PRIORITY AREA J
MARINE RENEWABLE ENERGY ACTION PLAN
JULY 2013

Marine Renewable Energy (Priority Area J)

Context

The development of renewable energy is central to overall energy policy in Ireland as it reduces dependence on fossil fuels, improves security of supply and reduces greenhouse gas emissions while creating other environmental benefits, delivering green jobs to the economy and contributing to national competitiveness. Many of Ireland's Renewable Energy (RE) commitments are derived from those set out in European Directive 2009/28/EC.

Ireland's ocean territory, at approximately ten times the size of our land area, is an excellent potential source of energy. Our marine environment can provide a vast amount of energy through offshore wind, wave and tidal energy technologies. The Government's ambitious target of 40 per cent of electricity generated from renewables by 2020 is on track to be met, and will be vital to ensuring that we meet our internationally binding renewable energy and greenhouse gas emissions targets by 2020. These targets and the prospect of more stringent EU-wide targets post 2020 are set to open opportunities for offshore renewable energy to contribute not only to Ireland's energy needs but could also, along with resources from other European Atlantic seaboard countries, become a very important future energy/electricity source for Europe.

The focus of this priority area is to promote the green economy by positioning Ireland as a research, development and innovation hub to drive the deployment of marine renewable energy technologies and services. This would facilitate the development of industry in this area as well as the creation of research clusters, and open up the possibility of sustainable commercialisation of these natural resources and becoming a significant exporter of electricity from these resources. In addition Smart Ocean seeks to develop a marine ICT innovation cluster that can widen and deepen the supply network of products and services to the marine energy sector delivered by Irish enterprise.

Within its renewable energy targets, Ireland has set itself a target of 500MW of ocean energy capacity by 2020. Given the current state of development of the suite of power conversion, transmission and ICT technologies in this environment, this represents a very significant challenge to which industry will be looking to academic researchers for innovative solutions. Key challenges faced by offshore renewable energy include speeding the lead time to market and reducing costs to be comparable with the most competitive renewable and fossil fuel based power generation. Against this background, the Ocean Energy Development Unit (OEDU) in the Sustainable Energy Authority of Ireland [1] (SEAI) was established in 2008 to take forward the Government's Ocean Energy Strategy. That same year, SFI's remit was extended to include the funding of energy research, while Enterprise Ireland continues to fund applied energy research in industry and academia.

Ireland has considerable third-level expertise in areas including sea current turbine design, wave tank model testing and wave energy modelling. Offshore wind, platforms, modelling and marine ecosystems are other key areas of research. Its industrial base includes a growing complementary

1 www.seai.ie/renewables/ocean_energy/

expertise in energy conversion and transmission technologies and ICT, and the Marine Renewables Industry Association draws its membership from a wide range of energy generation and supply chain interests.

In its review in 2008, Indecon suggested that delivering 500MW via offshore wind energy could aggregate to €4.3 billion added to the Irish economy. The key supply chain elements required to exploit these markets are: the structure and the core wind/wave/tidal converter technology; the power take-off; foundations & moorings; electrical connection; installation process; and O&M (Operation & Management) process.

While the core energy conversion technologies for off-shore wind, wave and tidal energy differ in terms of both design concept and product maturity, there are however significant commonalities and synergies between all three markets such as: grid connection & integration (Smart Grids); installation; and O&M. Offshore wind is the most developed of the three technologies with wave and tidal energy technology still at research, development and pilot deployment stages. On a global basis, there are currently only a small number of pilot-scale tidal stream and wave devices that have developed to the point of generating electricity output. But a rapid acceleration of effort is taking place internationally. Despite being less mature than the offshore wind sector, wave and tidal power offer much long-term potential and the next five to ten years could see a number of technologies reach commercial application. In this respect these developing industries can be seen as being at a similar stage to offshore wind a little over a decade ago.

The safe and reliable deployment of offshore renewable energy devices for electricity export will require new or adapted grid infrastructure, services and management systems, the development of which will also call for significant research inputs. In its development, testing and deployment of new solutions for grid integration of variable renewable energy, Ireland has developed recognised research and operational strengths, which can position it well internationally in engaging with the further grid development requirements necessary to deliver on electricity export opportunities. This has significant synergies with elements of the Smart Grid agenda and the offshore grid vision explored inter-governmentally in the Irish – Scottish Links on Energy Study ('ISLES' project) completed in 2011.

The integration of ICT in the marine environment will become strategically more important with the growth of the marine energy market. This is a key element of the Smart Ocean concept developed by the Marine Institute in collaboration with industry, research funding and development agencies, and academic researchers. The global market for marine IT and ocean surveying is estimated to be worth €6.7 billion, including a €200M sub-market for marine monitoring applications served by integrated and real time systems. The Marine IT market includes digital design and simulation tools; subsea and wireless communication systems; web enabled sensor networks; satellite to seafloor sensing; data management systems including GIS; seabed mapping; and forecast models. Ireland has a strong enterprise and expertise base in the development of such "Smart Ocean" technologies. Similarly, there is scope for the innovative application of other underpinning technologies, such as nanotechnology, new materials and coatings, for deployment in this environment. In addition to marine renewable energy applications these products, services and expertise can also target significant opportunities in related sectors such as maritime transport, security and surveillance, aquaculture and environmental monitoring.

There are a number of collaborative initiatives, most notably Smart Bay and the quarter scale ocean energy test facility in Galway Bay, which provide testing infrastructure and involve significant FDI ICT players, SMEs and the HEI sector. The Atlantic Marine Energy Test Site (AMETS) at Belmullet is being developed as a grid-connected test facility for wave and possibly floating offshore wind devices, at the final stage of test and demonstration of arrays of candidate technologies for full commercial deployment. The underlying strategy is to retain existing and attract additional device and project developers, create a unique pre-operational facility, and support the build-up of the cluster of industrial technology and operational expertise that will contribute to maximising a value-added supply chain in Ireland.

The HEI sector collaborates extensively with national and international device developers and has been successful in securing significant EU FP7 funding. Irish Universities, Institutes of Technology and SMEs have attracted €12M in FP7 funds for marine energy projects since 2007, representing almost half of funds secured by Irish partners in the energy sector of this programme. Between 2004 and 2010, marine energy received 10 per cent of all Irish public R&D funding in the energy field. Total current funding for marine energy is €27.2M and for marine ICT is €13.2M. A recent assessment by the Marine Renewable Industry Association estimates that in Ireland six HEIs and approximately 120 research personnel in HEIs, industry and government agencies are active in this arena.

Marine Renewable Energy

Vision/opportunity: To position Ireland as a research, development and innovation hub that will leverage the Irish enterprise base and maximise the economic benefit to Ireland from the development and future deployment of marine renewable energy resources, and specifically to:

- Drive the earliest feasible deployment at scale of marine renewable energy technologies and services;
- Create an industry and research cluster leading to sustainable marine energy commercialisation, a vibrant industry and job creation in Ireland;
- Develop the competitive technical and systems capacity to meet future renewable electricity needs of Ireland and of European export markets; and
- Develop and test new enabling ICT applications in the marine environment based on the Smart Ocean concept.

Objective 1	To develop a **co-ordinated strategic research agenda** for marine renewable energy technologies, ICT applications, underpinning technologies and engineering applications in the marine environment, which is informed by the needs of all relevant stakeholders, facilitates economic growth within the sector, satisfies environmental and other legislative requirements and enables active participation in EU and International research activities.
Objective 2	To ensure the availability of graduates, postgraduates and researchers with **appropriate skills** relevant to the needs of the industry and ensure that a **critical mass of researchers** is in place to deliver on the Vision.
Objective 3	To facilitate the creation of an early stage industry and research cluster, ensuring that **research outputs** from State funded research are leveraged and **exploited** in accordance with National IP Policy and that **technology transfer** supports are developed/adapted to connect research to industry.
Objective 4	To ensure that an adequate **infrastructure/ecosystem** is managed, developed and future needs identified in order to support research across the development spectrum from early stage research to full scale deployment, aligned to the needs of each category of ocean energy technology, engineering materials and ICT in the marine environment.
Objective 5	To ensure that the sector is developed in tandem with existing and emerging protocols and standards in an evolving national and European **regulatory** environment, facilitating the development and deployment necessary to establish a world leading marine renewable energy technologies and services industry.

Pre-existing or pre-requisite actions

The effectiveness of the package of strategic actions developed through this Plan for delivering and commercialising research is dependent on timely implementation of a number of complementary enabling or leveraging actions outside of the strict remit of research policy. The resultant overall policy coherence for the marine renewable energy sector will provide essential strategic clarity and security for enterprise and infrastructure investors, the research community and other stakeholders in the sector. Many of the actions in this Plan and in that complementary domain are underlined in the vision and recommendations set out in the following two key documents:

The Government's Integrated Marine Plan (Harnessing Our Ocean Wealth which also includes the National Marine Mapping Programme, INFOMAR)), launched in July 2012, sets out a series of relevant and concrete actions that are key to the progression of this Priority Area:

- Adopting and implementing the Offshore Renewable Energy Development Plan (OREDP). Such a Plan will provide a clear policy roadmap and integrating framework towards Marine Renewable Energy development, including planning and environmental protection aspects.
- Updating/improving legislation to streamline the planning and consent process. Such streamlining will improve time and cost efficiency in trialling and deploying marine energy devices and arrays, including attraction of national and international projects beyond pilot scale.
- Developing an integrated enterprise strategy for marine renewable energy. This would outline how the composite industry can be developed and supported.
- Progressing targeted emerging business development opportunities, including offshore renewables and marine ICT/sensors.
- Supporting relevant test-bed facilities for marine renewable energy technologies and ICT.
- Putting in place clear policies/strategies for strategic infrastructure, including grid and port infrastructure to support marine renewable energy. This is necessary logistical infrastructure for to support both cost efficient R&D and deployment of the technologies.

Implementation of these actions will be closely monitored by the Inter-Departmental Marine Co-ordination Group, chaired by the Dept. of an Taoiseach.

SmartOcean *(Harnessing Ireland's Potential as a European and Global Centre for Ocean Technologies)* sets out actions and

recommendations for developing the marine ICT sector. These focus on, inter alia, innovation test-beds; fostering industry-academia collaborations; facilitating market development; and strengthening international alliances to attract research funding and FDI. Such ICT technologies have the potential to leverage new functionalities and efficiencies in the chain of research, development, deployment and operation of marine renewable engineering (e.g. power generation, conversion, transmission, management) technologies and services.

Forward actions to support and enable effective strategic research

Successful delivery on the actions below will call for an open collaborative engagement by all parties.

No	Action	Deliverable	Benefit	Lead	Support	Timeline
Objective 1		To develop a **co-ordinated strategic research agenda** for marine renewable energy technologies, ICT applications, underpinning technologies and engineering applications in the marine environment, which is informed by the needs of all relevant stakeholders, facilitates economic growth within the sector, satisfies environmental and other legislative requirements and enables active participation in EU and International research activities.				
J1.1a	Building on the work carried out by the Irish Energy Research Council (IERC) in "*An Energy Research Strategy for Ireland*" 2008 and the Marine Renewables Industry Association's (MRIA) "*Review of R&D in Ocean Energy in Ireland*" 2012: **Conduct a 'research needs' analysis for the marine renewable energy industry ecosystem.** Include in the analysis the broad dimensions of the priority area, including:	A comprehensive cataloguing of the research needed by the industry to develop, including the ICT, materials and environmental dimensions. This should also include consideration of mechanisms for engaging different sectors of	A clear scoping and focus on the current and future research to be conducted to exploit the opportunity and develop the nascent sector.	DCENR / SEAI	SFI, MI, DEHLG, EI, IDA, MRIA, GSI	Q4, 2013

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	▪ Smart Ocean which deals with ICT applications in the marine environment ▪ Nanotech and materials for marine energy ▪ Environmental issues.	enterprise, including SMEs, in collaborative research.				
J1.1b	Build into the research needs analysis a mechanism for regular review and monitoring to keep the 'research needs' current.	A codified review process.	This will ensure that stated research needs are maintained current.	DCENR / SEAI	SFI, MI, DEHLG, EI, IDA	Q1, 2014
J1.2a	Building on the Research Prioritisation Exercise analysis and SEAI's Energy Research Map of Ireland: **Compile an easily updatable map of the Irish Energy Research Landscape**, clearly identifying areas of research strength, research centres and clusters, areas of collaboration both national and international and between academic institutions and industry. As with the 'Research Needs' analysis above, include research strengths from ICT, nano, materials and the environment where they apply to the Marine energy sector.	Online website showcasing collaborative marine energy R&D projects.	Visibility of Irish marine energy research capacity for all actors.	SEAI	HEA, SFI, MI, EI, HEI	Q3, 2013
J1.2b	As with 1.1b above - Build in to the research mapping exercise a mechanism for regular	Agreed and documented review process.	Ensure new activities	DCENR	HEA, SFI,	Q1 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	review and monitoring to keep the 'research map' current.	Maintained information portal.	are included.	/ SEAI	MI, EI, HEI	
J1.3	**Conduct a 'Research Gap Analysis'** by aligning the 'research needs' analysis in 1.1 and the 'research strengths' map in 1.2 to identify the gaps and/or changes in focus required.	Documentation of gaps and recommended thematic focal points in marine energy R&D.	Inform resourcing decisions to close critical gaps and avoid bottlenecks in R&D.	DCENR / SEAI	HEA, SFI, MI, DEHLG, EI, IDA	Q1, 2014
J1.4	**Develop a suite of co-ordinated funding instruments** for Marine Renewable Energy Research across all relevant funders to facilitate the full spectrum of research (oriented-basic, applied, industry) required to deliver this priority area. This will cover the range of engineering systems research and accompanying Marine ICT, environmental and ancillary research which will be integral to delivering on the Vision. The suite of funding instruments will thus include appropriate supports for underpinning research with identified potential and necessary cross-pollination, including: ▪ Development and application of nano and materials technologies, ensuring their safe use	Establishment of a coherent, focussed and phased set of funding instruments, with an appropriate multiannual financing framework. A defined funding strategy, with clear competitive process, aimed at collaborative research delivery through a limited number of centres of excellence.	Efficiency and focus, leading to commercialisation opportunities. Clarity of priorities, process and criteria for researchers and industry across the array of thematic focal points in this sector.	DCENR / SEAI	DJEI, DAFM, SFI, HEA, Forfás, MI, DEHLG, EI, IDA, IRC, EPA,GSI	Q2, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	▪ Research, collation, management and dissemination of environmental data and information. Co-ordination of research & development support with demonstration & deployment and enterprise support mechanisms (Section 3 below) is also important to ensure a credible supply chain develops with export potential.					
J1.5	Maintain and strengthen Ireland's participation in EU and international collaborative research groups focussed on marine energy (including EU FP7, EU ERA-NET 2013, EU NER300 initiative, IEA Ocean Energy Implementing Agreement, e.g. testing protocols, grid integration, and environmental impacts).	Ensure availability of funding and advance preparation to enable Irish participation in key international research networks.	These groups provide funding efficiencies, accessing and leveraging of international expertise and best practice/ standards. They can also shape future research funding, industry support mechanisms (and possibly regulation).	DCENR	SEAI, EI	Q2, 2014
Objective 2		To ensure the availability of graduates, postgraduates and researchers with **appropriate skills** relevant to the needs of the industry and ensure that a **critical mass of researchers** is in place to deliver on the Vision.				
J2.1	Building on the "Marine Renewable Energy Industry Skills Needs Report", in conjunction with the report of the Expert Group on	Profiled categories, curricula and numbers. Relevant skillsets	Graduate and research formation processes well aligned with the	HEA	DJEI, Forfás, DES, MI,	Q2, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	"Future Skills Needs of Enterprise within the Green Economy of Ireland" 2010: ▪ Address skills gaps as identified and validated by the Expert Group, specific to the range of research skills and associated needs for development of Ireland as an innovation hub for marine renewable energy. ▪ Build on the progress to date by HEIs in adapting third level curricula in line with Expert Group recommendations. ▪ Continue to monitor implementation of the Expert Group recommendations.	identified and third level curricula revised (including core and specialist modules, and modes of delivery) – based on cataloguing of the nature and volume of research skills and support skills required to deliver the solutions for the industry. Postgraduates / researchers attain the required skillsets to work within the sector.	needs of this enterprise sector to meet current needs and ensure future human capital is available.		SEAI, SFI, IDA, EI, MRIA.	
J2.2	Assess potential options and develop a self-sustaining graduate development programme (including industrial-academic placement) to ensure delivery of sufficient industry ready graduates and postgraduates in areas of identified need and identified gaps (e.g. power systems engineering) to support the industry's application or delivery of research.	Programme options and proposals developed. Proposed initiatives to increase numbers as required. When implemented, critical mass of postgraduates with skills required by relevant industry and research.	Practical experience for graduates. Strengthened complementarity and active links between industry and academia. Pipelines of skills to underpin innovation (in products, processes and services), development and competitiveness in the marine renewable	HEA	DES, IRC, SFI, SEAI, EI, IDA.	Q2, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
			industry.			
J2.3	Identify key senior and/or permanent researcher posts in RPOs and in the HEIs necessary to meet the Vision of this PA. Develop a mechanism to fill these positions. Identify and fill junior research positions where critical mass does not exist and is necessary to meet the Vision.	Critical mass of researchers to deliver on the Vision	Research capacity that can be exploited by enterprise and leverage international collaboration.	HEA	DES, IRC, SFI, SEAI, EI, IDA.	Q2, 2014
Objective 3		To facilitate the creation of an early stage industry and research cluster, ensuring that **research outputs** from State funded research are leveraged and **exploited** in accordance with National IP Policy and that **technology transfer** supports are developed/adapted to connect research to industry.				
J3.1	Ensure research outputs from State funded research are leveraged and exploited in accordance with National IP Policy.	Embedding of facilitating IP conditions within the terms of funding.	Facilitation of faster track research synergies, leading to deployment and commercialisation.	EI	SFI	Q1, 2014
J3.2	Support the exploitation of research outcomes among relevant technical, financial, scientific, and social disciplines.	Co-ordinated dissemination of research outcomes to key actors and enablers (including SME) survey of outcomes.	Maximum synergy and leverage of value deriving from R&D outcomes.	EI	IDA, SEAI, SFI, MRIA.	Q4, 2014
J3.3	Promote Irish research institution participation in the European Energy Research Alliance (EERA) for marine energy.	Active Irish researcher engagement with the wider EU research	Potential access to faster track deployment and	SEAI	SFI, EI, MI	Q1, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
		community.	commercialisation.			
J3.4	Progress targeted emerging business development opportunities, including offshore renewables and marine ICT/sensors.	Enterprise development supports for specific technology development.	Focus on selected opportunities for early wins and confidence building.	EI	MI, SEAI	Q4, 2013
J3.5	Implement actions in the SEAI report – *'Industrial development potential of offshore wind in Ireland'*.	Suite of enterprise oriented actions delivered.	Maximise development potential of the offshore wind sector.	EI	SEAI, IDA	Q3, 2014
Objective 4		To ensure that an adequate **infrastructure/ecosystem** is managed, developed and future needs identified in order to support research across the development spectrum from early stage research to full scale deployment, aligned to the needs of each category of ocean energy technology, engineering materials and ICT in the marine environment.				
J4.1	Conduct a mapping and gap analysis of research infrastructure for marine renewable energy, including access procedures.	Catalogue of all relevant infrastructure (buildings, equipment, test facilities, etc) and processes, assessment of fitness for purpose and identified actions.	Informing national investment in the provision of, and ensure optimum use of, facilities.	SEAI and MI	HEA, SFI	Q4, 2013
J4.2a	Identify and explore options available to ensure on-going, adequate support for the full range of infrastructure required to enable this Priority Area, enabling world class development, commercialisation and deployment of Marine Renewable Energy	Suite of facilities (sustaining, strengthening or expanding existing facilities) such as: ▪ Lab scale test service	On-going credibility and capacity to host and service the needs of Irish and collaborative international product	SEAI and MI	SFI, HEA, EI	Q2, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	devices, systems and related ICT. Determine the facilities required to enable research into all key MRE system elements - ranging from heavy mechanical engineering and electrical power systems to marine operations and ICT systems.	▪ Quarter/ half scale testing site and service ▪ Grid-connected marine test site/s for full scale devices and arrays ▪ Testing facilities for small components ▪ Computer modelling facilities ▪ Related data management, monitoring and ICT supporting facilities ▪ ICT innovation cluster and development facilities.	and system developers.			
J4.2b	Ensure appropriate mechanisms are in place to facilitate access by HEI/ industry researchers to research infrastructure.	Published protocols for national and international researcher access.	Open, competitive, cost efficient delivery of key phases of R&D process.	SFI, MI, SEAI, EI, IDA, HEA, EPA	HEI	Q2 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
J4.3	Within the policies/strategies for strategic infrastructure, identify the measures including grid, shipping and port infrastructure necessary to support MRE research, development and deployment.	Necessary logistical infrastructure to support cost efficient R&D and deployment of MRE technologies.	Confidence, time and cost efficiency for the research/ industry community.	SEAI and MI	DCENR (CER, ESBN, Eirgrid), DECLG, DJEI, EI, IDA,GSI	Q2, 2014
J4.4	Explore further the potential for interconnection between RoI, NI, Scotland and France to accommodate offshore renewable energy, as identified in the '*ISLES*' (EU INTERREG) project.	Grid network system modelling. Stakeholder consultations. Deeper feasibility assessment.	Emerging blueprint for first phase of offshore grid development to facilitate active export trade in marine renewable energy.	DCENR	DJEI, DECLG, DAFM, SEAI, EI, IDA	Q2, 2014
Objective 5		To ensure that the sector is developed in tandem with existing and emerging protocols and standards in an evolving national and European **regulatory** environment, facilitating the development and deployment necessary to establish a world leading marine renewable energy technologies and services industry.				
J5.1	Implement appropriate regulatory provisions outlined in the Offshore Renewable Energy Development Plan (OREDP)	Clear and coherent framework of cross-governmental policy intent to develop the industry.	A clear and coherent regulatory framework (including grid code, planning, environmental, export) facilitating medium to long term investment commitments.	DCENR	DF, DJEI, DAFM, DECLG, ABP, EPA, (CER/ SEM), EI, IDA, SEAI	Q3, 2014
J5.2	Identify steps to ensure that the sector is	Close engagement with	Establish a culture of	DCENR	DF, DJEI,	Q1, 2014

No	Action	Deliverable	Benefit	Lead	Support	Timeline
	developed in tandem with existing and emerging protocols and standards in a supportive national regulatory climate, benchmarked to best international practice. Such regulation may address: ▪ Work of IEC TC114 committee through Ireland's national mirror committee (ETCI TC 18) to establish international standards for marine energy converters ▪ Planning and environmental issues ▪ Grid connection and operational codes ▪ Evolving all island and EU electricity market design and rules ▪ Incentive mechanisms ▪ Frameworks for energy export and trading ▪ Possible offshore grid network.	research and industry stakeholders in the promotion of existing and evolution of new regulatory provisions. Active involvement in this activity will ensure best practice is adopted and that the Irish industry is at the cutting edge of international best practice for potential export of services, etc. A well-coordinated and communicated regulatory regime duly anticipated, understood and complied with by all stakeholders.	compliance, anticipation and excellence that will facilitate the timely development and deployment necessary to establish a world leading marine renewable energy technologies and services industry.	/ SEAI	DAFM, DECLG, ABP, EPA, (CER/ SEM), MI, MRIA	

Forfás

An Roinn Post, Fiontar agus Nuálaíochta
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