

Our Ocean Wealth

Towards an Integrated Marine Plan for Ireland

*Seeking Your Views on
New Ways;
New Approaches;
New Thinking*

Background
Briefing
Documents

Part II: Sectoral Briefs



Purpose of these documents

Three briefing documents have been prepared to accompany the document *'Our Ocean Wealth – Seeking Your Views on New Ways; New Approaches; New Thinking'*. These documents provide further background information to support the development of an Integrated Marine Plan for Ireland. Further information is available on www.ouroceanwealth.ie

Part I: Context

- Provides an economic and environmental profile of our oceans and an overview of marine governance and policy (national and international) context

Part II: Sectoral Briefing Papers

- Profiles of our marine sectors including an overview of current government plans and policies in place
- Seafood (fisheries, aquaculture, seafood processing) and Seaweed
- Shipping, Ports (and Services)
- Marine Renewable Energy
- Offshore Oil & Gas and seabed resources
- Marine and coastal tourism and leisure including cruise tourism
- Marine ICT
- Marine Biotechnology and Bioproducts

Part III: Enablers

- Describes the so-called 'enablers' that can assist Government in getting the conditions right for growth and investment.
- Licensing, Planning and Compliance
- Marine Research & Innovation
- Integrated Mapping
- Maritime Safety, Security and Surveillance
- Education and Training
- European Marine Policy Framework

PART II: SECTORAL BRIEFS

TABLE OF CONTENTS

1. Seafood (Fisheries, Aquaculture & Seafood Processing) and Seaweed	1
1.1 Profile of the sector	1
1.2 Opportunities and Key Constraints	4
1.3 Existing Government Policy, Plans and Targets	7
2. Shipping, Ports and Services.....	10
2.1 Profile of the sector	10
2.2 Opportunities and Key Constraints	13
2.3 Existing Government Policy, Plans and Targets	13
3. Marine Renewable Energy (Offshore Wind, Wave and Tidal Energy)	15
3.1 Profile of the sector	15
3.2 Opportunities and Constraints.....	21
3.3 Existing Government Policy, Plans and Targets	21
4. Offshore Oil & Gas and Offshore Minerals.....	26
4.1 Profile of the sector	26
4.2 Opportunities and Key Constraints	28
4.3 Existing Government Policy, Plans and Targets	29
5. Marine and Coastal Tourism and Leisure (including Cruise Tourism)	31
5.1 Profile of the sector	31
5.2 Opportunities and Key Constraints	32
5.3 Existing Government Policy, Plans and Targets	36
6. Marine ICT and SmartOcean.....	38
6.1 Profile of the sector	38
6.2 Opportunities and Key Constraints	40
6.3 Existing Government Policy, Plans and Targets	40
7. Marine Biotechnology and Bioproducts	42
7.1 Profile of the sector	42
7.2 Opportunities and Key Constraints	44
7.3 Existing Government Policy, Plans and Targets	46
Glossary of Acronyms / Terms	48

1. SEAFOOD (FISHERIES, AQUACULTURE & SEAFOOD PROCESSING) AND SEAWEED

1.1 Profile of the sector

The Seafood sector comprises the commercial sea fishing industry, the aquaculture industry and the seafood processing industry. The Irish seafood industry makes a significant contribution to the national economy in terms of output, employment and exports. It is estimated that the industry contributed approximately €719 million to the national economy in 2010, supporting an estimated 11,000 jobs in rural coastal regions, mostly in rural coastal communities¹.

Primary Production from Fisheries (Sea Fisheries and Aquaculture)

The Irish fishing fleet, made up of 2,132 vessels, operates within four defined segments - Pelagic, Polyvalent, Inshore and Coastal fleet. In 2009 these vessels landed over 282,000 tonnes of fish (over 170,000 tonnes landed in home ports) with an associated first sale value of €158m. This represented a decline of 9.7% in volume terms in comparison to 2007, however early indications are that there has been a stabilisation and modest recovery in output in 2010, driven by the strong market demand for farmed Irish seafood products. This positive performance is expected to continue in 2011.

Market Opportunity

Experts from the FAO and the World Bank predict that the global trend of rapidly growing demand for seafood will continue for at least three decades.

The graph from the FAO shows that an additional 42 million tonnes of farmed seafood will be required by 2025. Aquaculture is the fastest growing food sector in the world.

The rising global population and the shift in economic power towards the east, mean that seafood demand is set to rise sharply for the foreseeable future.

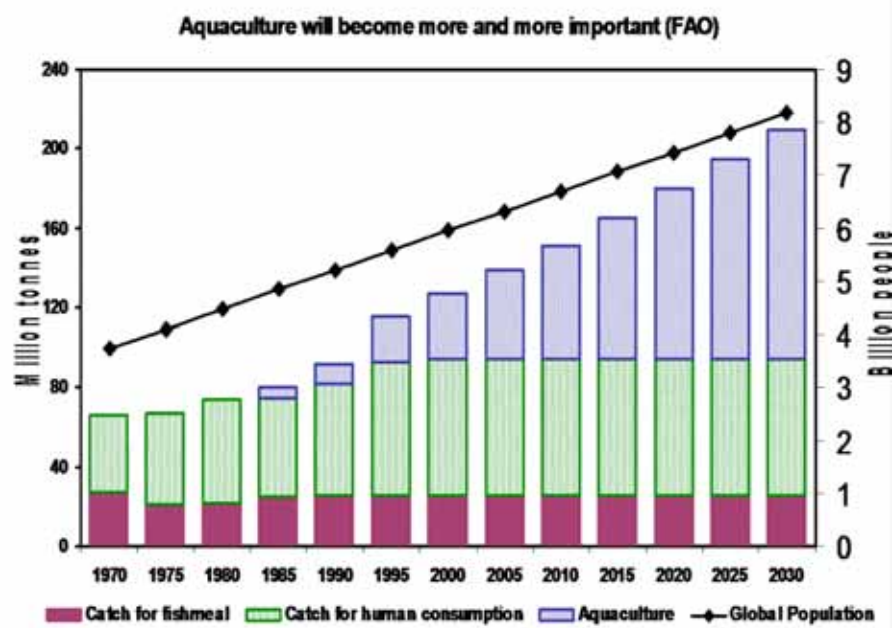


Figure 1: Projected demand for seafood and the respective roles of fisheries and aquaculture in the future supply (Source: FAO)

¹ Department of Agriculture Fisheries and Food, (2009) Annual Review & Outlook for Agriculture, Fisheries & Food 2009/2010

The EU market for seafood is already 65% dependent on imports. As supply becomes more restricted, it is anticipated that prices will rise and farmed fish will contribute a hugely increased share of global supply. There is a clear opportunity for Ireland, with its pristine marine environment, to become a major exporter of farmed seafood, particularly to the European market.

The Seafood Market

The market for Irish seafood was valued at some €719 million in 2010, of which €340 million was in domestic sales and €379 million was exports. In common with other food sectors, seafood companies faced buoyant export markets but a difficult demand situation on the home market. Irish seafood exports increased by 14% in 2010 to €378 million compared with the previous year with a further increase of 13% to €420m in 2011. The significant contributors to this success as well as favourable currency movements, were sales of Irish salmon, mostly organic, which grew in value by one third to €67 million; increased volumes of pelagic products, (mackerel, herring, horse mackerel) at €112 million and strong shellfish sales at €143 million. The EU is the main market destination for 80% of Irish seafood exports with the remaining 20% going to Russia, Africa and Asia. At present 85% of all Irish seafood is commodity traded and vulnerable to competition from cheaper imports from low cost countries. Having regard to these lower production costs, the strategy for the future of Irish seafood must be to facilitate development of added value through innovation and new product development while also pursuing cost competitiveness throughout the sector.

Seafood Processing Sector

During 2010 the processing sector generated direct revenue of €559 million. Close to 70% of output from this sector goes for export to markets as diverse as France, UK, Spain, Italy, Germany and commodity markets in Russia, Nigeria and Egypt.

The sector is concentrated in the coastal regions of Donegal, Cork, Kerry and in the South East. The industry is facing limitations on raw material supply and the need to scale-up to meet demand in competitive export markets. Currently there are some 138 companies engaged in handling, processing, distribution and marketing of seafood. Twenty of these companies turnover between €5 million and €50 million p.a. and these represent approximately 60% of the total turnover in the sector. The remaining 118 companies are small with turnover of less than €1million and are focussed on the domestic and niche exports markets. Altogether the sector employs 2,867 people.

The Seafood Benchmark Report 2009, commissioned by BIM in partnership with Enterprise Ireland, reports on practises and performance of the seafood sector against world-class food organisations. The findings indicated that the sector performs well in the manufacturing areas of production, quality management and logistics. However, the sector needs to address a number of strategic and development areas to ensure future viability and growth. These include:

- Low sector profitability - the report found that 44% of the sample group of companies had recorded a loss or zero net profit in the last accounting year and that 41% of the companies recorded negative sales growth.
- The leadership, strategic management and investment practices were scored low, and there is a lack of customer, consumer and market perspective with a poor focus on customer awareness. Innovation and new product development practice need to be prioritised as a critical component to the business viability.
- The environmental management systems are not integrated into the core business functions.

Based on these findings and consistent with the Government's Food Harvest 2020 Strategy, BIM and the processing sector have developed a profitable growth strategy for the sector. This sets out a number of measures to address the challenges found in the Benchmarking study. The measures are geared to boost value adding in the sector. They include mentoring and through specialised business planning, differentiation of Irish seafood, the scaling-up of the sector with potential expanded raw material supplies from increased aquaculture output and landings from foreign vessels and by engendering increased co-operation between processors in co-processing, sales and marketing areas.

Food Harvest 2020 recognises the potential to capitalise on Ireland's high quality natural seafood and sets out a vision to grow the seafood industry to €1 billion and employment to 14,000 by 2020. Key strategy recommendations for the seafood processing sector include:

Support innovation and value adding:

- The development of innovative, value added, consumer orientated seafood products through BIM Seafood Development Centre and Teagasc Ashdown Food Research Centre.

Scaling, restructuring and competitiveness:

- The share of catch being processed by Irish companies should be progressively increased, adding value in Ireland. While seeking to maximize landings from Irish vessels, sourcing additional supply for Irish processors from non Irish vessels should be encouraged.
- While recognizing the place of specialist processors serving niche markets, restructuring and enhanced co-operation within production, processing, sales, marketing should be supported by specific programmes.
- The skills level in the sector should be augmented by focused technical training and boosting of management competence through the induction of training, mentoring programmes and Graduate Placement programmes.

Marketing and Differentiation:

- The implementation of quality and traceability labelling including voluntary labelling and certification for Irish fish products accelerated by the sector with appropriate supports from BIM and Bord Bia to differentiate Irish products on domestic and export markets.
- Greater integration of seafood into the wider Irish food sector.

The **Irish aquaculture sector** consists of 850 licensed aquaculture operations (mostly shellfish) covering 2000 sites. The volume and value of output from the sector reached 47,400 tonnes valued at €104million in 2009, representing an 11% increase on 2008. Of this amount shellfish production was valued at €36m, while the corresponding figure for finfish was €68m. Further growth in output has been reported in 2010 with a turnover of €115m. At present 68% of total production is exported.

Fish farming continues to provide valuable employment around the coast of Ireland, especially in counties Cork, Donegal, Galway, Louth, Wexford and Waterford. Some 1952 people were directly employed in the sector on a full and part time basis in 2009.

Ireland has an established and a comprehensive system of environmental and food safety monitoring for the aquaculture industry which meets EU and market demands.

There is significant scope for aquaculture expansion in Ireland, including in deep water sites. It is estimated that each new large-scale deep water salmon farming site could generate an extra €100m in exports per annum and create 350 direct jobs with a further 150 indirect jobs in service sector supplying fish feed, netting, transportation and other services. Work is underway to examine and prepare three suitable deep water sites.

Seaweed (Aquaculture & Wild Seaweed Harvesting)

There is a significant and expanding global market for seaweed, with total output reaching 15.8 million tonnes in 2008, valued at \$7.4 billion². The use of seaweed in non-food applications is increasing, with clearly defined markets for seaweed as dietary supplements; over-the-counter medicines and pharmaceuticals; animal feeds; in agriculture and horticulture; as an aquaculture feed; as the basis of bioremediation and for use in cosmetics. Seaweeds are increasingly being recognised as a source of novel bioactive compounds with applications in pharmaceutical and functional foods, many of which are only being discovered.

² FOA- Fisheries and Aquaculture Department of the Food and Agriculture Organization of the United Nations (2010), The State of World Fisheries and Aquaculture 2010

³ Bord Iascaigh Mhara, (2011), A Market Analysis towards the Further Development of Seaweed Aquaculture in Ireland.

Ireland's seaweed industry is following international trends and is expanding. The sector is worth approximately €18m per annum, processes 36,000 tonnes of seaweed (entirely from wild resources) and employs 185³. The Irish seaweed resource and industry is based primarily on inter-tidal harvesting and is concentrated along the west and south coasts from Co. Donegal to Co. Waterford. The product range is limited in the main to high-volume, low-value products such as animal feeds and plant supplements and agricultural products. A smaller proportion goes into higher-value products such as foods, cosmetics and therapies. Although there is strong industry interest in wild harvest of the significant sub-tidal seaweed (e.g. kelps) resource, it is constrained by the absence of a regulatory framework and management plan. Seaweed aquaculture activity in Ireland is limited to only a small number of licensed sites in Cork, Kerry and Galway, with a number of new license applications pending. Work carried out by BIM and industry partners over a number of years has developed seaweed hatchery and grow-out capabilities for a number of species⁴⁵; shown the commercial viability of grow-out given the right conditions⁶; and led to the increased industry activity and interest in seaweed aquaculture.

1.2 Opportunities and Key Constraints

	Opportunities	Constraints
Sea Fisheries Resource	<ul style="list-style-type: none"> ✓ Rebuilding and managing the fish stocks so as to enable higher annual fish quotas ✓ Increasing the value of fish caught by: <ul style="list-style-type: none"> ○ moving from production-led to a market-led sector; ○ developing new higher value seafood products and presentations; ○ differentiating Irish seafood from cheaper third country imports; ○ improving the quality and presentation of catch ○ attracting a larger share of the fish caught in waters from the North of France to the North of Scotland to be landed into Ireland for sale, processing and transportation 	<ul style="list-style-type: none"> ✓ Access to resources: Review of CFP: <ul style="list-style-type: none"> ○ Implementation of MSY by 2015 ○ possible reductions in allowable catches for some stocks in the short-term ○ Introduction of 'concessions' / Individual Transferable Quotas (ITQs) and landings of Irish quota into foreign ports ✓ Profitability: <ul style="list-style-type: none"> ○ trends in fuel costs, ○ global trade patterns; and ○ reduced prices for seafood products. ✓ Impacts of fishing to achieve Good Environmental Status (GES) required under the MSFD
Aquaculture (shellfish, finfish)	<ul style="list-style-type: none"> ✓ Strong global demand for both finfish and shellfish ✓ Further develop existing network of conventional sites to increase productivity and output ✓ Create additional output via high volume offshore sites, especially for marine finfish production ✓ New species (e.g. cod, turbot) ✓ Specialisation in organic and 'eco-certified' aquaculture 	<ul style="list-style-type: none"> ✓ Licensing and funding difficulties arising from challenges on the State regulatory structure in achieving compliance with the Birds and Habitats Directives.

³ Socio- Economic Marine Research Unit, NUI, Galway (2011), Ireland's Ocean Economy.

⁴ Bord Iascaigh Mhara, (2011), Cultivating Laminaria digitata' BIM Aquaculture Explained No 26

⁵ Bord Iascaigh Mhara, (2011), Cultivating Palmaria palmata', BIM Aquaculture Explained No 27.

⁶ Bord Iascaigh Mhara, (2011), Business Plan for the Establishment of a Seaweed Hatchery and Grow-out Farm

	Opportunities	Constraints
Seafood Processing	<ul style="list-style-type: none"> ✓ strong global demand in new markets e.g. China, India and rest of Asia ✓ Seafood innovation and new product development ✓ maintenance of an international reputation for wholesome, fresh and natural seafood, produced in the most sustainable and environmentally friendly manner 	<ul style="list-style-type: none"> ✓ Profitability of the sector <ul style="list-style-type: none"> ○ lack of scale, ○ high production costs ✓ Inconsistency of product supply ✓ Inefficient logistics chain ✓ Reduced prices for seafood products. ✓ Low cost imports from countries operating from significantly lower cost bases ✓ Lack of differentiation of Irish seafood
Seaweed (Wild and Aquaculture)	<ul style="list-style-type: none"> ✓ High market potential ✓ Exploiting the multiple biological functionality of seaweeds, generating increased added value ✓ 'Ireland brand' – provenance/quality <p>Seaweed Aquaculture</p> <ul style="list-style-type: none"> ✓ Controlled production of high-value seaweed including excellent growing conditions and suitable sites <p>Wild Resource</p> <ul style="list-style-type: none"> ✓ Abundant renewable wild seaweed resource 	<p>Seaweed Aquaculture</p> <ul style="list-style-type: none"> ✓ Ongoing R&D support to improve hatchery and grow-out techniques <p>Wild Resource</p> <ul style="list-style-type: none"> ✓ The absence of a management plan and regulatory framework for Ireland's seaweed resource ✓ Lack of current data on total and harvestable biomass and species distribution ✓ Property rights ✓ Labour intensive

The potential for the sector lies in adding value to the existing wild catch which is likely to remain stable and boosting output from aquaculture through a move offshore while also increasing productivity from existing conventional sites. All Irish seafood products should be quality and eco-assured, processed and delivered in the most efficient and cost effective manner and targeted at high value markets both in the EU and elsewhere.

In sea fisheries growth potential lies in increasing the value of the fish caught by:

- (a) rebuilding and managing the fish stocks so as to enable higher annual fish quotas in line with Common Fisheries Policy (CFP) objectives and Maximum Sustainable Yields (MSY) obligations
- (b) fishing for the market
- (c) improving the quality and presentation of catch
- (d) developing new higher value seafood products and presentations
- (e) attracting a larger share of the €1.18 billion worth of fish caught in waters from the North of France to the North of Scotland to be landed into Ireland for sale, processing and transportation.

The reform of the **Common Fisheries Policy**, currently underway, is of critical importance to the future of the sector for the next decade, particularly with respect to access to resources for the Irish industry. Production of wild fish is regulated at national and EU levels.

Reform of the Common Fisheries Policy (CFP)

In 2009, the Commission launched a wide-ranging public debate on the way EU fisheries are managed. This will lead to a reformed Common Fisheries Policy which will come into effect in January 2013. The main elements of the revised CFP are:

- A multi-annual ecosystem-based management of the fishery resource
- The banning of discards
- Making fishing profitable through a system of transferable catch shares, known as 'concessions'
- Supporting small-scale fisheries which are important in the economic development of many coastal areas
- Developing sustainable aquaculture with appropriate environmental, societal and economic standards including member state plans to remove administrative barriers
- Improving scientific knowledge through collecting, maintaining and sharing scientific data about fish stocks and the impact of fishing at sea-basin level. Activity will be coordinated through national research programmes
- More decentralised governance giving member states larger roles and responsibilities in relation to the resource

International obligations to have fishing rates at a Maximum Sustainable Yield (MSY) by 2015 may lead to reductions in allowable catches for some stocks in the short term. As stocks recover these reductions should be reversed by 2020. The transition and implementation of MSY will pose particular challenges. The implementation will need to be managed on a rational basis over an appropriate time frame.

There are still considerable implementation issues with MSY (e.g. defining MSY for 'data-poor' stocks; MSY for mixed fisheries situations) and these need to be resolved in an open and transparent way so it doesn't undermine the livelihoods of fishermen and coastal communities' dependant on fishing – particularly in the short-term⁷.

Concerns have been raised that ITOs could result in the effective privatisation of fish quotas and their concentration in the hands of multi-national companies without links to Ireland's coastal communities, potentially creating a loss of jobs in Irish coastal communities.

Although the ban on discards is a positive direction for the industry, there are concerns e.g. on how the ban may be implemented for mixed fisheries and Nephrops. In the interim technical measures tested in the Irish Sea have been shown to reduce discards and also the by catch of many other species. The Commission is now considering the implementation of technical measures in West of Scotland, Irish and Celtic Seas fisheries to help reduce discarding.

Innovation and new product development together with **maintenance of an international reputation for wholesome, fresh and natural seafood, produced in the most sustainable and environmentally friendly manner**, are essential to the advancement and further development of the Irish seafood sector. State support for the sector is focused on initiatives that endeavour to deliver these fundamental requirements while also seeking to increase Ireland's market share of the international seafood industry.

Ireland has a valuable resource in terms of marine biodiversity and there are obvious direct benefits to food producers from healthy wildlife populations, which form the basis of production as in the case of sea fisheries. While biodiversity conservation is an imperative in its own right, it may also offer opportunities in the future for food producers who could utilise biodiversity conservation initiatives as an opportunity to add value to food products. Organic, as well as so-called

⁷ <http://www.bim.ie/media/bim/content/bim4.0%20Irelands%20CFP%20green%20paper%20response.pdf>

'conservation grade' food is an attractive ethical concept for many consumers and a potential source of commercial opportunities.

Aquaculture

Ireland is well placed to increase aquaculture production but has to address difficulties within the state regulatory structure in achieving compliance with the Birds and Habitats Directives before the true potential of the sector can be realised. The expansion of aquaculture will result in job creation in peripheral coastal communities and will drive the expansion in seafood processing through increased raw material supply.

Whilst the existing network of conventional sites can be further developed to increase productivity and output, a further source of expansion will be a move to occupy high volume offshore/deep water sites, especially for marine finfish production. Ireland's fish farmers have considerable experience in operating in high energy farming locations and this expertise and experience will be leveraged into an effort to create additional output in offshore locations. If these two approaches are pursued in parallel, then over the coming years this will generate further employment and high value exports and a significant increase in output can be achieved as set out in the Food Harvest 2020 strategy.

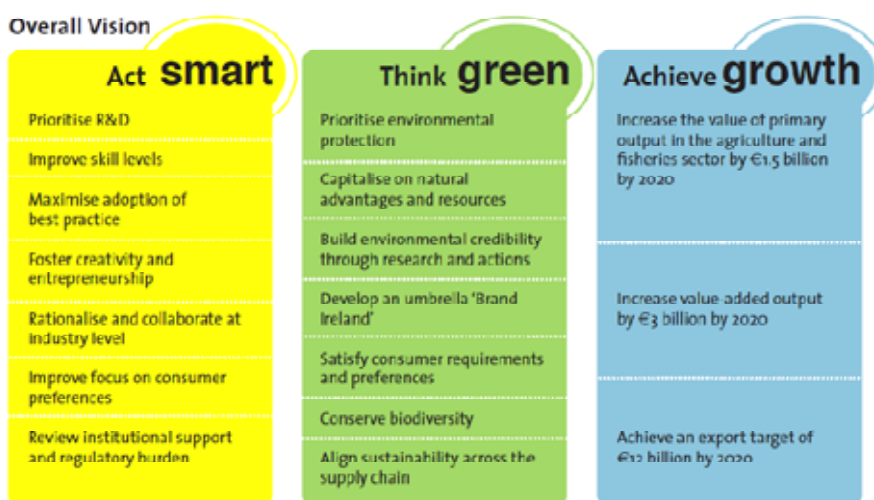
Seaweed

Despite a long traditional use of seaweeds in Ireland, the seaweed sector remains largely underdeveloped at a time when national and global demand for seaweeds is rising. To capitalise on the potential for increased profitability in Ireland, the existing Irish seaweed processing sector must move up the value chain into the identified opportunity areas. The nutraceutical, pharmaceutical and cosmetics industries represent increased profit for the sector. To achieve this, the sector, in association with the agencies and research providers needs to identify specific market opportunities, innovate and introduce greater automation, including new processing and packaging technologies.

1.3 Existing Government Policy, Plans and Targets

Food Harvest:

Food Harvest 2020⁸, published by the Department of Agriculture, Fisheries and Food in July 2010, is the strategic blueprint for the development of the agriculture, food, fisheries and forestry sector for the next decade. The report has a strong focus on industry's role in developing the sector and exploiting its potential. Food Harvest 2020 is based on the premise of Smart, Green Growth and contains 215 recommendations (16 related to seafood):



⁸ Food Department of Agriculture Fisheries and Food, (2010) Food Harvest 2020 – A Vision for Agri-food and Fisheries, Bord Iascaigh Mhara, (2010), Delivering on the Potential of Irish Seafood - BIM Strategy 2010 – 2012

- smart in the sense of embracing innovation, new technologies and improving cost competitiveness,
- green in the sense of clearly demonstrating and capitalising on Ireland's environmental credentials and
- growth in the sense of efficient and environmentally sustainable production that delivers the specified growth targets.

Food Harvest 2020 sets out a **roadmap for growth in the seafood sector** with recommendations that set the context for delivering on the potential.

BIM is the Irish State agency responsible for developing the Irish seafood industry. BIM provides commercially relevant and innovative services including technical expertise, business support funding and training that drive growth opportunities, add value, enhance competitiveness, and create jobs in the seafood industry for the benefit of coastal communities. BIM provide technical expertise, business support, funding and training. BIM's strategy, *Delivering on the Potential of Irish Seafood 2010-2012*⁹, was developed in consultation with industry and includes 70 actions geared to realising opportunities for the Irish seafood sector to grow and develop. The National Seafood Programme (2007-2013) provides Exchequer funded support to assist the seafood sector through a number of schemes including new products and process development, innovation, adding value to products, maintaining and improving environmental and food quality standards and improving cost efficiency.

The **Marine Institute** is the national agency responsible for Marine Research, Technology Development and Innovation (RTDI). The Institute provides research funding, scientific, technical and advisory services that support the fisheries, aquaculture and seafood sectors. Specifically in relation to fisheries research, the Institute conducts research, collates, analyses data and provides scientific advice on the sustainable exploitation of the natural fishery resource. The scientific advice also ensures compliance with Natura 2000 and Marine Strategy Framework Directive (MSFD).

Sea Change – *A Marine Knowledge, Research and Innovation Strategy for Ireland*, the implementation of which is being co-ordinated by the Marine Institute, presents a national research agenda for the entire marine sector. The Strategy provides a roadmap for selective and managed investment in marine research and innovation over the period 2007-2013. It incorporates applied and basic research programmes, which aim to increase industry competitiveness, build new research capacity and address policy issues. For the sea fisheries and aquaculture sectors, *Sea Change* defines the research requirements to drive the development of the sectors. The Seaweed Research Programme objectives in *Sea Change* remain relevant—namely the need for a regulatory framework and management plan for the sustainable harvest of seaweed; development of integrated systems for seaweed aquaculture including seed hatchery production; and development of a screening programme for potential seaweed products. *Food Research Ireland*, developed by the Department of Agriculture, Food and Marine, is a research plan for the food industry; incorporating priorities for seafood processing and value-added food products e.g. the use of marine biomaterials in functional foods.

⁹ <http://www.bim.ie/media/bim/content/Delivering%20on%20the%20Potential%20of%20Irish%20Seafood>

Existing Targets and Milestones

Food Harvest 2020 Recommendations	2015 Milestones/Targets ¹⁰
Increase added value sales of seafood ¹¹ .	The Irish seafood industry will generate an additional €100 million + in added value sales
The raw material supply for the Irish seafood industry will be expanded ¹² . This expansion in raw material will come from aquaculture and from landings by non-Irish vessels into Irish ports.	<p>Aquaculture: The increase in output from aquaculture will come from two sources:</p> <ol style="list-style-type: none"> (1) Establishment of offshore production: By 2015 harvesting will commence on a 10,000 tonne production unit (2) Increase conventional aquaculture output: By 2015 the annual aquaculture production capacity will be expanded by 10,000 tonnes <p>Increase landings by foreign vessels into Irish ports: By 2015 the seafood industry will process/value add to landings from eight foreign whitefish vessels per week.</p>
Develop new route to market structures ¹³ .	A seafood hub centred on Irish product will be developed and fully operational on the continental mainland of Europe generating €20 million in seafood sales by the end of 2015.
Strengthen the scientific knowledge base to underpin sustainable exploitation of the fisheries resource	<ul style="list-style-type: none"> • Continue to progress the implementation of Maximum Sustainable Yields (2011 onwards) • Continue to move from current single stock management plans to fisheries-based plans (2011 onwards) • Continue to progress the ecosystem approach to fisheries management in line with Marine Strategy Framework Directive (ongoing to 2020: plans in place by 2015 and operational by 2020) • Comprehensive database informing scientific advice on the sustainable exploitation of the resource base (2015)

Food Harvest 2020 Targets

- Increase revenue from €700m to €1 billion
- Increase employment from 11,000 to 14,000 full-time equivalent in sea fisheries and aquaculture
- 78% increase in aquaculture volume production

¹⁰ These interim targets set for 2015 are a half way mark en route to the final targets set out in Food Harvest 2020.

¹¹ Food Harvest 2020 Recommendation Number 187

¹² Food Harvest 2020 Recommendation Numbers 186, 196, 197, and 200

¹³ Food Harvest 2020 Recommendation Number 189

2. SHIPPING, PORTS AND SERVICES

2.1 Profile of the sector

Profile of the Shipping Sector

The Irish maritime transport cluster is made up of companies serving two distinct markets. The majority of shipping firms, service providers and government agencies serve the larger local market, facilitating imports and exports associated with the Irish economy. A newer but smaller international market is made up of shipowners and shipping service providers, providing international shipping services unconnected with the Irish economy. A detailed illustration of the Irish maritime cluster is provided below.

Irish Sector

The Irish shipping and maritime sector has an important role to play in supporting economic recovery. The sector acts as an essential part of the strategic infrastructure that allows the Irish economy to connect with the global market place. However, between 2008 and 2010 domestic shipping volumes have endured a severe correction across all the key market segments: i.e. lift on-lift off (lo/lo), roll-on/roll off (ro/ro), liquid (tanker), dry bulk and break bulk. After the previous record volumes in 2007 each market segment recorded a 36 month volume low at varying points in 2009. The lo/lo and ro/ro markets declined by 23% and 15% respectively. The deterioration in bulk volumes was far more severe than projected, with dry bulk volumes down 29%, tanker volumes declining by 22% and breakbulk by a staggering 48%, the latter being largely attributed to the demise of residential construction demand. This has resulted in less demand for domestic shipping and port-related services, culminating in reduced supply and frequency of shipping capacity (-33%) on mainline routes. Finally, the supply of shipping capacity has also been affected due to the exit from the market by some major operators which had led to restructuring, job losses and redundancies.

Unlike most other industrial sectors in Ireland, the shipping sector has no or very low levels of functioning R&D capacity, which, given its role in supporting export led growth would appear to be a fundamental weakness in the sector's ability to plan for and add long term strategic value to the domestic economy. If economic recovery is based fundamentally on export led growth, then a far higher level of priority should be placed on industries that directly contribute to this strategy.

Global Markets

The Global shipping/maritime sector is a highly diverse multi-billion dollar industry, the total global value of which in 2010 was estimated at \$550bn for shipping transactions. Global shipping markets, historically, tend to be cyclical in nature. However, between 2002 and 2008, it enjoyed its longest period of year on year record growth across almost all sectors. Since then the markets have endured a highly turbulent period with record losses and declines across many segments as a result of the sudden downturn in the global economy.

After long periods of decline for the Irish industry, policy support measures, such as the Tonnage Tax scheme, have encouraged investment which has led to growth and new employment. In 2010, employment in the International Shipping Services sector in Ireland grew by 10%.

Compared to the size of the global market, Ireland has a small but active international shipping sector. Over the past decade Ireland has only captured a relatively small level of the global growth with traditional centres such as London, Hamburg, New York, Hong Kong and Singapore controlling the majority of regular market transaction value while also winning the majority of new business from emerging markets. The global shipping services market is likely to continue to grow. Ireland has

many of the primary conditions in place to compete for business to locate in Ireland. However, it is unlikely to achieve any substantial growth relative to the underlying potential.

The Irish Maritime Development Office (IMDO), the statutory development body under the aegis of the Department of Transport, Tourism and Sport responsible for the development of the Irish shipping services sector has advocated that a more sustained and higher level strategy focused on creating a dedicated shipping services centre in Dublin could lead to growth in new employment in the sector.

THE IRISH MARITIME CLUSTER

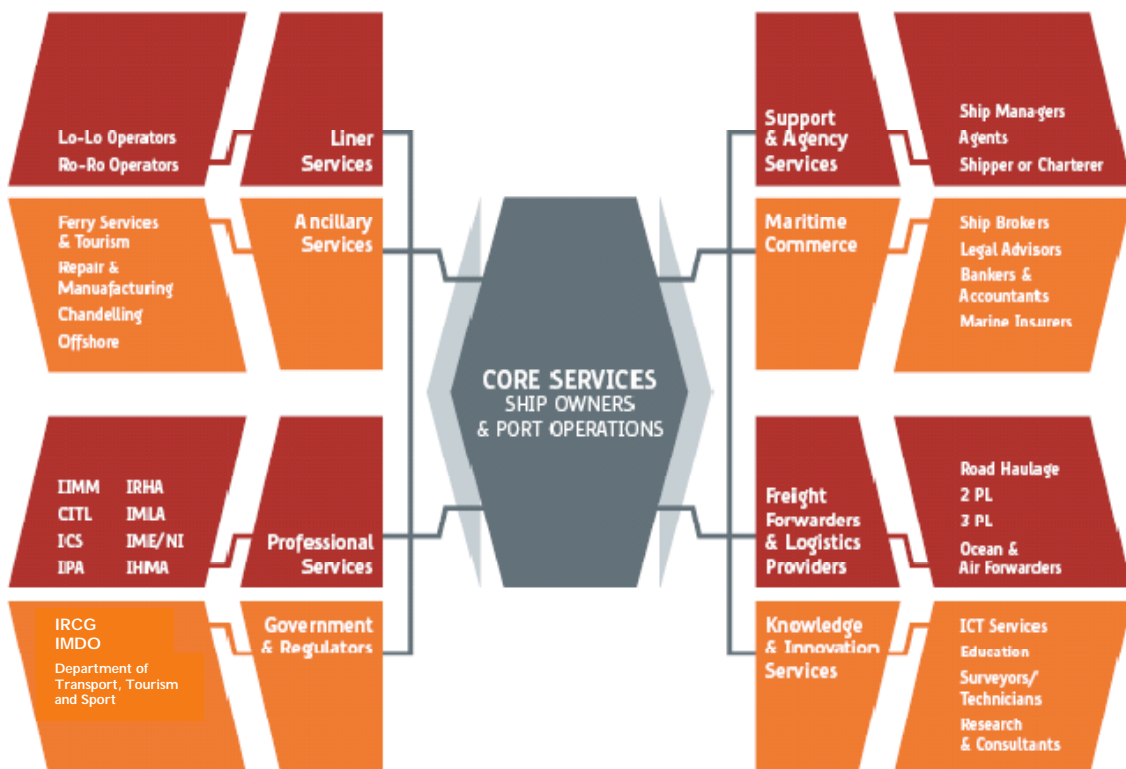


Figure 2: The Irish Maritime Cluster

Ports

The vast majority of the State's commercial port infrastructure falls under the control of the Irish government. Nine port companies currently operate under the aegis of the Department of Transport, Tourism and Sport. Greenore port is a 50/50 public/private joint venture, whilst Rosslare is publicly owned and operated by Iarnród Éireann.

Harbours

The Department of Transport, Tourism and Sport also has responsibility for five regional harbours operating under the Harbours Act 1946. Policy in relation to the regional harbours, published in the Ports Policy Statement in 2005, is that most of these harbours would best achieve their potential through transfer to local authority ownership. In harbours where significant commercial traffic exists, transfer to a port company should be considered.

The Department of Transport, Tourism and Sport is working with the Department of the Environment, Community and Local Government to advance the transfer of the five remaining Harbours.

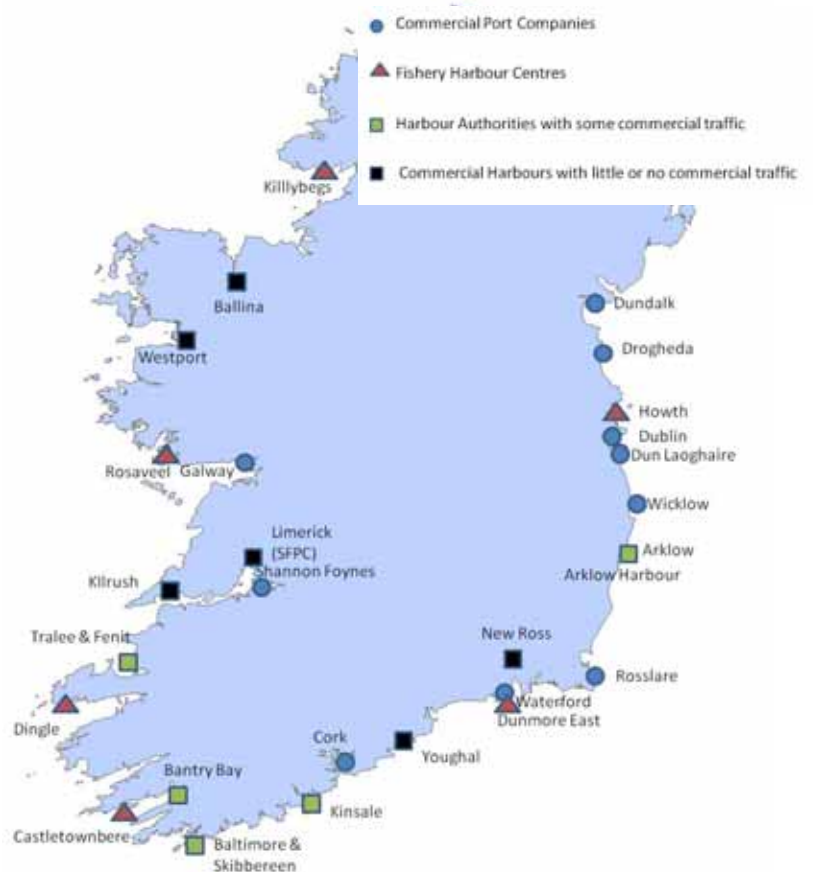


Figure 3: Ports and Harbour Locations

The Country's six **Fishery Harbour Centres** were established to promote, develop and carry on sea fishing, fish processing, fish related activities and matters connected with the fish industry as well as any other purpose, including the provision, improvement and development of leisure or amenity facilities or for facilitating or promoting the social or economic development of the area in which the Fishery Harbour Centre is located¹⁴. These Centres fall under the control of the Department of Agriculture, Food and the Marine who has overall responsibility for the development of infrastructure at the Fishery Harbour Centres and for the leasing of property within the harbours.

¹⁴ Raymond Burke Consulting and McIver Consulting, (2009), Development of business plans for the Fishery Harbour Centres
<http://www.agriculture.gov.ie/media/migration/fisheries/businessplanforthedevelopmentofthefisheryharbourcentres/Part1.pdf>.

2.2 Opportunities and Key Constraints

	Opportunities	Constraints
Domestic Market	<ul style="list-style-type: none"> ✓ High growth potential in new offshore services ✓ Cruise Liner Tourism (See Marine Tourism Section for details) ✓ Local tourism opportunities ✓ Offshore construction, education and training 	<ul style="list-style-type: none"> ✓ Financial difficulties of port companies in the current economic climate. ✓ Current organisational structure and ownership of the port companies. ✓ Port capacity and new infrastructure: consent and investment requirements ✓ Environmental issues (e.g. Natura) ✓ Planning consent/foreshore issues
International Market	<ul style="list-style-type: none"> ✓ Potential to create major centre for shipping services ✓ Growth in inward investment by foreign shipowners ✓ Marine engineering, particularly design related to offshore construction and vessel design 	<ul style="list-style-type: none"> ✓ General economic position and impact on the global business community ✓ State investment challenges for new development

Opportunities associated with the Irish International Shipping Services Sector

The global shipping services market has continued to grow and expand in Ireland with new firms entering and establishing operations in Ireland, leading to new job growth. The IMDO projects up to 170 new jobs by 2015 in International shipping services based on its current development program. In Ireland, there are already policy conditions in place for International shipping services. A significant increase in the level of activity over and above the level currently focused on international shipping development would likely lead to further growth and new inward investment.

2.3 Existing Government Policy, Plans and Targets

The following are the high level objectives for the sector set by the Department of Transport, Tourism and Sport:

High-Level Objectives:

1. To develop and implement a national ports and shipping policy to facilitate a competitive and effective market for maritime transport services;
2. To foster conditions supportive of the development of Irish based ship ownership, ship management and related maritime activities;
3. To provide regulation to ensure compliance with international and national requirements to preserve and protect the marine environment from Ship Source Pollution Prevention.

Main strategies to achieve the objectives include:

- Implement arrangements to ensure that port companies provide services that are efficient and effective for the needs of our trading economy;
- Completion and publication of a new Ports Policy Review;
- Review shipping development policies;
- Introduce a new Shipping Registration Bill.

The Minister intends to publish a revised ports policy document in 2012 following a public consultation that took place last year. A key policy issue raised in the consultation is the current structure of the sector, whereby the State owns nine separate port companies of very varied size. The recent McCarthy Group Report recommended that the number of port companies be reduced through amalgamations and that consideration be given to the State selling off some of its port interests. These wider policy issues will be addressed in the revised policy document. The Joint Oireachtas Committee examined the ports sector and their recommendations will be considered in the overall context of the Ports Policy review and the national freight forum.

The Department of Transport, Tourism and Sport intends to review shipping policies in 2012 with a view to ensuring measures are in place to promote shipping and shipping services out of Ireland, in order to provide the optimum return to the economy. Proposals for a bill to update the registration of ships is being prepared at this time to facilitate the more efficient and effective management of the process of registering ships on the Irish Flag.

3. MARINE RENEWABLE ENERGY (OFFSHORE WIND, WAVE AND TIDAL ENERGY)

Transformational changes are taking place in the energy sector in Europe and the world. In the context of a very large-scale shift to the use of renewable energy technologies, Ireland has one of the most energetic offshore wind and wave resources in the world, which will yield higher power levels than other European neighbours. The opportunity to position Ireland as one of the most efficient solutions to Europe's clean energy imperative needs to be proactively pursued.

3.1 Profile of the sector

The marine renewable energy sector in Ireland encompasses the generation of power from offshore wind, wave and tidal resources. To a large extent, marine renewable energy has remained unexploited and offers great development opportunities. The offshore wind and the wave and tidal sectors are to be distinguished. The wave and tidal sectors are still in the RD&D stage globally with the technology not yet commercially viable, while the offshore wind sector is seeing considerable development taking place at a European and global level. In Ireland to date 25MW of offshore wind is installed. On a European level, at the end of 2010, the European Wind Energy Association (EWEA) notes that 1,136 offshore wind turbines have been installed and grid connected, totalling 2,946MW in 45 wind farms in 9 European countries.

As a result of the launch of the Ocean Energy Strategy in 2006 aimed at developing the wave and tidal sector, there has been ongoing work to create a supportive policy framework, develop infrastructure and build research capacity to create a favourable developmental environment. To this end, the Ocean Energy Development Unit (OEDU) was set up in the Sustainable Energy Authority of Ireland (SEAI) in 2008 to take the sector forward.

The ocean energy programme has, to date, resulted in Ireland taking some significant steps to grasp the opportunity represented by ocean energy and progress has been made. Ireland is recognised as one of the 'early movers' in developing the wave and tidal technology required to capitalise on this resource, with Irish companies like Wavebob, Ocean Energy and Open Hydro. Ireland is assembling other key elements of the ocean energy industry including utility project developers, engineering consultants, academic research institutions and companies engaged in supply chain activities.

Market

The market potential of marine renewable energy sector is significant and provides commercial opportunities to a range of Irish businesses throughout the full supply chain; including R&D, resource analysis, environmental impact assessment and planning, design and build, installation, operations and maintenance (Figure 4). Recent studies commissioned by SEAI on the benefits to Ireland identified significant employment and economic opportunities, provided current challenges associated with the exploitation of the resource are addressed.

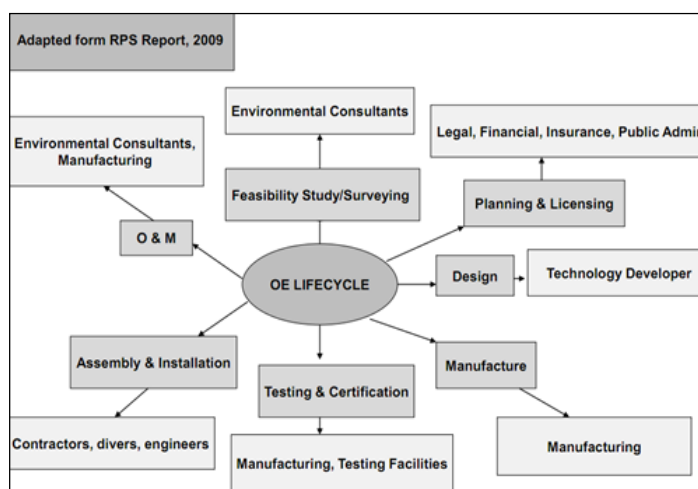


Figure 4: Ocean Energy Life Cycle, adapted from RPS Report (K Morrissey, 2011)

Enterprise Base

The marine renewables sector is a relatively new category of economic activity which has seen an increase of activity from €18 million in 2003 to €101 million in 2007. In 2007 there were eight companies actively involved in the design, development, testing and deployment of marine renewable energy devices in Ireland. These companies utilise a number of facilities and services developed by the public and private sector for the testing and development of prototypes. The Irish wave and tidal energy industry is a mainly indigenous, knowledge-based and highly innovative group of companies primarily focusing on the pre-commercial design stage.

Marine Renewable Energy Resource

Ireland's location at the western edge of the Atlantic Ocean means that we are ideally located to take advantage of the emerging opportunities to harness power from marine renewable sources. The 'real map of Ireland' illustrates our potential resource, as well as some maps showing theoretical wind and wave resources available to us.

Following this, we have set out what some of the findings of the Strategic Environmental Assessment of our offshore renewable energy resource against low, medium and high

development scenarios tell us about the extent to which the energy could be developed without likely significant adverse effects on the environment.

Table 1 below from the Strategic Environmental Assessment (SEA) Environmental Report on Ireland's draft Offshore Renewable Energy Development Plan (OREDPP) shows a summary of the results of the Cumulative Assessment that was undertaken on Ireland's offshore renewable resource against a number of scenarios.

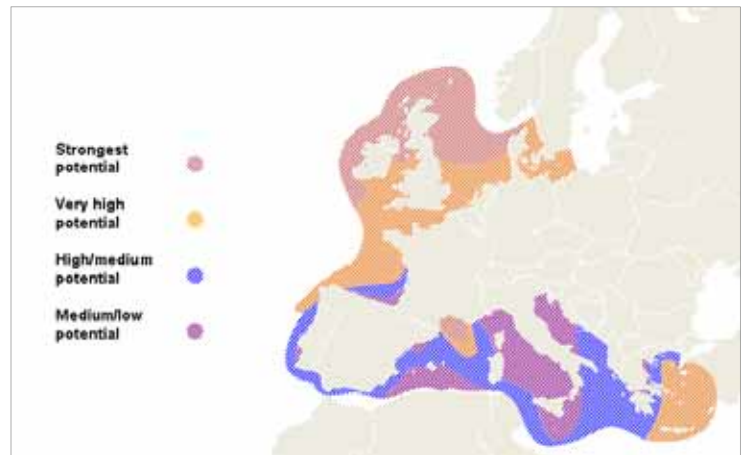


Figure 5: European Wind Energy Resource (Simplified map based on Risø National Laboratory, Denmark, 1989)

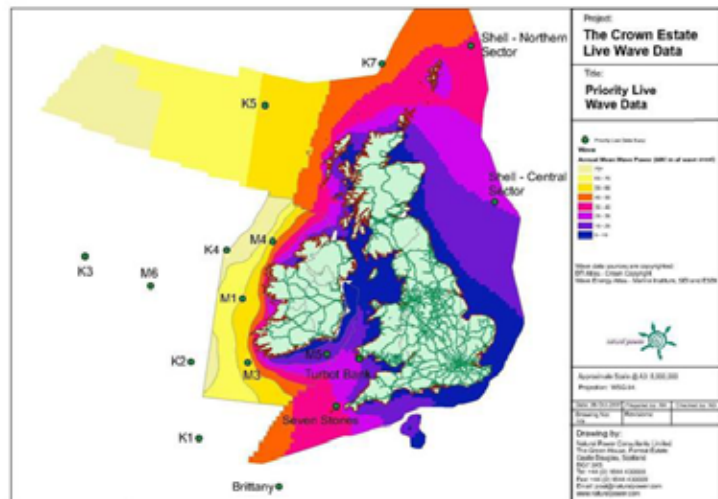


Figure 6: Ireland's Theoretical Wave Energy Resource

Table 1 summarises the total amount of development that could potentially occur within each Assessment Area without likely significant adverse effects on the environment. The scenarios assessed were low, medium and high scenarios for offshore wind, wave and tidal energy, with up to 4500MW of offshore wind in the high scenario to 2030 and up to 1500MW in the high wave and tidal scenario.

The description of the assessment areas can be found in the Environmental Report and draft OREDPP available on the DCENR and SEAI websites. 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 SEAI scoping document¹⁵ 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) Maximum distance of 100km from shore. The scoping document also sets out the energy / resource requirements.

Table 1: Summary of Results of the Cumulative Assessment on Ireland's Offshore Renewable Resource against a number of scenarios.

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 ¹⁶	-	-	-	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

Notes:

* = 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).

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.

¹⁵ Coastal Concern Alliance, (2009) Scoping for the Strategic Environmental Assessment on Plans to Develop Offshore Renewable Energy http://www.seai.ie/Renewables/Ocean_Energy/Offshore_Renewable_SEA/Scoping_Report/

¹⁶ The Shannon Estuary was assessed for tidal stream energy, but not for tidal barrage which was outside the scope of the SEA.

Strategic Environmental Assessment (SEA) Environmental Report Findings on the scenarios in the draft Offshore Renewable Energy Development Plan:
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.
- 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.

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.
- No tidal potential was identified 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.

Technologies

Offshore wind

Offshore wind devices are generally the most advanced and standardised types of devices. The most common type of commercial scale offshore wind farm that is deployed today is the Horizontal Axis wind turbine. Each turbine has a capacity of between 3MW and 5MW. They have a height from base to tip of around 80m to 120m and a tower height of about 60m to 80m. The blades are typically 40m long.

Most offshore wind developments to date have been built in shallower water (e.g. less than 30m depth) on gravity foundations, steel monopiles or jacket structures. The majority of offshore windfarm developments in European waters have used monopile foundations for the shallower water areas. Monopiles are long steel tubes embedded in the seabed until secure, and then platforms or towers are installed on top.

New devices are currently being tested that would enable deployment in deeper water e.g. 40m to 60m depth. These include turbines that use quadropod jacket bases in waters of around 45m depth and floating devices which use moored platforms and are currently being tested at full scale. These could enable windfarms to be developed in much deeper waters, up to 700m.

Offshore Wave & Tidal

The technologies for extracting energy from waves (wave height or energy from the motion of waves) and tidal streams are at a much earlier stage in their development than offshore wind turbines. Consequently there are a wide range of different types of wave and tidal devices currently in development and testing.

In wave technology, oscillating water column, point absorbers, overtopping/collector devices, attenuators and terminators, wave rotors/turbines are examples of current technologies. In tidal technology, tidal barrages and lagoons, horizontal and vertical axis turbines, venture devices and hydroplanes and oscillating hydrofoils are the types of technologies being tested.

More information on these can be found in the Strategic Environmental Assessment Environmental Report of the draft Offshore Renewable Energy Development Plan (OREDPP.)

Through the Prototype Development Fund, the Ocean Energy Development Unit in SEAI offers grant-aid to stimulate RD&D in the sector and has provided funding to several Irish projects. Notable Irish developers in the wave and tidal sector include Open Hydro, which is currently developing commercial projects in the Channel Islands and Canada. WaveBob and Ocean Energy Limited have tested their wave devices at the quarter scale Galway Bay test site.

Strangford Lough in Northern Ireland hosts a grid connected tidal energy converter, one of the world's first commercial tidal turbines.

Research Base

Ireland is developing world-class research and test facilities in the offshore marine sphere. This includes the Quarter Scale Wave Energy Test Site and SmartBay Ireland (the national facility for marine ICT) in Galway Bay; the proposed full scale pre commercial prototype grid connected Atlantic Marine Energy Test Site off Belmullet, Co. Mayo and the upgraded wave tank facilities of the HMRC (Hydraulics & Maritime Research Centre) that will be housed in the IMERC initiative being part funded through PRTLII initiative.

Research Capacity

Across all *Sea Change* research priorities, Irish participation in ocean energy projects is highest and significant research funding has been secured. This performance is directly as a result of various national investments in research and capacity building in the sector.

Galway Bay (Quarter Scale Wave Test Site & SmartBay)

The Marine Institute, in association with Sustainable Energy Authority Ireland, established an Ocean Energy Test Site for quarter scale prototypes of wave energy devices situated on the north side of Galway Bay. The site is 37 Hectares in area and is in 21-24 metres of water. It is utilised by ocean energy companies, technology developers and national/international researchers. 2 Irish developers have successfully completed testing of quarter scale wave energy converters. EU funded research projects have continued to use the site and wave data collected from the sites. Technology developers have used the site for acoustic monitoring of cetaceans, and communications and telemetry research.

SmartBay is a National R&D & Test Facility for Marine ICT that provides a real world test environment for the demonstration of innovative marine ICT products and services. The objective is to 'get research prototypes out of the lab and into the sea'. SmartBay is co-located with the quarter scale wave energy test site so it provides ocean energy developers with a unique platform to investigate next generation monitoring, communication and data management technologies of relevance to the ocean energy sector.

Atlantic Marine Energy Test Site off Belmullet, Co Mayo

The proposed full scale grid connected wave energy test site off Annagh Head near Belmullet, Co. Mayo has been progressed by SEAI over the last 2 years. The purpose of the proposed site is to assess the performance of wave energy converters in generating electricity and to test the survivability in open ocean conditions. The final decision about full build out of the test site is subject to Government approval in the context of budgetary discussions.

IMERC /Hydraulics & Maritime Research Centre/Coastal & Maritime Research Centre [CMRC]

The IMERC (Irish Maritime Energy & Research Cluster) project involves a partnership between University College Cork, Cork Institute of Technology and the Irish Naval Service. IMERC involves the development of a new campus in Ringaskiddy, Cork adjacent to the National Maritime college of Ireland and the Irish Naval Service.

University College Cork has developed significant marine energy expertise through 3 research groups – the Hydraulics and Maritime Research Centre (HMRC); the Coastal and Marine Research Centre (CMRC) and the Sustainable Energy Research Group (SERG.) It is intended that these groups will form part of the IMERC project and will be co-located in Ringaskiddy, along with the national ocean energy test tank facility. The HMRC is one of the top Irish performers in the EU's FP7 research programme, involved in 6 FP7 projects and leading 2 of them.

European Commission call for NER 300¹⁷ proposals for innovative renewable energy and carbon capture and storage projects: Ireland has nominated two projects¹⁸ under the NER300. This includes one project in the ocean energy category (WestWave Project - ESB¹⁹).

INFOMAR

The INFOMAR (Integrated mapping for the sustainable development of Ireland's Marine Resource) programme is a joint venture seabed mapping programme between the Geological Survey of Ireland and the Marine Institute. The programme supports the acquisition/or full availability of, appropriate

¹⁷ "NER300" is the name of a financing instrument managed jointly by the European Commission, European Investment Bank and Member States. Further details are available on www.NER300.com

¹⁸ <http://www.dcenr.gov.ie/Energy/Sustainable+and+Renewable+Energy+Division/NER+300.htm>

¹⁹ www.westwave.ie

baseline data to underpin resource evaluation, including mapping and measurements. The marine renewables industry is benefiting from this project, producing integrated mapping products covering the physical, chemical and biological features of the seabed which contributes baseline information for the development of the sector. INFOMAR has facilitated site investigation for Galway Bay and Atlantic Test sites and West Wave project, through SEAI.

3.2 Opportunities and Constraints

	Opportunities	Constraints
Marine Renewable Energy	<p>The offshore energy resources could provide Ireland with future economic opportunities by:</p> <ul style="list-style-type: none"> ✓ Creating jobs in the full marine energy supply chain ✓ Contributing to security of energy supply ✓ Reducing carbon emissions ✓ Rural development ✓ All island co-operation ✓ R&D opportunities 	<ul style="list-style-type: none"> ✓ Large capital investment required ✓ High guaranteed support price ✓ Data gaps and environmental uncertainties ✓ Grid Infrastructure development required ✓ Offshore permitting and planning streamlining needed ✓ Competing with other marine stakeholders ✓ Technological barriers - wave and tidal sector

It is clear that a united vision across Government is required along with enhanced co-ordination and concerted action if the economic opportunities of offshore marine renewable energy are to be harnessed and the industrial development side of the business opportunities facilitated. The opportunities, some of which still require quantification, need to be proactively explored but the most immediate challenge commercially is addressing the constraints. The opportunities and constraints will be taken forward in the implementation of the Offshore Renewable Energy Development Plan (OREDPP), when finalised.

3.3 Existing Government Policy, Plans and Targets

The table below sets out the context for the development of renewable energy in Ireland.

Table 2: EU and National Policy Developments

EU Level Policy Developments	National Level Policy Development
<u>2007</u> Political Agreement in EU on “20-20-20 by 2020” <ul style="list-style-type: none"> • 20% energy efficiency • 20% reduction in carbon emissions • 20% of Europe’s energy consumption to be from renewable energy sources 	<u>2007</u> Energy Policy Framework – White Paper on Energy Policy set national renewable targets and included an initial ambition of 500MW of installed ocean capacity by 2020 while the 2007 Programme for Government committed to the establishment of the Ocean Energy Development Unit (OEDU) in SEAI.
<u>2008</u> EU climate package proposing Directives to achieve renewable energy and carbon emissions reduction targets.	<u>2008</u> 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.
<u>2009</u> - Directive 2009/28/EC published. - Ireland’s target set by EU = 16% of all energy [up from 3.1% in 2005] - to be met across electricity, heat & transport.	<u>2009</u> Foreshore consent for offshore renewable developments transferred to the Department of Environment. 2009 Carbon Budget increased Ireland’s target in the electricity sector to 40% by 2020.
<u>2010</u> Directive 2009/28/EC requires each MS to publish a National Renewable Energy Action Plan (NREAP) showing how their legally binding target will be achieved. 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 3 rd countries, joint support schemes.	<u>2010</u> Ireland’s National Renewable Energy Action Plan (NREAP) published showing our overall 16% target (under Directive 2009/28/EC) being achieved with 10% renewables in transport, 12% renewables in heat and 42.5% renewables in electricity. Achievement of our 2020 target is not predicated on the use of the co-operation mechanisms. In our NREAP we noted significant offshore resources which hold electricity export potential and could potentially be available for joint projects with other MS given the right circumstances. 2010 Planning & Development Act published. Draft Offshore Renewable Energy Development Plan (OREDPP) published along with SEA Environmental Report.
<u>2011</u> Concerted action on the renewable energy directive, including use of the co-operation mechanisms. 3 subgroups on the North Seas Offshore Grid Initiative, supported by the European Commission, set up to look at issues around the development of a North Seas Offshore Grid.	<u>2011 / 2012</u> Natura Impact Statement (NIS) on draft OREDPP published. Public consultation until May 2011. OREDPP due to be finalised in 2012. ISLES project report due by end 2011/early 2012. Participation in British Irish Council renewable energy subgroups. Participation in EU concerted action exploring co-operation mechanisms under Directive. Joint leader of one of the North Seas Offshore Grid Initiative subgroups on market and regulatory issues.

Ireland's Offshore Renewable Energy Development Plan (OREDPP) is currently being developed by the Department of Communications, Energy & Natural Resources. The draft OREDPP is publicly available on the Department's and SEAI's websites. The draft OREDPP describes the current state of play in Ireland on offshore wind and wave and tidal energy. It explains how policy is in development in this sector and some of the factors that are likely to affect policy as it develops. The draft Plan notes Ireland's involvement in many initiatives and its openness at a strategic level to considering the possibilities and opportunities offered by offshore renewable energy. The draft OREDPP considers low, medium and high scenarios for the development of offshore wind, wave and tidal energy in the period to 2030. The Strategic Environmental Assessment has been undertaken on these three scenarios which include up to 4,500MW of offshore wind and 1,500MW of wave and tidal energy in the period up to 2030.

Ireland has been set a binding renewable energy target under Directive 2009/28/EC and has published a National Renewable Energy Action Plan (NREAP) setting out how the target is to be achieved.

Separate to the contribution to our domestic target and domestic electricity consumption needs, the **Renewable Energy Directive** provides co-operation mechanisms for Member States to trade renewable energy in the period to 2020 if they are able to exceed their national target. For this reason, Ireland also included in our NREAP a non modelled renewable electricity export scenario [subject to constraints being overcome], noting our significant offshore marine energy potential. Should Ireland become an exporter of renewable energy, the co-operation mechanisms are currently the only means by which excess renewable energy beyond our target can be sold to other countries. At the recent British Irish Council summit, the Council agreed the all islands approach vision of an approach to energy resources across the British Islands and Ireland which enables opportunities for commercial generation and transmission, facilitating the cost-effective exploitation of the renewable energy resources available, increasing integration of their markets and improving security of supply. The Council agreed a set of principles to underpin the vision, and launched a programme of joint work spanning the potential for renewable energy trading, as well as workstreams on interconnection and market integration.

A study on the cost benefits of Ireland engaging in the co-operation mechanisms under the Directive has been commissioned by SEAI together with DCENR, EirGrid and CER and the study should be completed in early 2012.

Other factors influencing development of the sector include how **offshore grid** develops, noting Ireland's involvement in the ISLES project (a study in receipt of EU Interreg funding that is examining the feasibility of an offshore grid between Ireland, Scotland and Northern Ireland); the North Seas Offshore Grid Initiative and the British Irish Council (which has 2 renewable energy related working groups) and some recent further interconnection and offshore grid studies modelled by Eirgrid. The Commission for Energy Regulation has the statutory function relating to grid connection.

The draft OREDPP notes that policy is not definite at the current time in many areas and there are many bodies involved that are responsible for the articulation of policy going forward. It will be essential that we develop a mechanism for working more closely together to ensure policy coherence going forward and one of the recommendations for action in the draft plan is the setting up of a high level group involving the relevant bodies that will be taking forward the various policy areas.

The Department asked SEAI and the Marine Institute to carry out a **Strategic Environmental Assessment** (SEA) of Ireland's offshore renewable energy resource. SEAI commissioned Aecom and Metoc to undertake the SEA on the low, medium and high scenarios identified in the draft OREDPP. The SEA Environmental Report was published along with the draft OREDPP in November 2010. Overall, as noted elsewhere, 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 in the period to 2030 without likely significant adverse effects on the environment.

Aecom were also subsequently commissioned to undertake a **Natura Impact Statement (NIS)** on the draft OREDP which was published in April 2011. Following publication, the NIS, the Environmental Report and the draft OREDP remained open simultaneously for public consultation for a further month.

Public consultation on the draft OREDP and accompanying SEA Environmental Report and Natura Impact Statement closed in May 2011. Over 60 submissions were received and these are being reviewed with a view to the Plan being finalised and published, subject to Government decision.

The final OREDP (which will include the appropriate assessment decision) will be published along with a Ministerial SEA statement which will indicate how environmental considerations and the NIS were taken into account in the Plan and how the public consultation was considered.

Recommended Policy Actions for the Marine Renewable Energy Sector

The draft OREDP contains recommended policy actions for the marine renewable energy sector going forward arising from the SEA process. These actions were reviewed and revisions proposed as part of the Natura Impact Statement.

Collaboration and Coordination:

- **Proposed 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.
- **Proposed Action 2:** Collaborative working with the existing Ocean Energy Advisory Group to assist/advise SEAI and DCENR with taking forward the OREDP. The composition of the Ocean Energy Advisory Group should be expanded to include other interests in the marine sector including fisheries and environmental bodies.

SEA Monitoring Requirements:

- **Proposed 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:

- **Proposed Action 4:** DCENR and SEAI, in the context of the offshore renewable energy sector, will collaborate with the lead authorities on the Marine Strategy Framework Directive and other statutory requirements that are taking forward requirements relating to research, collation, management and dissemination of data and information collected for the marine environment (including research work on the marine environment being undertaken by the Marine Institute and National Parks and Wildlife) to ensure 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.
- **Proposed Action 5:** A combination of filling data gaps at a strategic level (as set out in Action 4), filling data and knowledge gaps at individual project level and filling data gaps through use of the deploy and monitor approach will be pursued. DCENR and SEAI, in the context of their collaboration with lead authorities on the Marine Strategy Framework Directive, should

endeavour to ensure as much data collection and research as possible on Resource Assessment Areas 5 and 6 which are considered more high risk than other resource assessment areas.

Consenting and Permitting:

- **Proposed Action 6:** Future foreshore consenting processes will take into account the broad findings and assessment of the SEA and this Natura Impact Statement (NIS) in terms of location and constraints.
- **Proposed Action 7:** The foreshore consent process will require developers to put in place appropriate monitoring programmes to assess the effects of their development.
- **Proposed Action 8:** The foreshore consenting authority will consider the application of an incremental (the 'deploy and monitor') approach as part of the scaling up of larger offshore renewable energy developments.
- **Proposed Action 9:** All individual projects subject to foreshore consent for development will be required to comprehensively demonstrate that the development would not have a Likely Significant Effect (LSE) on the integrity of a Natura 2000 site. Where it is not possible to conclude that there would be no LSE, the applicant must clearly demonstrate as part of the Foreshore Consent Application process the mitigation measures that will be implemented as part of the project to avoid LSE, detailing how these measures will be implemented. Where there are no options for avoiding LSE the applicant must demonstrate that there are Imperative Reasons of Overriding Public Interest (IROPI) for the project.

Guidance and Advice:

- **Proposed Action 10:** The project level mitigation measures/EIA Guidance prepared as part of the SEA Environmental Report will be integrated into the final OREDP (rather than being an Appendix) and will be incorporated into National EIA Guidance for offshore renewable energy developments by the relevant authority. Project level mitigation measures in the OREDP (and in the National EIA Guidance for offshore renewable energy) will incorporate Table 7.1 of this Natura Impact Statement "Suggested Mitigation Measures where there is Potential for LSE."
- **Proposed Action 11:** Development and maintenance of a GIS database tool to inform the Foreshore Consenting process, led by the Marine Institute.
- **Proposed Action 12:** As policy develops and evolves, and as the OREDP is implemented, any decisions around levels of development to be pursued and around future foreshore consenting policy, particularly if it is decided to instigate a foreshore leasing round, will take into account in-combination effects. At a project level, the assessment of in combination effects will be an obligatory part of the award of a foreshore lease. The state bodies identified in Action 1 undertake to consider in-combination effects in their decision making as policy evolves. Consultation and liaison between relevant Government Departments nationally and with state bodies in Northern Ireland, Isle of Man and mainland UK will be undertaken and maintained as policy develops, including through such structures as the British Irish Council. In-combination effects will be considered as part of the initial review in 2015 of the OREDP and the full review in 2020 in light of policy development in the interim.

4. OFFSHORE OIL & GAS AND OFFSHORE MINERALS

The future picture of the offshore oil and gas sector in Ireland will vary depending on the amount of oil and gas exploration in offshore Ireland over the coming decades.

In the event of several major oil and/or gas finds, Ireland could easily find itself self-sufficient and becoming a net exporter of oil or gas. A more likely scenario, however, is that a smaller number of new finds will be made, which however, could also transform the E&P (Exploration and Production) scene here in Ireland.

4.1 Profile of the sector

The Irish offshore oil and gas sector has significant potential, which can only be confirmed if the level of exploration is significantly increased²⁰. Over the last 40 years some 129 exploration wells have been drilled with limited success - less than 1 in 30 success ratio (discovery of commercial fields)²¹ when the exploration of all offshore basins is taken together. Total investment to date by the private sector in exploration activity is estimated at approximately €3bn, resulting in four commercial discoveries (three off Cork, one at Corrib off Mayo). Currently, exploratory drilling is running at one - two wells per year.

The first offshore well in Ireland was drilled in 1971, about the same time as Norway and the UK started (especially in the North Sea). Since the early 70's, there have been small/moderate sized discoveries of oil, gas and gas condensate in the North Celtic Sea, Porcupine, Slyne and Rockall basins. Ireland has been a producer of offshore gas since 1978, with production coming from the Kinsale, Ballycotton and Seven Heads fields off the south coast. These resources are progressing towards depletion but new production is scheduled to come on-stream at the Corrib Field off the west coast. Ireland's offshore gas resources currently supply about 5% of the economy's gas demand, while the power sector share of total gas demand has grown from 61.7% in 2002/03 to 64.8% in 2008/09. Irish annual gas demand actually contracted by -3.1% in 2008/09 with the largest reduction of -4.6% occurring in the Power Generation sector. It is forecast to have decreased to 2006/7 levels by 2013/14 when demand is forecast to pick up. However, despite the demand contraction in 2008/09, Irish annual gas demand had grown by 3.0% p.a. over the seven year period 2002/02 to 2008/09.

For the immediate future, Ireland is forecast to be a small producer of gas unless there are some major discoveries. No commercial Irish oil production has been achieved to date although active appraisal of existing discoveries is currently in progress.

Although exploration activity levels offshore Ireland have historically been relatively low, it has been estimated that there is potential yet to find resources of 10 billion barrels of oil equivalent (oil or gas) in the Irish Atlantic Margin²². Exploration has been successfully encouraged through active promotion of the opportunities by the Department and the holding of regular licensing rounds. (Further details are provided under Government Policy Section below).

²⁰ <http://www.iooa.ie/irelands-offshore-potential-page.html>

²¹ Expert Advice on Review of Irish Petroleum E&P Licensing Terms. Report prepared for The Department of Communications, Marine and Natural Resources (Dec 2006). Indecon in association with London Economics. <http://www.dcenr.gov.ie/NR/rdonlyres/A1DDF6AC-C1CD-4470-A2CB-53197DF2E928/0/IndeconReport.pdf>

²² <http://www.dcenr.gov.ie/Natural/Petroleum+Affairs+Division/2011+Atlantic+Margin+Licensing+Round.htm>

While recent research and surveys, such as multidisciplinary petroleum research projects and other surveys such as the Irish National Seabed Survey (INSS), have added to the knowledge of Ireland's seabed and associated potential, it is only through active exploration that the potential will be proven.

Offshore Minerals /Mining / Economic Minerals/Aggregates

The distribution of commercial minerals such as mineral placer deposits is largely unknown offshore Ireland but in the case of maërl (coralline algae used mainly as organic fertilizer), has offered some commercial opportunities. The most commonly extracted offshore material is aggregate (sand & gravel) although to date this has been for once off projects, such as beach protection, rather than as a commercial alternative to onshore resources. Several evaluations have taken place for marine aggregates, including a recent EU INTERREG funded study the Irish Sea Marine aggregates Initiative (IMAGIN), which indicated significant resources with commercial potential²³. Deposits of orthogenic phosphate, and various metallic compounds including manganese nodules and crusts can be expected but are not well documented²⁴. Heavy Mineral Sands, an important worldwide source of zirconium, titanium, thorium, tungsten, rare earth elements, are known to occur along the Irish coast and were explored in the 1980's but are not being actively investigated at present.

Gas Hydrates

Methane, occurring as a gas hydrate in marine sediments, is considered by many to be a strong candidate for a new energy resource and is currently the target of many international research programmes. Worldwide they concentrate remarkable volumes of gas, probably exceeding all other fossil fuels. Methane hydrate is stable in ocean floor sediments in water depths greater than 300 metres and at low temperature and is thought to be widespread in ocean sediments, including those off the Irish coast. Ireland is believed to have a possibly significant, but un-quantified, offshore methane hydrate resource that, given the appropriate extraction and utilisation technology, may be of future importance.

²³ Irish Sea Marine Aggregate Initiative (IMAGIN) Policy Report, CMRC and Marine Institute, Marine Environment & Health Series, No. 32, 2008

²⁴ http://cmrc.ucc.ie/publications/reports/Final_Seabed_Resources_Report_2001.pdf

²⁸ http://cmrc.ucc.ie/pages/research_project_page.php?project_code=imagin

4.2 Opportunities and Key Constraints

	Opportunities	Constraints
Oil & Gas Exploration and Production	<ul style="list-style-type: none"> ✓ Potential discoveries would strengthen Ireland's security of energy supply ✓ Attractive fiscal and licensing environment for E&P companies ✓ Current revised licensing option regime that encourages exploration for an initial 2 year period without large up-front investment. ✓ Higher tax rates on more profitable fields – 25% for pre-2007 licences and up to 40% for post-2007 licences. ✓ Potential major contribution to economic development including potential for increase in employment linked to exploration and production activities / spin-offs. ✓ Infrastructure provided by Corrib. ✓ INSS and size of Irish marine territory 	<ul style="list-style-type: none"> ✓ Harsh geographical and climatic conditions. ✓ Relatively high costs of deepwater exploration. ✓ Unproven resource ✓ Low success rate ✓ Negative experience of Corrib Gas Field ✓ Investors dependent on fiscal terms and prosperity of the region ✓ Limited availability of associated infrastructure leading to high cost associated with development ✓ Potential environmental issues ✓ Limited data availability in deeper water areas
Gas Storage, CCS,	<ul style="list-style-type: none"> ✓ Element of Ireland's Generation Fuel Mix ✓ Security of Supply ✓ Climate change-driven activities 	<ul style="list-style-type: none"> ✓ Potential environmental issues
Offshore Minerals, aggregates and Minerals	<ul style="list-style-type: none"> ✓ Potential mineral resources to be exploited as onshore mines are depleted. ✓ Marine aggregates 	<ul style="list-style-type: none"> ✓ Unproven resource ✓ Environmental issues (e.g. Natura)

- The cost of exploring offshore Ireland is high because of its remoteness and water depths (in the Atlantic Margin water depths are 7 – 8 times greater than that of the North Sea).
- The limited availability of infrastructure (pipelines, terminals, platforms) due to the absence of production, in turn makes the development of a discovery expensive.
- While Ireland's fiscal terms are relatively attractive, the low success rate has had a negative impact on investment.

4.3 Existing Government Policy, Plans and Targets

The Government White Paper '*Delivering a Sustainable Energy Future for Ireland*²⁵ sets out the Government's Energy Policy Framework 2007-2020. It is set firmly in the global and European context which has put energy security and climate change among the most urgent international challenges.

One of the strategic goals included in the Government's Energy Policy Framework 2007-2020 is to '*Create a Stable Attractive Environment for Hydrocarbon Exploration and Production*'. [Section 3.6, p 30-31]

The Government recognises that the overarching objective of securing Ireland's national energy supply will be a key driver in the development of this country's approach to hydrocarbon exploration and production. Therefore, it is a key Government policy objective to encourage investment in oil and gas exploration off the Irish coast and to optimise the value of any oil and gas finds for Ireland. Accordingly, the Government's strategy for the exploitation of the State's natural hydrocarbon resources aims to maximise the level of exploration activity and increase the level of production activity, while ensuring a fair return to the State from these activities. It is noted in the White Paper that this strategy is already underpinned by fiscal terms designed to attract an increased level of exploration activity, which will also ensure a higher return to the State from more profitable fields, where increased levels of exploration result in potential reserves being proven. If prospectivity improves substantially, it is stated in the White Paper that the fiscal terms will be subject to review for future licences in that context.

The White Paper advises that the regulatory framework should encourage an increase in the level of exploration and production activity while ensuring that this activity is conducted in a manner that is both safe and has due regard for the environment.

More recently, Forfás' Enterprise Strategy Report 'Sharing our Future²⁶', has described the underwater seabed along Ireland's coasts as '*largely an untapped resource*'. The report refers to a '*strategic objective of the Government [...] to maximise the area of the Continental Shelf under Irish jurisdiction and to establish and delineate its outer limits beyond 200 nautical miles.*'

The 2011 Atlantic Margin Round featured a number of special initiatives designed to encourage new momentum in the level of exploration activity offshore Ireland. Under the Round, Licensing Options were offered in frontier basins for the first time. The response from the exploration industry was positive and gives some grounds for confidence. Key facts include:

- Fifteen applications were received by the deadline compared to two in the previous round.
- Thirteen Licensing Options have been awarded which cover a total area of just over 15,000 square kilometres and comprise 55 full blocks and 7 part blocks.
- Twelve companies were involved in the awards, seven of which were new to Ireland.
- A wide variety of exploration plays were recognised, some of which were the focus of the Department's recent technical promotion campaigns.

The outcome of 2011 Round confirms this strategy to encourage exploration, both the number of applications and the number of awards resulting from the Round are the highest of any Frontier Round, the first of which was in 1994. There is optimism that the holders of many of the new licensing options will be successful in identifying exciting exploration opportunities that warrant progression to full exploration licenses and substantial further work programmes.

²⁵ Department of Communications, Marine and Natural Resources (2007). The White Paper. Delivering a Sustainable Energy Future for Ireland, The Energy Policy Framework 2007-2020.

²⁶ Forfás (2009), Sharing Our Future: Ireland 2025, provides a long term assessment of what is required to develop a competitive sustainable enterprise sector. <http://www.forfas.ie/publication/search.jsp?ft=/publications/2009/title.4403.en.php>

Licensing Regime²⁷

Ireland's current licensing regime was established in 1992 and revised in 2007. The regime recognises the geographically varying risks and costs of offshore exploration. For example, it differentiates the terms and duration of frontier and deepwater acreage from shallow water inshore basins. Ireland was one of the first nations to offer licensing options to industry as a low-cost entry to exploration in the more mature basins, in order to permit innovative, smaller oil companies to participate in the exploration effort.

Acreage Availability

Ireland's current acreage release policy uses:

- a. Licensing rounds to offer the Atlantic margin basins to industry, and
- b. An 'open-door' facility for the shallower-water provinces from the Celtic Sea through St. George's Channel and up into the Irish Sea.

Fiscal Terms

Ireland recognises that its offshore acreage, particularly the Atlantic margins are under-explored. It has therefore established fiscal terms that are amongst the most attractive in the world. Government take was set at 25% corporation tax with immediate deductibility of exploration and development costs. In 2007, a profit resource rent tax (PRRT) was introduced which applies to any finds made under licences issued on or after 1 January 2007 and allows for an additional tax of up to 15%.

Gas storage

The southwest part of the Kinsale Head Gas Field has been used for gas storage for a number of years. Currently the Operator of the field is assessing the viability of expanding the gas storage capacity in SW Kinsale and the potential of developing the depleted Ballycotton gas field as additional storage capacity. Government policy and regulation in this area is still being developed.

Carbon Capture and Storage (CCS)

Carbon capture and storage (CCS), alternatively referred to as carbon capture and sequestration, is a means of mitigating the contribution of fossil fuel emissions to global warming. The process is based on capturing carbon dioxide (CO₂) from large point sources, such as fossil fuel power plants, and storing it geologically in such a way that it does not enter the atmosphere. Following the completion of an all-island study on CCS, a number of initiatives are under way to further progress the development of CCS offshore Ireland, particularly in the Kinsale area and in the Irish Sea/Central Irish Sea basins. An Inter Departmental Group on CCS is chaired by DCENR and mandated with developing recommendations for Ireland in this area. In addition there is an EU Directive providing guidance in this area, dealing with the Geological Storage of Carbon Dioxide²⁸.

²⁷ PAD/DCENR Special Publication No. 1/09, (2009). Licensing, Permitting and Gas Marketing in Ireland. Commercial Handbook. An information summary for E&P managers.

<http://www.dcenr.gov.ie/NR/rdonlyres/C33B10B8-2CA3-4E53-BE0A-E75D210D5FC0/0/Commercialhandbookweb.pdf>

²⁸ <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2009:140:0114:0135:EN:PDF>

5. MARINE AND COASTAL TOURISM AND LEISURE (INCLUDING CRUISE TOURISM)

5.1 Profile of the sector

In 2007 the marine tourism and leisure activities had an estimated turnover of €944m, adding €453m to Irish GDP and supporting the equivalent of 5,836 full time jobs. The turnover comprises an estimated €658m from domestic tourism, €213m from visitors and €73.5m revenue relating to marine activity companies (diving, surfing, sailing etc)²⁹. Marine tourism accounts for approximately 7% of the total tourism industry.

The sector includes the following variety of activities:

Watersports <ul style="list-style-type: none">• Sailing at Sea• Boating at Sea• Water Skiing/Jet Skiing• Surfing, Kite/windsurfing• Sea Kayaking• Scuba Diving/Snorkelling• Other Sea Sports	Seaside/Resort/ Coastal Trips <ul style="list-style-type: none">• Swimming in the Sea• Bird Watching in Coastal Areas• Whale/Dolphin Watching• Visiting Coastal Natural Reserves• Other Trips to the Beach, Seaside, Islands, Harbour tours• Nature tourism, sightseeing including coastal drives• Wellness e.g. thalassotherapy• Marine/ water themed visitor centres
Angling <ul style="list-style-type: none">• Sea Angling from boats• Sea Angling from the Shore	

In addition to the above activities, Ireland continues to host a number of high profile marine sporting events such as the Volvo Ocean Race, Cork Race Week and the Tall Ships Race.

Adventure Travel is the fastest growing segment in tourism globally with 30% of all holidays taken now classified as adventure holidays. Activity and adventure holidays have been on a strong up-ward curve for the past decade (prior to the recession overseas activity holidays grew worldwide by an estimated 22% between 2004 and 2008) as travellers adopt more adventurous styles of holidays with resumption in growth expected when economic stability is restored. The adventure holiday product is estimated to be worth \$89 billion worldwide with the UK taking in almost £5 billion in 2009 on activity and adventure holidays.

The overseas Activity/ adventure sector was worth €830 million to the Irish economy in 2010 and these visitors spend on average 40% more during their trip to Ireland. Mainland Europe and Britain are the primary source overseas markets for activity tourism accounting for over 75% of activity tourists.

Ireland is ranked 7th amongst the top 10 developed countries in the world with the highest adventure tourism potential (International Adventure Tourism Development Index 2010) indeed Killarney has recently been voted No. 5 in the Top 10 list of Outdoor and Adventure Destinations in Europe by Trip Advisor.

²⁹ Economic statistics are based on 2007 courtesy of SEMRU unless otherwise stated. Ireland's Ocean Economy Report. SEMRU, NUI Galway. December 2010.

The growing number of adventure festivals and events offer a new platform to promote the adventure product in Ireland and are attracting attention from overseas adventure journalists.

International Cruise Tourism

A recent commissioned report by Fáilte Ireland³⁰ has shown that the worldwide cruise market is a massive industry and in 2009 was estimated to be worth \$26.9 billion. This segment of the tourism market demonstrates potential to attract high spending visitors to their shores. Cruise ship expenditure not only contributes to the immediate port area but also to the hinterland economies of the ports. Continued growth in the area has lead cruise operators to invest in capacity expansion and to continually seek new destinations and excursions to satisfy guest's experiences.

In 2011, Fáilte Ireland organised a workshop with stakeholders and Port CEOs to review the report findings and to scope out a strategy and plan for the sector over the next 5 years. Fáilte Ireland will be meeting with Cruise Ireland and other interests over the coming months with a view to supporting a strategy for growth.

Since the launch of Cruise Ireland (1994), the island of Ireland has enjoyed significant success in the cruise sector with the number of ships increasing from 61 in 1994 to 202 in 2010 and passenger numbers increasing by over 200% to 204,489 passengers. Last year direct spend from passengers and crew who disembarked at Irish ports, including port charges, was estimated at €20.3 million.

Main ports of call for cruise liners include: Dublin and Cork, however, a number of other ports and harbours (commercial, regional and fishery) are also keen to take advantage of this growing market which would significantly boost tourism to more remote and rural locations.

5.2 Opportunities and Key Constraints

	Opportunities	Constraints
Development policy	<ul style="list-style-type: none"> ✓ Marine tourism identified as a policy / development priority by Government ✓ Coherent and Co-ordinated implementation plan for the development of the marine and coastal tourism and leisure sector 	<ul style="list-style-type: none"> ✓ Lack of ownership and strategic leadership ✓ Policy issues and development actions not fully co-ordinated
Environment and Resource	<ul style="list-style-type: none"> ✓ Create an awareness around the vast Atlantic Ocean offering a 'playground' like no other ✓ Ireland's 2000km coastline and spectacular coastal scenery ✓ Westerly Atlantic seaboard ✓ Clean Green Image ✓ Beaches / water quality and associated blue flag status ✓ Eco-Tourism such as whale and dolphin watching ✓ Marine Conservation Parks (promotion of Natura sites) ✓ Marine or water-themed visitor centres, in key strategic locations 	<ul style="list-style-type: none"> ✓ Incorrect perception around bathing water quality ✓ Lack of integrated coastal zone management to support development ✓ Licensing and planning fragmented ✓ Physical access to the resource is poor in places ✓ Beach management and safety practices is not co-ordinated and standards not as high as that seen abroad ✓ Lack of resources from LA in order to sustain existing facilities e.g. beaches

³⁰ Cruise Tourism to Ireland Research Report, 2010, Policy and Futures, Fáilte Ireland

	Opportunities	Constraints
Product s / Product Development	<ul style="list-style-type: none"> ✓ Niche Markets: Angling, boating and sailing, watersports ✓ Beaches and coastal walking routes ✓ Signature products e.g. Escape to the Islands, touring the Irish coast ✓ Revitalising Irish seaside resorts ✓ Product clustering ✓ Food Tourism (linked to seafood – 'Brand Ireland') ✓ Eco-tourism ✓ Marine Sporting Events e.g. Volvo Ocean Race, Cutty Sark Tall Ships etc. 	<ul style="list-style-type: none"> ✓ Significant gaps in the product base ✓ Lack of up-to-date data on the specific gaps ✓ Lack of up-to-date economic statistics and market data on consumer demands ✓ State investment challenges for new development ✓ Planning and foreshore issues ✓ Incomplete visitor marina network, particularly along the west and north-west coastline ✓ Viewing points or vessels for whale and dolphin watching are poorly provided compared with our neighbouring competitors.
Cruise Liner Tourism ³¹	<ul style="list-style-type: none"> ✓ More co-ordinated activity from ports ✓ Better dedicated cruise berths ✓ Better welcome at berth ✓ Capitalise on friendly image ✓ On board tourism representatives ✓ Excursions: economic impact on local economy offering rural / remote locations new streams of tourists 	<ul style="list-style-type: none"> ✓ Inconsistent tourism offer in ports ✓ Poor landings facilities in some ports ✓ Unfavourable exchange rates ✓ Competing with other destinations in Europe and globally who often offer better value and have set high service standards

In addition to the above activities, the Irish marine and coastal resource has significant natural and built tourism assets and infrastructure. There is potential to make better use of these assets for product development through sustainable management and development.

Marine and Coastal Tourism Assets (natural and built heritage)

Beaches (bathing waters, Blue flag, green coast)
 Caves
 Islands
 Cliffs
 Marshes
 Estuaries
 Saltwater lagoons
 Spits
 Reefs
 Dunes
 Fauna (cetaceans, Fish, birds, mammals, crustaceans etc)
 Flora (seaweed, marram grass, etc)
 Archaeology and Architecture (Martello towers, forts etc)
 Shipwrecks
 Traditional and heritage boats
 Naval artefacts, old ships

Marine and Coastal Tourism Infrastructure

Marinas
 Piers/ jetties
 Lighthouses
 Coastal towns/ resorts
 Walking routes
 Driving routes
 Scenic lookouts/ parking
 Picnic areas
 Fishing ports
 Ferries
 Access points

Ireland has a unique opportunity to invite our visitors to come and experience some of the most pristine waters in Europe. Although modern public facilities in Ireland and services for visitors, linked to best practice in beach management are not as high as the standards commonly seen abroad, Ireland is now well on its way to meeting, by 2015, the high standards set by the EU Water Framework Directive (WFD) which covers water quality waters for one nautical mile out to sea.

³¹ Cruise Tourism to Ireland Research Report, 2010, Policy and Futures, Fáilte Ireland.

The Tourism Renewal Group stressed the need for the tourism agencies to identify, appraise and pursue new areas of potential in which Ireland may have a particular competitive advantage, including:

- Food tourism/gastronomy;
- Eco-tourism (including outdoor activities, such as surfing and walking);
- Cruise tourism (including gateways as well as rural ports); and
- Niche markets (for example, retired travellers, activity tourism, and health and wellness tourism).

The potential value of hosting international marine focused sporting events is significant. For example, an assessment of the economic value of the 2009 Volvo Ocean Race stopover in Galway showed that the event generated an economic impact of €50m for Ireland. The total Government support of €8 million (incl. VAT) covered 40% of the total cost of hosting the event³².

Building on the growing international market for adventure holidays, Fáilte Ireland have been working to harness the resources of the western seaboard in particular to establish a destination of excellence through targeted investment in infrastructure, business support and promotion of active engagement and authentic adventure experiences that play to Ireland's strengths with regard to: welcome and service, natural heritage, culture and landscape. This work will be underpinned by the development of specific policies and actions that will include marine and coastal tourism and will link to Driving Routes and Tourism Towns initiatives.

The main issues and obstacles to the development of marine and coastal tourism identified in the past include fragmented policy and unclear ownership of marine tourism development at national level, water safety, water quality, training and up skilling of providers, legislation, funding, planning issues and an over emphasis on marina development. Looking to the future, there is a need to move towards a range of both sea-to-land and land-to sea solutions and opportunities. Opportunities exist both in the management and maintenance of existing facilities as well as the development of new assets.

Despite the potential of the sector there are significant gaps in the product base in many coastal counties where investment in access and infrastructure is essential. The following tables highlight the immense opportunities for marine tourism development on a County basis³³. To get an accurate up-to-date picture of these gaps an updated product audit on a county basis is required. Any updated product audit should also look at not only the product strength but also the accessibility of the product to the non specialist.

³² Volvo Ocean Race 2008-2009 – Economic impact on Galway and Ireland, Deloitte, 2010.

³³ Marine Tourism and Leisure Development Strategy 2007-2013

Table 3: Status of Marine Leisure Product - activity by county

Order of Existing Product Strength	Coastal Counties	Beaches	Diving	Visitor Marinas	Sailing, Boating, Water Sports	Sea Angling	Inland Angling	Coastal Walking	Whale & Dolphin Watching	Inland Waterways	Small Tourism Vessels	Marine/Water Themed Visitor Centres
1	KERRY	Excellent	Good	Reasonable	Very Good	Very Good	Good	Good	Excellent		Excellent	Excellent
2	CORK	Very Good	Excellent	Good	Excellent	Excellent	Good	Reasonable	Excellent		Excellent	Good
3	DONEGAL	Excellent	Good	Very Limited	Limited	Very Good	Good	Excellent	Good	Cross Border	Very Good	Limited
4	GALWAY	Good	Limited		Good	Good	Very Good	Limited	Good	Good	Very Good	Good
5	CLARE	Good	Limited	Very Limited	Reasonable	Limited	Good	Limited	Excellent	Good	Excellent	Good
6	DUBLIN	Good	Good	Reasonable	Excellent	Reasonable	Very Limited	Limited	Very Limited	Reasonable	Very Good	
7	MAYO	Excellent	Limited		Good	Good	Excellent		Good		Limited	
8	WEXFORD	Good	Limited	Some	Limited	Good	Very Limited		Good			Very Good
9	WATERFORD	Reasonable	Limited	Some	Good	Good	Very Limited		Limited		Limited	Good
10	WICKLOW	Reasonable		Some	Good	Limited	Very Limited		Limited			Reasonable
11	SLIGO	Reasonable			Reasonable	Good	Very Limited		Limited		Very Limited	Reasonable
12	LOUTH	Reasonable		Some	Reasonable	Reasonable	Very Limited	Cross Border				
13	LEITRIM						Good			Excellent		
14	MEATH	Limited	Reasonable				Very Limited					
15	LIMERICK						Very Limited					

KEY	Product not developed	Excellent or very good product.	Good product that can be developed quickly.	Potential to develop in medium term.
-----	-----------------------	---------------------------------	---	--------------------------------------

Table 4: Product / Service Gaps - activity by county

Order of Existing Product Strength	Coastal Counties	Beaches	Diving	Visitor Marinas	Sailing, Boating, Water Sports	Sea Angling	Inland Angling	Coastal Walking	Whale & Dolphin Watching	Inland Waterways	Small Tourism Vessels	Marine/Water Themed Visitor Centres
1	KERRY	Services Gap					Services Gap					
2	CORK	Services Gap					Services Gap					
3	DONEGAL	Services Gap		Product Gap	Product Gap		Services Gap			Product Gap		Product Gap
4	GALWAY	Services Gap	Product Gap	Product Gap				Product Gap				
5	CLARE	Services Gap	Product Gap	Product Gap		Product Gap	Services Gap	Product Gap				
6	DUBLIN	Services Gap						Product Gap		Services Gap		Close to Bray
7	MAYO	Services Gap	Product Gap	Product Gap				Product Gap			Product Gap	Product Gap
8	WEXFORD	Services Gap	Product Gap		Product Gap			Product Gap			Product Gap	
9	WATERFORD	Services Gap	Product Gap					Product Gap	Product Gap		Product Gap	
10	WICKLOW	Services Gap	Product Gap			Product Gap		Product Gap	Product Gap		Product Gap	
11	SLIGO	Services Gap	Product Gap	Product Gap				Product Gap	Product Gap		Product Gap	
12	LOUTH	Services Gap	Product Gap					Product Gap	Product Gap		Product Gap	Product Gap
13	LEITRIM							Product Gap				
14	MEATH	Services Gap			Product Gap			Product Gap				
15	LIMERICK				Product Gap			Product Gap			Product Gap	

KEY	Product not developed / insufficient quality / relatively low tourism demand / relatively small element of county tourism product.	Excellent or very good product that can be brought to market immediately (requires promotion / packaging / service links).	Good product that can be developed in short term (requires improvement in quality and organisation to compete).	Potential to grow subject to investment in product development / infrastructure / links to tourism industry.
-----	--	--	---	--

5.3 Existing Government Policy, Plans and Targets

In 2006 the Marine Institute prepared a detailed and comprehensive **Marine Tourism and Leisure Development Strategy** (2007-2013), providing a detailed overview of the status of the sector at that time, the opportunities and constraints facing the industry and sets clear goals and targets for the sectors future development. The Strategy was supported by a detailed audit which assessed the quantity and quality of Ireland's water-based tourism and leisure products and identified product gaps and opportunities at local, regional and national level with a view to informing policy and investment decisions.

The **Fáilte Ireland Tourism Product Development Strategy** (2007-2013) also highlighted the potential of marine tourism, concluding that the potential in Ireland was not being exploited, and that there was a need to gain ground on EU competitors in the marine sports area, which the report considered a core product. The principal financial instrument used by Fáilte Ireland to implement the Strategy is the **Tourism Capital Investment Programme**. This investment programme provides supports for identified key products provided by the private sector that are critical to the continued viability of some rural tourism nodes. These products include the development of specialised water sports centres in both coastal and inland areas, and for the development of diving centres, sail training and other related water-based tourism facilities other than coastal infrastructure such as maritime marinas³⁴.

Since the preparation of these two Development Strategies major changes have taken place in the global and Irish economy which has impacted heavily on tourism. In light of this, a number of policy documents/strategies relating to the survival, renewal and growth of the tourism sector have been published.

The 2009 Report of the **Tourism Renewal Group: New Horizons for Irish Tourism**³⁵: identified (1) *A Framework for Survival - Urgent Actions in 2009-2010*, and (2) *A Framework for Recovery and Growth – Building for the Future 2010-2013*. This included specific actions and related targets. Recovery Action 6 identifies the need to prioritise markets segments where Ireland can gain competitive advantage calling on:

- Improved packaging and marketing of leisure segments where we have developed critical mass which includes outdoor activities such as water-based activities; and
- Public/Private Cooperation to develop additional niches with potential. Possible segments identified which have a marine element include Food tourism/gastronomy, Eco-tourism and Cruise tourism (including Gateways as well as rural ports).

Regional/ Local Strategies for Marine Tourism

There is a great deal of interest at regional and local level in marine tourism and this interest has resulted in some very detailed and comprehensive strategies for marine tourism. Examples of such strategies / programmes include:

- *A Marine Leisure Infrastructure Strategy for the Western Division of Cork County Council (2008)*³⁶
- *Donegal Marine and Water Leisure Programme*
- *The Potential for Growing Marine Leisure- A Study for establishing the scope and opportunities for expansion on the east coast of Ireland (2007)*³⁷
- *Waterbased Tourism: A Strategic Vision for Galway (2002)*³⁸
- *Options for Marine Leisure Development in Waterford Estuary (2001)*
- *Marine Ecotourism- A Marketing Initiative in West Clare (2001).*

³⁴ Fáilte Ireland Tourism Capital Investment Programme Operational Guidelines

³⁵ http://www.dttas.ie/tourism/pdfs/FINAL_TRG%20Report_Web%20Version.pdf

³⁶ Produced by Cork County Council

³⁷ Produced by the Irish Sea Marine Sector Marketing and Business Development Programme

³⁸ Produced by the Marine Institute

Fáilte Ireland has worked with destinations, businesses and communities engaged in the development of **adventure and activity tourism** and now have a database of over 1000 tourism providers and adventure centres offering surfing, wind-surfing, kite-surfing, sailing, kayaking, mountain biking, walking, hiking, mountain climbing, scuba-diving, power-boating and jet skis and adventure races all over Ireland but predominantly along the west coast from Donegal-Kerry. Hiking and walking is the largest segment within the adventure tourism category with the most potential to attract visitors followed by Cycling and Angling – however the development of water based and marine leisure activity offers much potential, particularly so along the west coast.

In 2012, Fáilte Ireland will be placing emphasis on the development of Ireland's Adventure Tourism experience as a platform to grow visitor numbers and target new markets. This will include walking and cycling, watersports, family fun, equestrian and aspects of angling. This type of activity-based holiday is particularly suited to the Western seaboard.

An internal working group within Fáilte Ireland's Dublin office has been set up to pool resources with a view to developing a **marine and coastal tourism plan** for Fáilte Ireland in 2012. This plan will address the demand from external stakeholders for Fáilte Ireland to become more prominent in the area of marine and coastal tourism in order to develop opportunities within the sector and will be informed by gathering and analysing data with regard to consumer demands, needs and trends.

The following work was carried out during 2011 to support the development of this plan:

- GIS Mapping of the marine infrastructure and amenities around the country is currently underway and will be completed by the end of the year.
- To supplement this, an infrastructure audit of 145 Blue flag and Green Coast beaches in Ireland was undertaken over the summer.
- The boating holiday survey of consumers was facilitated at 36 locations around the country during the summer of 2011. It has been decided to leave this research open through to the summer of 2012 so that further visitor surveys can be carried out.

Over the last two years Fáilte Ireland have worked with over 200 adventure tourism providers and adventure centres offering surfing, wind-surfing, kite-surfing, sailing, kayaking, mountain biking, walking, hiking, mountain climbing, scuba-diving, power-boating and jet skis and adventure races all over Ireland. A range of supports have been identified and prioritised for 2011 / 12 , to deliver high quality, distinctive holiday experiences that will drive the development of the key tourism destinations around the country, with the aim of increasing visitor numbers and supporting profitable businesses and communities.

Fáilte Ireland plans to carry out additional research in 2012 to further investigate demand and supply side issues in relation to marine tourism. This research will then be used to develop a marine and coastal tourism plan for Fáilte Ireland in 2012 and feed into specific destination development plans for subsequent years. This plan will seek to address obstacles to development such as training needs, beach management, safety and regulation, investment etc, and build upon opportunities identified as part of the consumer (demand) side research.

Linkage with other water based sectors

Water-based tourism spans both marine and fresh water. Although this Plan deals with the marine and coastal aspects of the product, an integrated approach is required to ensure that the development of water based tourism takes account of all aquatic tourism opportunities. Waterways cruising, angling, diving, sailing & sail training and jet skiing all take place on our inland waterways, which offers an ideal location for additional winter tourism products particularly in relation to watersports training courses and eco-tourism.

6. MARINE ICT AND SMARTOCEAN

6.1 Profile of the sector

Marine ICT is a multi-disciplinary activity that encompasses industry players across the ICT and marine sectors. Technology convergence and integration is a key theme encompassing specialist tools (e.g. software design, sensor hardware, control and interface systems through to software enabled advanced visualization and forecast tools) developed for application to marine businesses and resource management.

Ireland's marine technology sector was first profiled in 2007 and comprises a small but diverse group of approximately 50 "knowledge-based" companies (indigenous and FDI) with core capabilities in the development and provision of ICT enabled decision support tools to the global marine sector. A recent survey by the Marine Institute showed that the indigenous sector is dominated by specialist SME's (e.g. Nowcasting, MCS Kenny, Cathx Ocean, EpiSensor, etc) and is "research intensive". A number of companies have developed software products based on patented research, some of these such as MCS Kenny, Intune Networks and SonarSim are University spinouts while others such as Fairview Analytics and TetraGeo have licensed technologies developed in the Third Level Sector. As perceived barriers to entry are lower for software oriented technologies over physical hardware based technologies, a significant proportion of the SME's identified are engaged in software development and are already active in the global marine sector.

It is an emerging sector of strategic interest to many large multinational (ICT) companies investing in Ireland. It can develop quickly in Ireland when there is a catalyst to explore and exploit trends such as:

- a) Technology convergence and integration is a key enabler for the delivery of the next generation of decision support tools for the global marine sector.
- b) Exponential growth in specialist marine ICT tools ranging from software design solutions, sensor hardware, remote control and interface systems through to advanced visualization and forecast tools.

Such technologies are sought to improve decision making and drive efficiencies in global marine related markets including the areas of; environmental monitoring, oil & gas, transport & shipping, aquaculture, coastal tourism, safety, security and surveillance. New opportunities have also been identified in the emerging areas of marine renewable energy, and integrated marine monitoring systems and resource management.

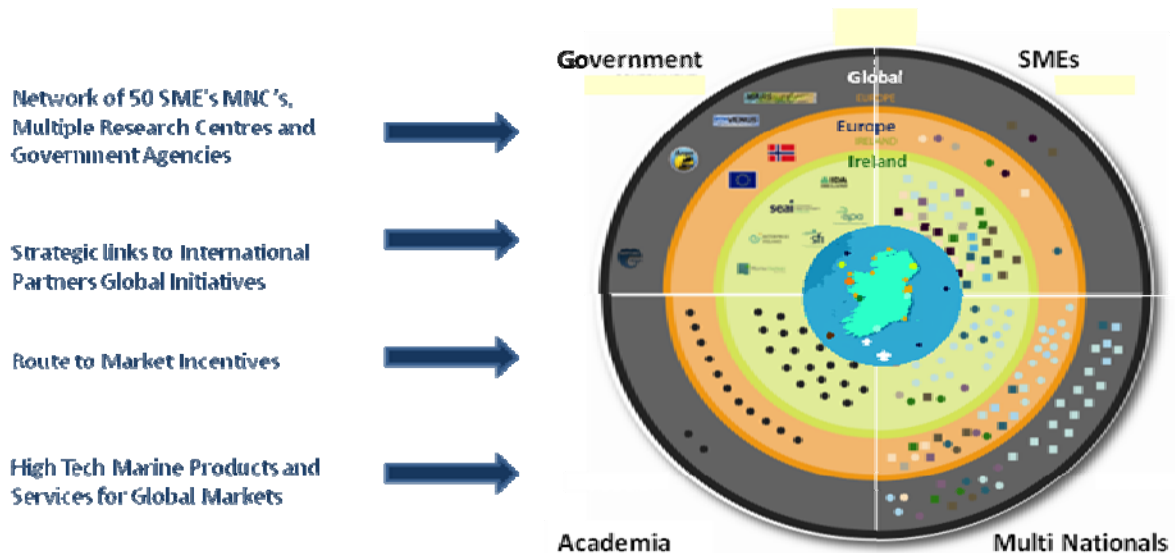
An industry survey conducted by the Marine Institute as part of the SmartOcean initiative illustrates the level of private sector involvement (SME and MNC) in marine R&D activities across a wide range of technology and market areas³⁹. Additionally The SmartOcean Strategy⁴⁰ demonstrates huge potential for Ireland to take a lead in convergence using the comparative advantage of our largest natural resource – the ocean – to capture untapped potential and to create 'new' commercial marine related opportunities which have global applications. The consultation exercise identified over 50 companies (both indigenous and FDI) developing ICT enabled products and services for key marine sectors.⁴¹

³⁹ Marine Institute (June 2010)

⁴⁰ SmartOcean Ireland, Consultation Document, 2010

⁴¹ SmartOcean Industry Consultation Report, Nuaventure, Nova UCD March 2011.

Industry Survey



In addition to industrial activity there is a strong research base in ICT and Marine. The range of centres of Excellence engaged in the SmartOcean Cluster above includes;

- National Centre for Sensor Research DCU
- Tyndall National Institute UCC
- Lighthouse Centre for Applied Photonics Galway
- Strategic Research in Advanced Geocomputation (STRATAG)
- Digital Enterprise Research Institute (DERI) NUI Galway
- IMERC 3, Cork
- CLARITY Centre for Sensor Web technologies (UCD, DCU, UCC)
- Ryan Institute NUI Galway
- Hydraulics and Maritime Research Institute, UCC
- Coastal and Marine Resources Centre, UCC
- Mobile and Marine Robotics Centre, UL
- Irish Climate Analysis and Research Units (ICARUS) NUIM
- Marine Institute, Galway
- Geological Survey of Ireland

Ireland's geographic location and extensive ocean resource, coupled with the existence of research infrastructure and datasets and the presence of a research orientated FDI & SME base offers Ireland as an attractive location for **test bedding**. Collaboration with international research leaders is also underway.

6.2 Opportunities and Key Constraints

Opportunities	Constraints
<ul style="list-style-type: none"> ✓ Growing global markets driven by <ul style="list-style-type: none"> ○ demand from related marine sectors (oil & gas, shipping, marine tourism/leisure, safety, security, marine renewables, fisheries & aquaculture) ○ increasing EU environmental monitoring requirements driving new decision support solutions ✓ Established world-class marine research infrastructure, datasets and research capabilities ✓ Ireland's is recognised as early mover in the establishment of specialist marine test-beds and technology development e.g.: SmartBay, iMERC, INFOMAR/INSS data ✓ Established SmartOcean brand for Irish Marine ICT sector, with strong research and innovation orientation ✓ Indigenous and FDI marine ICT enterprise base already delivering specialist decision support tools to global marine sector ✓ Research strengths of global corporations and global marine research partnerships ✓ Using mature technology platforms developed for other markets i.e. data management and analytics solutions for finance sector 	<ul style="list-style-type: none"> ✓ Ireland's Marine ICT enterprise base currently fragmented across ICT and market specific areas. ✓ No dedicated marine ICT sector representatives in national enterprise development agencies. ✓ Limited local market beyond test-bedding or niche applications ✓ Hardware systems developed must survive extended deployment in a challenging and dynamic operational environment ✓ Lack of sustained investment in comparison to increasing research capability & infrastructure investments by other international players ✓ Requirement for sustained support and coordinated marketing of world class physical and digital test beds and research infrastructure

6.3 Existing Government Policy, Plans and Targets

The Marine Institute's *Advanced Marine Technology Programme* seeks to give a visibility to the commercial activities and innovation that exists in Ireland's existing Marine ICT sector. It further seeks to co-ordinate and leverage R&D investments to:

- *Create a critical mass, multi-disciplinary and industry-oriented research grouping in the area of advanced marine sensing, communications and informatics;*
- *Create a focused capability in the application of next generation information and communications technology solutions for marine and environmental sectors; and*
- *Deliver innovative technology solutions for global marine markets.*

SmartBay a national Test and Demonstration Platform for Marine ICT is a flagship vehicle of the National Marine Technology Programme. , SmartBay was identified as a key action under the Government's *Strategy for Science, Technology & Innovation 2006-2013*, and has facilitated a range of innovative marine ICT projects since its establishment in 2008. Smartbay provides a test and service platform and will soon be expanded to a commercial hub to encourage, enable and exploit the new marine information and communication technology opportunities. Key clients of the infrastructure have included both multinationals and SME's, some of which including IBM and Intel, who have not previously been associated with the Marine Sector. These companies have developed new mandates in the area of marine ICT and have established new collaborations with other users of the infrastructure including a range of indigenous niche marine enterprises and national research teams.

There are enabling factors that support the SmartBay proposition and require greater collaboration and co-operation between industry (MNC & SME) and agencies including the HEI's. Those factors add uniqueness and create international interest in this Marine ICT Technology Platform. SmartBay will exploit many of these factors including;

- Ireland has a unique and publicly available database from its extensive Seabed survey INFOMAR, which can provide the focus for a digital domain testing environment.
- Ireland's opportunity for indigenous companies to work with research teams and develop and roll out niche sensing and communications technologies in the Marine.
- There is an expected exponential growth in the International Market for real time met ocean systems in the renewable energy sector (wind, wave and tidal) and that is expected to increase rapidly as this industry develops around the globe.
- The Vertical Market applications in areas such as gas pipeline and port security that are evolving and are new markets for ICT companies to actively engaged in.
- The International Market for real time monitoring of the marine environment surrounding food production area, as in shellfish and finfish aquaculture in open water.
- The National and EU ambition to develop large scale offshore aquaculture that can be realized through intense collaboration and interaction of engineers, marine biologists and other disciplines.

The SmartBay project has already developed International momentum based on the inclusion of multinational companies investing in Ireland who have again highlighted the strategic importance /opportunity of convergence in the Marine and ICT sectors.

In 2010, the Marine Institute published a **National Strategy for consultation on the development of the SmartOcean Innovation Cluster 'Towards a New Horizon: Harnessing Ireland's Potential as a European and Global Centre for Ocean Technology'.**

SmartOcean Vision 2020

By 2020 Ireland will be a recognized leader in the development, testing, commercialization and delivery to market of the next generation of innovative technologies addressing evolving global markets in marine renewable energy, environmental monitoring and water technologies.

The Strategy, developed in consultation with a group of leading Industry, Academic and Agency research partners set out a vision to establish Ireland as a European and Global leader in the development, testing and delivery of ICT enabled decision support tools to the global marine sector. The strategic intent of the SmartOcean Strategy is to leverage the existing ICT cluster and our science and technology base and to link this to our largest natural resource – the Ocean – using it as a catalyst for innovation, in a similar way to which other nations have used the oil and gas, shipbuilding or the defence sector to drive knowledge and innovation.

The Strategy is now being implemented through the resources of the National Marine Technology Programme and is focused on delivery of key actions aimed at advancing a multi-disciplinary innovation cluster. The SmartOcean cluster is focused on driving the convergence of ICT and marine related sectors enabling the sustainable economic development of the global ocean resource. These include the active facilitation of brokerage sessions for ICT and marine companies with national and international contacts, support of strategic industry-led development projects and the establishment of a SmartOcean graduate enterprise initiative delivering a pipeline of world class graduates with specialist multidisciplinary skillsets in the area of marine ICT.

7. MARINE BIOTECHNOLOGY AND BIOPRODUCTS

7.1 Profile of the sector

Interest in the economic and societal potential of marine biotechnology has been growing and gaining momentum thanks to new developments and technologies originating primarily in the life sciences, including advances in molecular biology and genomics, which enable new products based on marine materials to be created

The global market for Marine

Biotechnology based products includes:

- Industrial enzymes valued at €3.41 billion by 2015⁴²;
- Functional foods growing from €53.83 billion in 2007 to reach €88.34 billion by 2013⁴³;
- Nutraceuticals where the global market is expected to reach €121.46 billion by 2013⁴⁴
- Biomaterials - currently valued at €20.7 billion and to reach €40 billion by 2014⁴⁵;
- Drug delivery - a global market expected to be worth close to €138 billion by 2014⁴⁶;
- Bone replacement - growing at 7% per annum and currently valued at €1.38 billion⁴⁷;
- Aquaculture - set to continue exhibit growth opportunities which saw global output rise from 52.5 million tonnes to 55.1 million tonnes from 2007 to 2009 and valued at €73.15 billion.⁴⁸

What is Marine Biotechnology?

Biotechnology is the use of biological knowledge analytical and processing techniques to develop new products from marine biological materials. Marine biotechnology, sometimes referred to as "blue biotechnology", exploits the diversity in terms of the form, structure, physiology and chemistry of marine organisms, many of which have no terrestrial equivalents, in ways which enable new materials to be realised.

The potential for European nations to capture a share of the global opportunity is reflected in the recent European Strategy for Marine Biotechnology.⁴⁹ This strategy identifies target market areas where by exploiting the potential of marine biotechnology, Europe can secure a competitive advantage in the production of food products, health, environmental, industrial products and processes and energy.

Ireland has a strategic advantage with respect to marine biotechnology and bio-products in the context of an extensive natural marine resource encompassing a variety of habitats and organisms; an internationally recognised capability in biological sciences research and development; and strong food, pharmaceutical and medical devices industries competing globally.

Ireland's capacity to exploit marine biotechnology derived materials is developing rapidly. Interest in Ireland's seaweed resource is expanding in line with international trends which have seen increased output and an expansion in the use of seaweed in non-food products.

⁴² <http://www.bccresearch.com/report/BIO030F.html>

⁴³ http://www.economist.com/node/14520480?story_id=14520480

⁴⁴ <http://www.bccresearch.com/report/nutraceuticals-processing-markets-fod013c.html>

⁴⁵ <http://www.marketsandmarkets.com/PressReleases/global-biomaterials-market-worth-US58.1-Billion-by-2014.asp>

⁴⁶ Dublin, Cindy, "On the Rise: Drug Delivery Companies You Should Know About", Drug Development and Delivery, January 2010 Quoted in <http://finance.sfgate.com/hearst.sfgate/news/read?GUID=19206358>

⁴⁷ http://www.researchandmarkets.com/reportinfo.asp?report_id=1848996&t=e&cat_id=

⁴⁸ World Review of Fisheries and Aquaculture, FAO, Rome, 2011

⁴⁹ Marine Biotechnology: A New Strategy and Vision for Europe, Marine Board- ESF Position Paper 15, Ostend 2010

The contribution of marine biotechnology to the Irish enterprise sector is already visible with new applications in several end-use areas including:

- **FOOD** - An indigenous sector worth €8.5 billion in exports; 50,000 direct employees⁵⁰; increasingly research-intensive and driven by biotechnology; it possesses an international reputation for dairy origin functional foods and a rapidly developing reputation for marine functional foods research;
- **PHARMACEUTICALS** - Nine of the world top ten firms have a base in Ireland, in addition there are around 50 indigenous firms; exports from the sector top €46 billion per annum and the sector employs 25,000⁵¹;
- **MEDICAL DEVICES** - Eight of the world top ten firms have a strong presence in Ireland, there are also 100 indigenous firms, together these firms employ 24,000 and generate an annual revenue of €6.2 billion⁵¹;
- **AQUACULTURE** - Comprising a world leading aquaculture MNC and indigenous SMEs, there are 850 licensed operations engaged principally in producing finfish and shellfish for export markets. The sector employs close to 2,000 persons and output in 2009 was valued at €104 million⁵²;
- **SEAWEED** - Ireland's seaweed sector is a first mover in exploiting marine biotechnology to support its growth into high-value added products. Already eight firms⁵³ are engaged in the production of functional foods, nutraceuticals, cosmetics and agriculture products. Annual sales from this new marine bio-based marine sector have grown rapidly over the past 3 years to reaching an estimated €18million in 2010⁵⁴.

Marine Biotechnology research is driven by capabilities in life sciences and marine biological sciences, both areas where Ireland has established strong capabilities. Public funds totalling €21 million have enabled the development of Ireland's marine biotechnology related research activities. Together the publically funded marine functional foods research programme (NutraMara) and the Beaufort Marine Biodiscovery project represent an investment of close to €14 million, leading to the creation of significant new research capability and capacity under internationally ranked scientific leadership. These two initiatives and other publicly funded projects employ 76 researchers (including PIs, Post Doctoral Fellows and PhD students) working at all stages of the marine biotechnology value chain.

⁵⁰ http://www.ibec.ie/Sectors/FDII/FDII.nsf/vPages/Food_Industry_in_Ireland~sector-profile?OpenDocument

⁵¹ Health LifeSciences in Ireland – An Enterprise Outlook, Forfás, October 2009

⁵² Briefing Material for Minister 2011, DAFM, Dublin 2011

⁵³ Cybercolloids, ArraMara, Oilean Glas, Marrigot, BioAtlantis, Brandon Products, Voya and Irish Seaweed Processors

⁵⁴ Morrissey, K., Hynes, S., Cuddy, M., and O'Donoghue, C., Ireland's Ocean Economy SEMRU, NUI Galway, December 2010

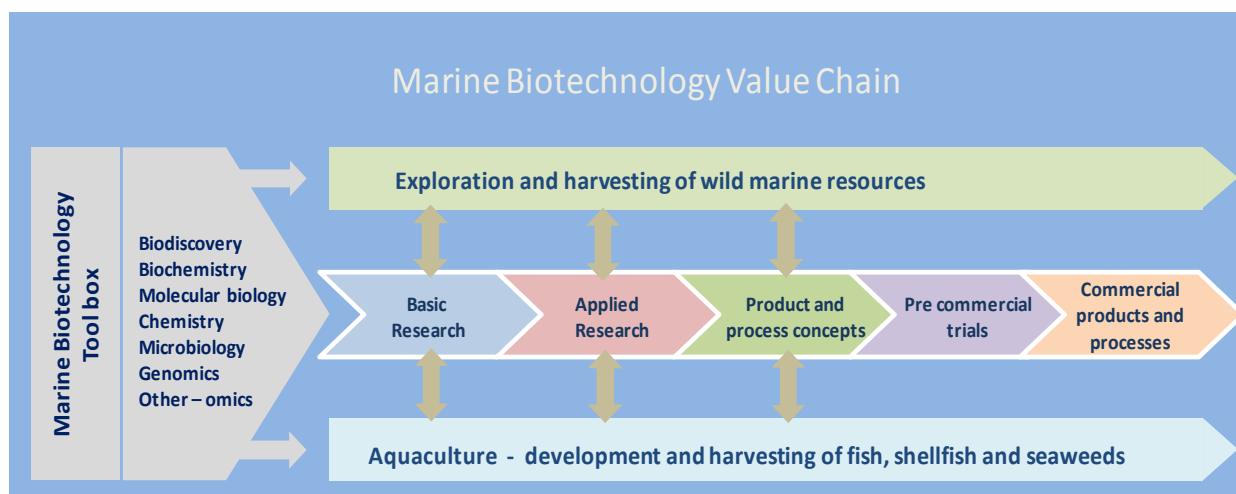


Figure 7: Marine Biotechnology Value Chain

7.2 Opportunities and Key Constraints

Preparatory work carried out by the Marine Institute, in consultation with the Life Sciences and Biotechnology sectors has identified a number of short (to 2016), medium (to 2020) and longer-term (2020-2030) opportunities and challenges for the sector (See below) which could underpin an emergent marine biotechnology and bio-products sector.

Growth Opportunities

The contribution of marine biotechnology is already visible with new applications in several end-use areas including pharmaceuticals, medical devices, environmental remediation, cosmetics and food sectors. Ireland's emerging knowledge-based bio-businesses, supported by solid research, already participate in this market growth. The key growth opportunities for Ireland exist in areas enabled by marine biotechnology including

- Exploring the diversity of our marine area to find organisms which can be sustainably exploited as sources of novel biomaterials.
- Creating novel products based on marine origin materials for use in health, advanced materials, functional foods, food processing and in environmental remediation.
- Using improved selective breeding methods for aquaculture by identifying species with unique traits required by consumers and industry alike, e.g. disease resistant, high feed conversion rates.
- Increasing the production, use and transformation of marine biomass (micro and macro algae, finfish and shellfish) to support commercial product development.

Opportunities		Constraints
Short-term (to 2016)		
Food	<ul style="list-style-type: none"> ✓ Exploiting marine ingredients in functional foods, food supplements, nutraceuticals and dietetics ✓ Use of marine materials as source of natural colours, gelling agents, fibre in consumer food products 	<ul style="list-style-type: none"> ✓ Limited access to wild materials for commercial purposes ✓ Links with the food industry slow to develop ✓ Low level of understanding of the potential of marine bioproducts ✓ Lack of continuity of funds for research
Aquaculture	<ul style="list-style-type: none"> ✓ New species development ✓ Reproduction, breeding and selection of high-value species 	<ul style="list-style-type: none"> ✓ Limited access to licences for aquaculture enterprise ✓ Absence of a connected development plan for aquaculture ✓ Low level of understanding of the potential of marine bioproducts ✓ Low priority of relevant research compared to initiatives in other sectors
Medium term (to 2020)		
Food	<ul style="list-style-type: none"> ✓ Using macro and micro algae in foods ✓ Creating novel processing technologies based on marine organisms 	<ul style="list-style-type: none"> ✓ Availability of research funds ✓ Competition from other sectors for marine materials
Aquaculture	<ul style="list-style-type: none"> ✓ Continued development of new species ✓ Modified nutritional and compositional profiles of aquaculture products 	<ul style="list-style-type: none"> ✓ Availability of research funds
Environmental and green Technologies	<ul style="list-style-type: none"> ✓ Improvements in the environmental status of marine environments ✓ Use of marine species in bioremediation ✓ Mining for enzymes for environmental bioremediation ✓ Extract value from food processing waste streams 	<ul style="list-style-type: none"> ✓ Low level industrial activity ✓ Fragmented research effort ✓ Low visibility research activity ✓ Lack of continuity of funds for research
Medical Devices and biomaterials	<ul style="list-style-type: none"> ✓ The use of marine biomaterials for bone replacement, stents, adhesives, wound closure and dressings, tissue repair and regeneration ✓ Bioassays and biomarkers based on marine model organisms 	<ul style="list-style-type: none"> ✓ Limited access to wild materials for commercial purposes ✓ Need to overcome regulatory barriers to innovative materials ✓ Low level of understanding of the potential of marine bio-products in medical device firms ✓ Low priority of relevant research compared to initiatives in other sectors ✓ Lack of continuity of funds for research
Long- term (to 2030)		
Medical Devices and biomaterials	<ul style="list-style-type: none"> ✓ Microbial control on implantable devices ✓ Dental devices ✓ Tissue culture scaffolds ✓ Medical diagnostics 	<ul style="list-style-type: none"> ✓ Need to overcome regulatory barriers to innovative materials ✓ Lack of continuity of funds for research
Pharmaceuticals and medical diagnostics	<ul style="list-style-type: none"> ✓ Marine compounds form the basis of new pharmaceuticals ✓ Marine materials used in targeted drug delivery ✓ Marine bioprocesses to produce new compounds ✓ Model organisms form the basis of novel medical diagnostics 	<ul style="list-style-type: none"> ✓ Lengthy development and regulatory regimes and associated high costs of getting product to market ✓ Absence of research intense pharmaceutical firms in Ireland ✓ Low priority of relevant research compared to initiatives in other sectors ✓ Lack of continuity of funds for research

7.3 Existing Government Policy, Plans and Targets

Reflecting Ireland's industrial development policy is a successful track record of attracting international life sciences industry to locate here. Ireland is a key location for the international life sciences industry; e.g. 9 of the top 10 global pharmaceutical companies

"The R&D programmes on marine biotechnology development and marine functional foods underway by the Marine Institute should be continued and intensified."
Food Harvest 2020

are based here. The entire life sciences industry is supported by a high level of government funding through Science Foundation Ireland, IDA Ireland and Enterprise Ireland. These foreign investments and an increase in indigenous activity represent an industry worth \$63b per annum, represent 30% of Ireland's exports and employ 46,000 people⁵⁵. The indigenous bio-pharmaceutical sector also plays a key role in this ecosystem. The sector is gaining increasing international recognition and growing at an average 18% per annum.⁵⁵ Related to this area, is the platform for experimentation in biomanufacturing and bioprocessing training recently created with the launch of the National Institute for Bioprocessing Research and Training (NIBRT). Ireland is also home to Europe's leading medical technologies cluster and now has the highest per capita employment of medical technologies personnel across Europe.

Significant commitment to the life sciences and biotechnology sector was made through Science Foundation Ireland which invested over €532 million in biotechnology research between 2000 and 2008. During the period 2007-2010, an estimated €16.8 million was invested in marine biotechnological research, including functional seafood.

Further support for the potential of the marine biotechnology and bio-products sector, are the Sea Change Strategy⁵⁶, Steering a New Course (the Cawley Report)⁵⁷ and Food Harvest 2020⁵⁸ Reports which each argue in favour of the benefits of a convergence between the significant technical and scientific capability in the life sciences and biotechnology and the opportunity to maximise the use of marine species as sources of value-added products based on exploiting their bioactivity and in this way emulate the success achieved in the life sciences industry sector.

⁵⁵ <http://www.sfi.ie/news-events/press-releases/innovation-ireland-showcases-irish-biotech-industry-at-bio-2011/>

⁵⁶ Sea Change - Ireland's Knowledge, Research and Innovation Strategy 2007 – 2013, Marine Institute, Galway 2007

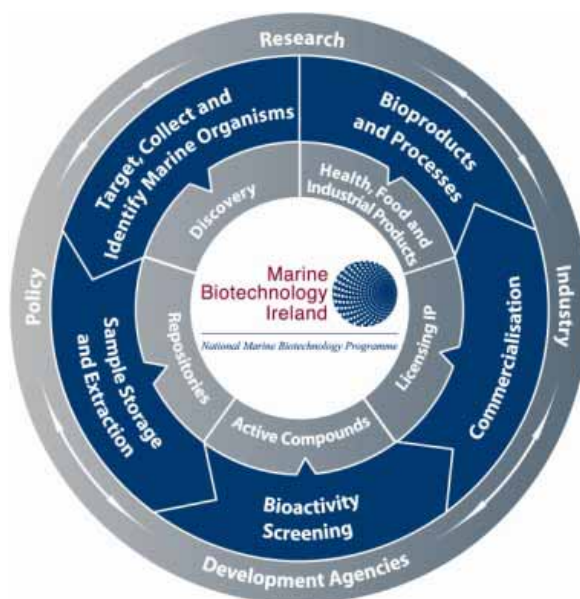
⁵⁷ Steering a new Course - Strategy for a Restructured, Sustainable and Profitable Irish Seafood Sector 2007-2013: Report to the Seafood Industry Strategy Review Group –December 2006 (Cawley Report)

⁵⁸ Food harvest 2020 – A vision for Irish agri-food and fisheries, Department of Agriculture Fisheries and Food, Dublin 2010

Marine Biotechnology Ireland

Marine Biotechnology Ireland (MBI) is one of a range of dedicated Marine Institute initiatives working to transform the marine sector into a knowledge-driven sector recognised for its ability to develop a range of high value-added products that result from marine biotechnology research. The Marine Institute established Marine Biotechnology Ireland as a national programme in 2007 to deliver on the objectives of Sea Change: A Marine Knowledge, Research & Innovation Strategy for Ireland 2007-2013.

The objectives of the Programme are to create and sustain Irish opportunities for research, development and innovation in marine biotechnology and to focus on strategically important research areas. Marine Biotechnology Ireland is also a response to international marine biotechnology policy initiatives.



The goal of MBI is for Ireland to be recognised internationally as a significant marine biotechnology research performer, occupying a lead position within Europe's bio economy through the commercialisation of marine biotechnology research outputs. Actions of MBI are focused on stimulating the utilisation of marine organisms and materials for the sustainable production of food, drugs, biomaterials, nutraceuticals and industrial processes.

MBI will support new scientific and technological capacity in Ireland by:

- Establishing a strong collaboration with the growing biopharma sector in Ireland;
- Building links between marine biotechnology research and the medical device and diagnostic sectors;
- Stimulating the use of marine origin materials by Ireland's agri-food sector;
- Encouraging the use of biological processes to help maintain healthy environments and
- Promoting the sustainable exploitation of Ireland's marine resources.

National Marine Biotechnology Programme short-term objectives

1. Develop Ireland as a location in which to engage in advanced marine biotechnology related activities.
2. Develop, support and operate Marine Biotechnology Ireland as a catalyst for marine biotechnology enabled innovation.
3. Connect publicly funded research activity with the commercially oriented targets of the enterprise sector in existing and emerging markets for marine biotechnology enabled products and processes.

GLOSSARY OF ACRONYMS / TERMS

BIM	Bord Iascaigh Mhara
CCS	Carbon Capture Storage
CER	Commission for Energy Regulation
CFP	Common Fisheries Policy
DCENR	Department of Communications, Energy and Natural Resources
DCU	Dublin City University
E&P	Exploration and Production
EIA	Environmental Impact Assessment
EU	European Union
EWEA	European Wind Energy Association
FAO	Food and Agriculture Organization (of the United Nations)
FDI	Foreign Direct Investment
GDP	Gross Domestic Product
GES	Good Environmental Status
HEI	Higher Education Institution
ICT	Information and Communications Technology
IMDO	Irish Maritime Development Office
IMERC	Irish Maritime Energy & Research Cluster
INFOMAR	INtegrated mapping FOr the sustainable development of Ireland's MARine Resource
INSS	Irish National Seabed Survey
ITQs	Individual Transferable Quotas
LA	Local Authority
lo/lo	lift on-lift off
LSE	Likely Significant Effect
MBI	Marine Biotechnology Ireland
MHW	Medium High Water
MNC	Multinational Corporation
MSFD	Marine Strategy Framework Directive
MSY	Maximum Sustainable Yields
MW	megawatt

Natura 2000	EU wide network of nature protection areas established under the 1992 Habitats Directive comprising of Special Areas of Conservation (SAC) designated by Member States under the Habitats Directive, and also incorporates Special Protection Areas (SPAs) designated under the 1979 Birds Directive.
NIS	Natura Impact Statement
NREAP	National Renewable Energy Action Plan
NUIM	National University of Ireland, Maynooth
OEDU	Ocean Energy Development Unit, SEAI
ORED P	Offshore Renewable Energy Development Plan
p.a.	Per annum
PI	Principal Investigator
PRTL I	Programme for Research in Third-Level Institutions
R&D	Research and Development
RD&D	Research, Development and Demonstration
ro/ro	roll-on/roll off
RTDI	Marine Research, Technology Development and Innovation
SEA	Strategic Environmental Assessment
SEAI	Sustainable Energy Authority of Ireland
SME	Small and Medium Enterprise
UCC	University College Cork
UCD	University College Dublin
UL	University of Limerick
WFD	EU Water Framework Directive

Our Ocean Wealth

Seeking Your Views on
*New Ways; New Approaches;
New Thinking*



Further Information: www.OurOceanWealth.ie