Energy Feed-in-Tariff

RES-E – electricity from renewable sources
RES-H – heat from renewable sources
RES-T – transport energy from renewable sources

SEA – Strategic Environmental Assessment

SEAI – the Sustainable Energy Authority of Ireland - The Sustainable Energy Authority of Ireland (SEAI), formerly the Irish Energy Centre was set up by the government in 2002 as Ireland's national energy authority.

SEM – Single Electricity Market - the wholesale electricity market operating in Ireland and Northern Ireland.

Appendix 2

Project Level Mitigation Measures

(from the SEA Environmental Report)

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Geology, geomorphology and hydrography			
Changes in hydrodynamic/ coastal processes and seabed morphology	CD CC OD	▪ Site specific geophysical and geotechnical surveys to establish a baseline and inform the impact assessment for individual developments. ▪ Modelling of hydrodynamics and sediment transport ▪ Avoidance of placement of devices in areas where sediment transport pathways are modelled as highly sensitive to change ▪ Modelling the effects on coastal processes should form part of pre-project activities to optimise location. ▪ Avoidance of placement of devices within zones where coastal processes are modelled as highly sensitive to change	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Seabed contamination and water quality			
Accidental release of contaminants (hydraulic fluids / vessel fuel)	CD CC OD	▪ Carry out potentially hazardous operations under appropriate weather/tide conditions ▪ Use low toxicity and biodegradable materials ▪ Use minimum quantities ▪ Design for minimum maintenance ▪ Risk assessment and contingency planning ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan).	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Disturbance of contaminated sediments	CD CC	▪ Avoid device/infrastructure placement within 500m of areas of known sediment contamination ▪ Carry out pre-installation bottom surveys ▪ Use installation methods that minimise disturbance of sediments ▪ Carry out work in appropriate tidal conditions to minimise effect ▪ Avoid sensitive time periods for local receptors ▪ Risk assessment and contingency planning ▪ If munitions are encountered advice such as that given in Department of the Marine and Natural Resources 2001 (Marine Notice No. 16 of 2001. (i.e. explosives picked up at sea in trawls or sighted; and ii. the removal of explosive items from wrecks)) should be followed.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Protected sites and species			
Degradation of protected sites	CC CD	▪ Careful site selection avoiding sensitive sites for devices and export cables (i.e. existing and proposed protected sites). ▪ Modelling of sediment transport ▪ Possible mitigation measures relevant to the specific interest features of the sites and their seasonal and other sensitivities are described elsewhere in this table for the relevant topic areas.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Impacts on protected species	CC CD	▪ See sections below on benthic ecology, fish and shellfish, seabirds, turtles and marine mammals.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Benthic Ecology			
Physical disturbance	CC CD	▪ Careful site selection avoiding sensitive sites for devices and export cables (i.e. areas with known sensitive intertidal and subtidal benthic habitats) ▪ Benthic survey to characterise seabed and identify sensitive sites and species. ▪ Avoid installation during sensitive seasons	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Smothering	CC CD	▪ Careful site selection avoiding sensitive sites for devices and export cables (i.e. areas with known sensitive intertidal and subtidal benthic habitats) ▪ Benthic survey to characterise seabed and identify sensitive sites and species. ▪ Avoid installation during sensitive seasons	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Contamination – from sediment disturbance	CC CD	▪ Avoid device/infrastructure placement within 500m of areas of known sediment contamination ▪ Benthic survey to characterise seabed and identify sensitive sites and species	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Accidental contamination (hydraulic fluids or vessel cargo/fuel)	CC CD OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan) ▪ Benthic survey to characterise seabed and identify sensitive sites and species	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Changes in wave regime and tidal flow	OD	▪ Avoidance of important habitats though careful site selection to reduce the potential effects of energy extraction ▪ Benthic survey to characterise seabed and identify sensitive sites and species	▪ Project design stage ▪ EIA stage
Substratum change	CC CD OD	▪ Careful site selection avoiding sensitive sites for devices and export cables (i.e. areas with known sensitive intertidal and subtidal benthic habitats) ▪ Benthic survey to characterise seabed and identify sensitive sites and species	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Fish and Shellfish			
Smothering	CC CD	▪ Avoid sensitive sites/species/periods	▪ Project design stage ▪ EIA stage ▪ Project installation
Noise	S CC CD OD	▪ Adherence to IDWC recommendations to minimise impacts on marine mammals (Irish Whale and Dolphin Group 2005) ▪ Undertaking studies to determine site specific noise effects ▪ Minimise use of high noise emission activities such as impact piling ▪ Avoid installation during sensitive periods ▪ Consider using alternatives (i.e. clump weights, gravity bases, cable protection rather than burial) ▪	▪ Project design stage ▪ EIA stage ▪ Project installation

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Collision	OD	▪ Design device for minimal impact ▪ Do not site devices in particularly sensitive areas – e.g. migration routes, feeding, breeding areas ▪ Maximise device visibility ▪ Use of Acoustic Deterrent Devices (there is concern regarding the benefit of using these devices) ▪ Use of protective netting or grids	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project operation
Hydraulic injury	OD	▪ Use of protective screens to prevent marine organisms from entering the device (i.e. shrouded turbines) ▪ Do not site devices in particularly sensitive areas – e.g. migration routes, feeding, breeding areas	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project operation
Accidental contamination (hydraulic fluids or vessel fuel/cargo)	CC CD OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Design to reduce risk ▪ Avoid shipping routes where collision risk is high ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan)	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Habitat exclusion	OD	▪ No specific mitigation identified	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Substratum loss	CD CC OD	▪ Avoid sensitive sites/species ▪ Site specific surveys to establish a baseline and inform the impact assessment for individual developments ▪ Workshops with expert representatives from the Marine Institute, B.I.M., N.P.W.S., industry and other appropriate bodies	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Changes in wave and tidal regime	OD	▪ Avoid sensitive sites/species/periods	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Barrier to movement	OD	▪ Avoid constrained waterways ▪ Avoid sensitive areas	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
EMF	OC OD	▪ Cable configuration and orientation can reduce field strength Cable burial, where possible to minimise field effect at the seabed	▪ Project design stage ▪ EIA stage
Marine Birds			

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Physical disturbance	CC CD	▪ Avoid sensitive sites/species (i.e. SPAs) ▪ Avoid installation during sensitive seasons (i.e. breeding and moulting) ▪ Site-specific surveys at project level to identify the presence of key foraging hotspots and/or resting areas and to aid site selection	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Noise	CD CC OD	▪ Minimise use of high noise emission activities such as impact piling or blasting ▪ Avoid installation during sensitive periods ▪ Review and consideration of noise reduction techniques (e.g. bubble curtains around the pile) ▪ Use full sound insulation on plant equipment device design. ▪	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Accidental contamination (hydraulic fluids or vessel fuel/cargo)	OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Design to reduce risk ▪ Avoid shipping routes and other areas of potential high collision risk ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan)	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Collision risk	OD	▪ Appropriate siting of developments e.g. away from seabird breeding colonies, important feeding/roosting areas, nearshore areas and “migration corridors”; ▪ Alignment of turbines in rows parallel to the main migratory direction; ▪ Several kilometre-wide free migration corridors between wind farms; ▪ No construction of wind farms between e.g. resting and foraging areas; ▪ Shut-down of turbines at night with bad weather/visibility and high migration intensity; ▪ Avoiding large-scale continuous illumination; ▪ Measures to make wind turbines more recognisable to birds ▪	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Habitat exclusion	OD	▪ Appropriate siting of developments e.g. away from important feeding/roosting areas	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Barrier to movement	OD	▪ Appropriate siting of developments e.g. away from seabird breeding colonies, important feeding/roosting areas, nearshore areas and “migration corridors” ▪ Site-specific surveys at project level to identify the presence of key foraging hotspots and/or resting areas and to aid site selection	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Marine Mammals			
Physical Disturbance	CC CD	▪ Detailed study would be required to examine marine mammal distribution around the coast in order to fully understand and mitigate for this risk. ▪ Avoid sensitive sites/species ▪ Avoid installation during sensitive seasons	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Noise	S CC CD ODOC	▪ Minimise use of high noise emission activities such as impact piling and blasting. ▪ Avoid installation during sensitive periods ▪ "soft starting" piling activities / passive acoustic deterrents – gradually increasing noise produced to allow mammals to move away from activities ▪ Underwater noise during operation may be beneficial in alerting species to the presence of the device, reducing the risk of collisions. This requires further research. ▪ Noise from operating turbines can be reduced by using isolators. However this has not been tested over long term and to account for cumulative effects ▪ Use sound insulation on equipment. ▪ Use of bubble curtains (this is expensive and may only be effective in shallow water). ▪ Use acoustic deterrent or disturbance devices to scare sensitive species away ▪ Use of mammal observers and passive acoustic monitoring to facilitate implementation of exclusion zone during noisy activities ▪ Use of IWDG recommendations for multibeam survey and cetacean impacts	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Collision risk	CD CC OD	▪ Design device for minimal impact ▪ Do not site devices in particularly sensitive areas – e.g. migration routes, feeding, breeding areas ▪ Increase device visibility, or use of acoustic deterrent devices ▪ Enforce speed limits for vessels used in construction and establish a code of conduct to avoid disturbance to marine mammals both during construction activities and in transit to the construction area if entering areas of high animal abundance. ▪ Use of protective netting or grids ▪ Seasonal restrictions could be placed on operation to avoid impacting on marine mammals at vulnerable times such as breeding season. ▪ The use of acoustic deterrents such as pingers or acoustic harassment devices. ▪ Soften collision by adding smooth edges or padding. ▪ Protect against entrapment by incorporating escape hatches into device design.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Accidental contamination (hydraulic fluids or vessel cargo/ fuel)	CC CD OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Design to reduce risk ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan)	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Habitat Exclusion	OD	▪ Avoid sensitive sites/species ▪ Surveys of habitat use by marine mammals	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Barrier to movement	OD	▪ Detailed study would be required to examine coastal distribution in order to mitigate for this risk and avoid large installations in migratory corridors ▪ Avoid sensitive areas ▪ Avoid placement of devices within constrained areas where array could completely block or cause a significant perceptual barrier to marine mammals	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
EMF	OC OD	▪ Cable configuration and orientation can reduce field strength ▪ Cable burial, where possible to minimise field effect at the seabed	▪ Project design stage ▪ EIA stage
Marine Reptiles			
Collision	CC CD OD	▪ Design device for minimal impact ▪ Do not site devices in particularly sensitive areas – e.g. migration routes, feeding, breeding areas ▪ Increase device visibility, or use of acoustic deterrent devices ▪ Enforce speed limits for vessels used in construction and establish a code of conduct to avoid disturbance to marine reptiles both during construction activities and in transit to the construction area if entering areas of high animal abundance. ▪ Use of protective netting or grids ▪ Seasonal restrictions could be placed on operation to avoid impacting on marine reptiles at vulnerable times such as breeding season. ▪ The use of acoustic deterrents such as pingers or acoustic harassment devices. ▪ Soften collision by adding smooth edges or padding. ▪ Protect against entrapment by incorporating escape hatches into device design.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Accidental Contamination (hydraulic fluids or vessel cargo/fuel)	CC CD OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Design to reduce risk ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan)	▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Barrier to movement	OD	▪ Detailed study would be required to examine coastal distribution in order to mitigate for this risk and avoid large installations in migratory corridors ▪ Avoid sensitive areas ▪ Orientating arrays parallel to the coastline rather than perpendicular to the coastline may help minimise a barrier effect as marine reptiles swim past ▪ Avoid placement of devices within constrained areas where array could completely block or cause a significant perceptual barrier to marine reptiles	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Noise	S CC CD OC OD	▪ No specific mitigation identified	▪ NA
EMF	OD OC	▪ Cable configuration and orientation can reduce field strength ▪ Cable burial, where possible to minimise field effect at the seabed	▪ Project design stage ▪ EIA stage

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Habitat exclusion	OD	▪ No specific mitigation identified	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Marine and Coastal Archaeology and Wrecks			
Direct disturbance of unknown and known sites	CC CD	▪ Conform to the legislative requirements of the National Monuments Acts 1930-2004 and follow the codes of practice published by the National Monument Service ▪ Carry out seabed investigations in preferred site locations prior to device installation. ▪ Avoid sites of interest and exclusion zones for marine archaeology ▪ Submit any artefacts recovered to the National Monuments Service ▪ Avoid protected and other sites of interest ▪ In addition to desk based studies, carry out field walkovers in preferred terrestrial site locations to determine need for site investigations (geophysical surveys/trial trenching) in consultation with the National Monuments Service and Local Authorities.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Changes to sediment regime	OC OD	▪ Conform to the legislative requirements of the National Monuments Acts 1930-2004 and follow the codes of practice published by the National Monument Service ▪ Carry out seabed investigations in preferred site locations prior to device installation. ▪ Avoid sites of interest and exclusion zones for marine archaeology ▪ Record and report potential archaeological and vessel remains to the National Monuments Service.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Data acquisition	CC CD	▪ Conform to the legislative requirements of the National Monuments Acts 1930-2004 and follow the codes of practice published by the National Monument Service ▪ Record and report potential archaeological and vessel remains to the National Monuments Service.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Commercial Fisheries			
Direct disturbance	CC CD	▪ Avoid device placement in sensitive areas ▪ Avoid key and peak fishing seasons for installation ▪ Clear area of debris post installation ▪ Early liaison with the fishing industry could help identify key fishing areas, particularly in the area where there is a lack of fishing effort distribution information for vessels under 15m ▪ Minimise effects by using procedures and structures that reduce the area of seabed disturbed for turbine foundations	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Temporary displacement from traditional fishing grounds	CC CD	▪ Avoid device placement in sensitive areas ▪ Avoid key and peak fishing seasons ▪ Liaison with the fishing community to keep them informed of installation operations.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Long term displacement from traditional fishing grounds	OC OD	▪ Avoid device placement in sensitive areas ▪ Consider spacing of turbines at wide enough intervals to permit use of mobile fishing gear. ▪ Workshops with expert representatives from the Marine Institute, B.I.M., N.P.W.S., industry and other appropriate bodies ▪ Liaison with industry and B.I.M	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project operation and maintenance
Aquaculture			
Smothering	CC CD	▪ Avoid sensitive sites/species/periods ▪ Consider cable installation methods that minimise suspended sediment (e.g. plough installation)	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation
Substratum loss	CC CD	▪ Avoid device placement in or near to existing fish farms	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage
Accidental contamination (hydraulic fluids or vessel fuel / cargo)	CC CD OD	▪ Design devices to minimise risk of leakage of pollutants ▪ Risk assessment and contingency planning ▪ Design to reduce risk ▪ Avoid shipping routes ▪ Implementation of SOPEP (Shipboard Oil Pollution Emergency Plan).	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation ▪ Project operation and maintenance
Ports, Shipping and Navigation			
Displacement of shipping	CD CC OD	▪ Where feasible site devices away from constraints and areas of high vessel densities ▪ Undertake a navigation risk assessment (NRA) which should include a survey of all vessels in the vicinity of the proposed development ▪	▪ Site / cable route selection stage ▪ Project design stage ▪ Project installation stage ▪ Project operation and maintenance
Decreased trade / supply	CD CC OD	▪ Maintain good communications with the relevant ports ▪ Issue the appropriate notifications during installation and maintenance ▪ Site selection for device arrays to take into account the requirement for continued access to port and harbours	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation stage ▪ Project operation and maintenance

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Reduced visibility	CD CC OD	▪ Avoiding areas of high vessel densities and areas constrained by land e.g. adjacent to the entrances of ports and Lochs. ▪ In busy shipping areas, potential effects may be reduced by minimising the period of installation, the number of vessels required and the area occupied during installation would reduce the potential impact on visibility. ▪ Any vessels and devices should be lit and marked in accordance with the International Association of Marine Aids to Navigation and Lighthouse Authorities (IALA) guidelines, in agreement with the Commissioners of Irish Lights.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation stage ▪ Project operation and maintenance
Collision risk	CD CC OD	▪ Avoid constrained areas or areas of high shipping densities and regularly used shipping routes. ▪ In busy shipping areas, potential effects may be reduced by minimising the period of installation, the number of vessels required and the area occupied during installation. ▪ Maintain good communications with the relevant ports, and issue the appropriate notifications during installation, maintenance, and decommissioning. ▪ The scale of potential effect on navigation should be assessed as part of the EIA and NRA as outlined above.	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation stage ▪ Project operation and maintenance
Recreation and Tourism			
Access Restrictions	CC CD OD	▪ Undertake construction, where possible, outside of peak tourist seasons (June to September) to minimise disruption to visitors and local people. ▪ Identify and avoid popular routes for sailing or other water sports such as kayaking. ▪ Where possible, facilitate safe access through arrays for sailing or other water sports.	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Noise	CC CD OD	▪ Avoid key recreational periods for installation works ▪ Identify and avoid popular recreational areas when possible	▪ Site / cable route selection stage ▪ Project design stage ▪ EIA stage ▪ Project installation stage
Safety and Collision Risk	CC CD OD OC	▪ Avoid popular cruising routes, diving areas and key water sport locations ▪ Incorporate suitable safety features such as lighting, netting and buoys into the device design. ▪ Provide suitable information for the public regarding safety ▪ Restrict access to construction sites ▪ Observe good practice during construction, removal and maintenance	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage ▪ Project installation stage ▪ Project operation
Disturbance to Wildlife	CC CD OD OC	▪ Avoid areas that are popular with tourists and wildlife tour operators. ▪ Other mitigation measures aimed at reducing or avoiding disturbance to wildlife including sea mammals and birds is set out in the relevant parts of this table.	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Aviation Radar			

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Collision	OD	▪ Ensure wind devices are lit with aviation lights in accordance with OAM 09/02 "Offshore Wind Farms Conspicuity Requirements" ▪ As required under the Obstacles to Aircraft in Flight Order, S.I. 215 of 2005, provide notification of the erection of wind devices to the IAA	▪ Site selection stage ▪ Project design stage ▪ Project EIA stage ▪ Project installation stage ▪ Project operation
Radar interference	OD	▪ Consultation with the IAA will be required and the location of wind devices supplied so they can be accurately plotted on the radar and any signals received from that area will not be confused with aeroplanes.	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Military Exercise Areas			
Disruption to general activities	CC CD OD OC	▪ Avoidance of byelawed and danger sites ▪ Carry out site selection studies in conjunction with liaison with the Department of Defence, ROI and the Ministry of Defence, UK where applicable	▪ Site / cable route selection stage ▪ Project design stage ▪ Project installation
Cables and Pipelines			
Direct damage	CC CD OC OD	▪ Use of recommended 500m avoidance zone ▪ Use of crossing agreements in accordance with ICPC guidelines ▪ The seabed lease pertaining to existing infrastructure will legally need to be observed when selecting sites for devices and export cables	▪ Site / cable route selection stage ▪ Project design stage
Access Restrictions	CC CD OC OD	▪ Use of recommended 500m avoidance zone ▪ Use of crossing agreements in accordance with ICPC guidelines ▪ The seabed lease pertaining to existing infrastructure will legally need to be observed when selecting sites for devices and export cables	▪ Site / cable route selection stage ▪ Project design stage
Dredging and Disposal Areas			
Access restrictions	CC CD OD OC	▪ Avoid development within 500m of dredging and/or disposal sites ▪ Notification of port and harbour authorities of the proposed works	▪ Site / cable route selection stage ▪ Project design stage ▪ Project installation ▪ Project operation and maintenance
Existing Renewable Infrastructure			
Access restrictions	CC CD OD OC	▪ Careful site selection to factor in the access needs of existing infrastructure to ensure that the proposed sites do not conflict with the activities of existing renewable infrastructure ▪ Communication with existing wind farm operators	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage ▪ Project operation and maintenance

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Removal of energy resource	OD OC	▪ Careful site selection taking into account resource assessment and modelling to determine if and how commercial-scale arrays could coexist with the existing renewable infrastructure.	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Natural Gas and CO_2 Storage			
Sterilisation of region	OD OC	▪ No specific mitigation measures identified ▪ Consultation with the relevant regulatory body to establish areas of search for possible future gas/carbon storage sites within Irish waters	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Oil and Gas Activity			
Access restrictions	CC CD OD OC	▪ Consultation with the relevant regulatory body would be required prior to siting of any renewable devices ▪ Careful site selection avoiding areas of existing and proposed oil and gas activity	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage ▪ Project operation and maintenance
Collision	CC CD OD OC	▪ Consultation with the relevant regulatory body would be required prior to siting of any renewable devices ▪ Careful site selection avoiding areas of existing and proposed oil and gas activity	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage ▪ Project operation and maintenance
Sterilisation of region	OD OC	▪ Consultation with the relevant regulatory body would be required prior to siting of any renewable devices ▪ Careful site selection avoiding areas of existing and proposed oil and gas activity	▪ Site / cable route selection stage ▪ Project design stage ▪ Project EIA stage
Seascape			

Potential Effect	Development Phase	Suggested Project Level Mitigation Measures	Timescale
Effects on seascape from offshore wind developments	CD OD	▪ Consideration should be given to locating devices at a maximum distance from the shore/coast (within technological constraints) ▪ Wind farms should not be sited where they appear to block or close the entrance to bays/loughs/narrows/sounds or where they separate a bay from the open sea ▪ Wind farms should reflect the shape of the coastline and align with the dominant coastal edge ▪ Wind farms should not be sited where they have the potential to fill a bay. The open, expansive nature of the water surface area should be allowed to continue to dominate ▪ Wind farms should avoid locations near scattered settlements, as the scale of the array has the potential to dominate the fragmented pattern of the settlement ▪ Wind farms should be avoided where they conflict with the scale and subtleties of complex, indented coastal forms ▪ Consideration should be given to locating devices in already industrialised and developed seascapes	▪ Project design stage
Climate			
Potential sterilisation of future gas/carbon storage areas	OC OD	▪ Consultation to establish areas of search for possible future gas/carbon storage sites within Ireland waters	▪ Site selection ▪ Project design

Key: CC – construction/decommissioning cables; CD – construction/decommissioning devices; OC – operation cables; OD – operation devices; S – survey

Appendix 3

SEA Environmental Report Explanation of the "Deploy & Monitor" Approach

The deploy and monitor approach to development has been identified as one of the mechanisms for acquiring necessary information on how offshore renewable energy developments interact with the marine environment, and in particular how interactions, and associated potential effects, change as developments are scaled up from demonstration and test projects through to a full scale commercial developments. This information helps increase confidence and certainty amongst environmental authorities on the potential effects of commercial scale offshore renewable energy developments and associated potential cumulative effects.

This approach would also help to reduce the potential barriers to development associated with knowledge and data gaps and the subsequent requirement to adopt a precautionary approach to development where there is uncertainty over potential effects on the environment. It will also demonstrate support to the industry and encourage investment by enabling commercial offshore renewable energy developments to be deployed on a stage by stage basis within an agreed framework of monitoring and research.

The main aims of the incremental or deploy and monitor approach to development are:

- Adopt a stage by stage approach to the deployment of commercial scale offshore renewable energy developments by attaching conditions to site leases that would specify that developments of a certain size or scale may only be permitted within the first few years of the lease award.
- Only permit consents for larger scale commercial developments where there is evidence (from surveying and monitoring) that the current development is not having an adverse effect on the environment and that there is sufficient evidence to support conclusions that a large scale development would also not have adverse effects on the environment. This may require the inclusion of more than one deploy and monitor stage within a lease agreement.

Appendix 4

Constraint Maps