Invest Northern Ireland

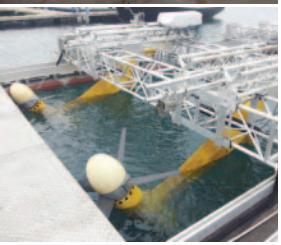
Northern Ireland

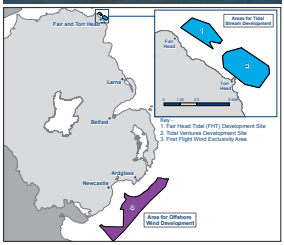
Marine Energy Capability Directory

Technology Development - Applied Research, Innovation & Testing - Consultancy Services - Engineering









Manufacturing & Components - Vessels - Surveying - Deployment - Ports, Port Operations & Land Based Support

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Foreword

Northern Ireland has considerable renewable energy resources, both onshore and offshore, and an ambitious Strategic Energy Framework (SEF) in place since 2010 to support their development. Our renewable energy targets have been endorsed by the Northern Ireland Executive and aim to ensure that 40% of Northern Ireland's electricity consumption comes from renewable sources by 2020.

For over 30 years, Northern Ireland's research establishments, engineers and scientists have been at the forefront of the development of ocean energy. World leading wave and tidal energy developers have found many key skills required in the exploitation of energy from our seas in one integrated community of academics and engineering businesses here in Northern Ireland.

The Supply Chain detailed here demonstrates the skills and capacity of the region's companies and researchers to make an impact on developing marine energy technologies, not only in the devices themselves, but also in all of the other technologies and services essential to achieving the ambitious targets we have set ourselves.

The Northern Ireland Executive is committed to supporting and developing marine industry technology and services with our UK and international partners. We have already seen successes by local companies in reducing costs of device deployment at home and abroad. This is now being developed further through collaborative academic research funded through Invest Northern Ireland. The Centre for Advanced Sustainable Energy (CASE) and The Northern Ireland Advanced Composites and Engineering Centre (NIACE) have been set up to facilitate industry-led research and development.

Invest NI has strong linkages with Renewable UK and through its local representative NIRIG and we continue to welcome collaborative working with our companies and research facilities to support and develop the marine energy industry.

Arlene Foster MLA
Minister for Enterprise, Trade and Investment

Introduction

Northern Ireland Renewables Industry Group (NIRIG)

The ocean energy businesses in Northern Ireland can deliver a fully developed, experienced and integrated range of disciplines to this exciting and rewarding industry. In the future, we will see an increasingly diverse energy mix for Northern Ireland.

The Northern Ireland Renewables Industry Group (NIRIG), which is a joint collaboration between the Irish Wind Energy Association and RenewableUK, supports Northern Ireland's ambitious targets. NIRIG represents the views of the large and small scale renewable electricity industry in Northern Ireland, providing a conduit for knowledge exchange, policy development support and consensus on best practice between all stakeholders in renewable energy.

NIRIG has a dedicated Marine sub-group, comprising developers, manufacturers, researchers and legal services, among others, who collaborate to ensure that the ocean energy industry in Northern Ireland has a voice to support positive strategy and policy development.

The development rights awarded by the Crown Estate for tidal energy and offshore wind represent a potential further 800MW of energy from renewable sources and we in NIRIG will continue to work with all stakeholders to support an appropriate policy environment to facilitate marine energy development. By doing so we will contribute to an improved security of supply, reduce our reliance on imported fossil fuels and unleash the jobs and investment that will accompany this development.

NIRIG welcomes the production of this supply chain directory and in particular the detailed breakdown of all elements of marine energy supply along with the services offered by Northern Ireland companies and their industry partners.

Dr Michael Shaw
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E: ni-rig@ni-rig.org

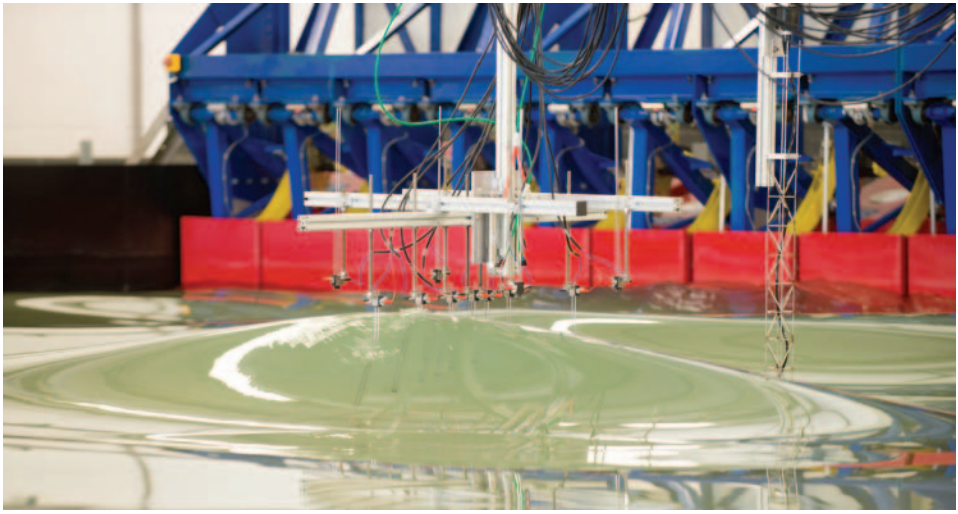
Technology development

Overview

Northern Ireland has proved an attractive location for overseas device developers. The deployment at Strangford Lough of the 1.2MW Seagen tidal energy convertor developed by Marine Current Turbines, part of the Siemens Group, has generated more power than any other tidal flow turbine. The deployment has also given Northern Ireland businesses an early glimpse of the challenges faced by marine energy generation, particularly in the areas of research and development, device deployment and environmental surveying and monitoring.

Queen's University Belfast has played a fundamental role in the design and development of many marine energy devices and is currently working with Aquamarine Power's Oyster II, the world's most advanced near shore full scale wave device.

The Centre for Advanced Sustainable Energy (CASE) at Queen's University Belfast, funded by Invest Northern Ireland, works with industrial and academic networks to develop marine device technologies including those in device deployment and environmental surveying. This includes work in developing the cost cutting deployment system of McLaughlin and Harvey, one of Northern Ireland's leading building and civil engineering contractors and the proposed innovative EnterNI project designed to streamline and reduce costs of environmental impact assessments.



Company listing

Company	Website
Aquamarine Power	www.aquamarinepower.com
Blaney Gears Ltd	www.blaneygears.com
B9	www.b9energy.co.uk
Harland & Wolff Heavy Industries Ltd	www.harland-wolff.com
Minesto	www.minesto.com
Pure Marine	www.puremarinegen.com
Queen's University Belfast	www.qub.ac.uk

Applied research, innovation and testing

Overview

Northern Ireland has a strong track record in innovation, supported by the strengths of its academic research at Queen's University Belfast, Ulster University and the Centres of Excellence - the Centre for Advanced Sustainable Energy (CASE) at Queen's University Belfast and the Northern Ireland Advanced Composites and Engineering Centre (NIACE) which supports Northern Ireland's world class composites sector. These attract significant public research funding from, for example, the Engineering and Physical Sciences Research Council and from European funding streams.

In addition, Northern Ireland has a number of suitable sites for offshore testing, particularly in Strangford Lough. Its entrance experiences high tidal flows, benign wave conditions and grid access making it ideal for testing tidal devices. Marine Current Turbines has been testing SeaGen there since 2008 and Minesto has started testing its quarter scale Deep Green underwater kite this year.

Northern Ireland works in collaboration with other UK testing facilities such as EMEC, NAREC, WaveHub and the facilities of the Hydraulics and Maritime Research Centre (HMRC) at University College Cork in the Republic of Ireland.

Company listing

Company	Website
Advanced Metal Forming Research	http://amfor.ulster.ac.uk
Belfast Metropolitan College	www.belfastmet.ac.uk
Centre for Advanced Sustainable Energy	http://questor.qub.ac.uk/CentreforAdvancedSustainableEnergy/
Intelligent Systems Research Centre	http://isrc.ulster.ac.uk
Mo Team	www.moteam.co.uk
NI Advanced Composite & Engineering Centre	www.niace-centre.org.uk
Queen's University Belfast	www.qub.ac.uk
South Eastern Regional College	www.serc.ac.uk
South West College	www.carbonzeroni.com
The Centre for Secure Information Technologies	www.csit.qub.ac.uk
The Institute of Electronics, Communications & Information Technology	www.ecit.qub.ac.uk
The Virtual Engineering Centre	www.vec.qub.ac.uk
University of Ulster	www.ulster.ac.uk
Wave Barrier	

Case study:

Centre for Advanced Sustainable Energy

The Centre for Advanced Sustainable Energy (CASE), the latest of a series of Competence Centres funded by Invest Northern Ireland in 2013, is a research organisation which brings together the renewable energy expertise of Queen's University Belfast (QUB), University of Ulster (UU) and the Agri-Food and Biosciences Institute (AFBI) to meet the research needs of industry.

CASE has a wide-ranging remit and supports research into:

- **The grid: demand side management**
- **Energy from biomass, and**
- **Turbines (wind, wave and tidal).**

1. Innovative site survey and characterisation methods
2. The use of composites and new or hybrid materials
3. Resource modelling and site assessment, and
4. Blade, gear box and generator innovations.

Centre for Advanced Sustainable Energy case study (continued)

QUB has been involved in marine energy since the 1970s and nine leading devices have been tested and developed at the QUB Environmental Engineering Research Centre (EERC) over the last 10 years. The EERC has two wave tanks including a new, wide facility at Portaferry at the mouth of Strangford Lough. With its cross-current capability this wave tank will be valuable in understanding the impact of arrays on coastal processes. In addition, EERC works closely with Aquamarine power and Wavegen on prototype testing of their wave energy capture devices and was instrumental in the deployment of Marine Current Turbines' SeaGen tidal turbine in Strangford Lough, supporting this project with:

- **Tidal resource characterisation**
- **Real-time monitoring during deployment**
- **Pre-installation environmental monitoring**
- **Post-installation environmental monitoring, and**
- **Turbine performance assessment.**

Recent research by EERC, in conjunction with CASE, involves a collaboration of five companies in the evaluation of the impact of tidal turbines in a small array. Two Oceanflow 1/10th scale Evopod devices have been tested in tandem in calm conditions on a local lake and in real sea conditions at Strangford.

CASE has been working with industry to determine the most suitable location for a tidal turbine commercial demonstration site to be based in Northern Ireland through its EnterNI Project. Initial research and development work on the North Coast will focus on areas as diverse as marine archaeology, geophysics, flow monitoring and the understanding of benthic ecology.

Consultancy services

Overview

The scope of activities provided by consultancies to device manufacturers includes design reviews, due diligence and reliability assurance such as resource assessment, hydrodynamic modelling, environmental monitoring, planning and impact assessments and local content analysis.

These skills are readily available in Northern Ireland, either through indigenous local businesses such as B9 Energy or through the Northern Ireland offices of international consultancies such as Arup and RPS.

Consultancy services to support marine energy in Northern Ireland also includes the Invest Northern Ireland Export Development Service, offering consultancy services to provide export strategy advice, business development, marketing strategy and export planning.

Company listing

Company	Website
Agri-Food and Biosciences Institute	www.afbini.gov.uk
ARR	www.arrltd.co.uk
ARUP	www.arup.com
Blaney Gears	www.blaneygears.com
B9 Energy	www.b9energy.co.uk
CEI Collins Engineers	www.ceicollinsengr.com
Copius Resources NI	www.copiusni.co.uk
Energis Global	www.energisglobal.com
Fugro-BKS	www.bks.co.uk
Mo Team	www.moteam.co.uk
Moyle Marine Energy	
Plan Energy Consulting	www.planenergy.co.uk
Pure Marine	www.puremarinegen.com
Queen's University Belfast	www.qub.ac.uk
RPS	www.rpsgroup.com
Williams Industrial Services	www.wis-ni.com

Case study:

RPS

RPS Group is a multi-disciplinary consultancy providing advice on the development of natural resources, land and property, the management of the environment and the health and safety of people. It employs 5,000 people globally, working on projects across six continents.

In Northern Ireland RPS has been providing services to the marine renewable energy industry for over 30 years, promoting the sustainable development of ocean energy.

Following a period of wave energy research with Queens University of Belfast, the company designed and supervised the construction of a small device into a gully on the Scottish island of Islay in 1980s. This successful project later evolved into the larger Limpet device, which was designed and constructed in conjunction with the pioneer wave energy development company Wavegen. The Limpet device was the first grid connected wave energy device in the UK and was only recently decommissioned.

In 2005 RPS carried out a study for Sustainable Energy Authority of Ireland that assessed the entire tidal energy resource contained around the coast of Ireland. The work included identification of areas for cost-effective exploitation of the resource, examination of the technical, economic, legal and other factors that may affect the development of tidal and marine current energy and evaluation of large deep water areas of high current velocity with a view to development of second generation deep water devices.

Later involvement in tidal energy included the design and contract management of the installation of OpenHydro's 5m prototype turbine test installation at EMEC in Orkney involving the civil construction in tidal currents of up to 8 knots. Later projects with OpenHydro included the provision of design, procurement and project technical support for the design of a gravity base to facilitate the larger 1MW turbine and its subsequent deployment in the Bay of Fundy in Canada.

Recognising the importance of optimising foundation cost, RPS has been working with McLaughlin and Harvey on a solution for deploying foundations for both tidal and wave devices. The company has been using the latest finite element techniques in assessing both the structural behaviour and geotechnical aspects of the design.

Other projects in which RPS has been involved have included a diverse array of locations from Ireland to the islands of Scotland, EMEC, Wavehub, the UK coastline and elsewhere within international waters. It has provided assistance in site location, resource studies, base design, detailed balance of plant studies and port development for many clients

RPS case study (continued)

worldwide. Recently, foundation studies and detailed design have been completed for the tidal energy developer Minesto, which has been testing its device in Strangford Lough. These projects have all involved engagement with the local NI supply chain in order to facilitate foundation installations and provide appropriate monitoring.

Engineering

Overview

Northern Ireland's engineering base is particularly strong in precision engineering allied to the aerospace, subsea, marine, civil and structural engineering industry sectors. It also designs, manufactures and exports over 40% of the world's mobile quarrying equipment.

This solid and flexible base has provided a platform for Northern Ireland companies to develop into the oil and gas and renewable energy industries.

Composite design and manufacturing are increasingly important for renewable energy devices and Northern Ireland has a leading cluster of composites engineering companies including Creative Composites and businesses, both local and international, can draw on the expertise and facilities of the Northern Ireland Advanced Composites and Engineering Centre (NIACE).

Northern Ireland can draw upon expertise in local, national and international energy engineering and these skills are being applied into the marine energy sector.

Company listing

Company	Website
ABCO Marine	www.abcomarine.co.uk
ADS Group NI	www.adsgroup.org.uk
Aidan Strain Electrical Engineers	www.aseeltd.com
Axon Power & Control	www.axon-online.com
BASE	www.basegroup.co.uk
Beattie Flanagan	http://beattieflanigan.com/
Blackbourne Electrical Services	www.blackbourne.co.uk
Blaney Gears	www.blaneygears.com
CEI Collins Engineers	www.ceicollinsengr.com
CMASS Ltd	www.cmass-ni.com
CM Precision Components	www.cmprecision.co.uk

Company	Website
Currie Engineering	www.currieengineering.co.uk
Dontaur Engineering	www.dontaur.co.uk
eMS	www.emsni.com
Engineering & Construction Group	www.ecpsteelfab.co.uk
EPS Automation	www.epsenvironmental.co.uk
ESL Engineering	www.eslengineering.co.uk
Farrans Construction	www.farrans.com
Fin Engineering	www.fin-engineering.com
Graham Construction	www.graham.co.uk
Grants Electrical Services	www.grantselectrical.co.uk
Harland & Wolff Heavy Industries Ltd	www.harland-wolff.com
Hulltec	www.hulltec.com
John Huddleston Engineering	www.jhe-group.com
Jotun Paints Europe Ltd	www.jotun.com
J W Kane Engineering	www.kaneprecisionengineering.com
Kane Engineering	www.kane-engineering.co.uk
Lagan Construction	www.lagangroup.co.uk
M&M Contractors	www.mm-contractors.com
McGrath Group	www.mcgrath-group.com
McGreevy Engineering	www.mcgreevyengineering.co.uk
McLaughlin & Harvey	www.mclh.co.uk
Marlborough Engineering	www.marlborough-eng.com
Mo Team	www.moteam.co.uk
Morson Project	www.morson.com/projects/
Moyolla Precision Engineering	www.moyola.com
Nicholl Engineering	www.nichollengineering.co.uk
Nitronica	www.nitronica.com
Northern Enterprises	www.northernenterprises.eu
OK Welding Marine	www.okweldingmarine.com
Powerteam NI	www.powerteam.eu.com
Project Design Engineers	www.pde.co.uk
Pure Marine	www.puremarinegen.com
Queen's University Belfast	www.qub.ac.uk
Ridgeway Renewables	www.ridgeway-online.com
RPS	www.rpsgroup.com
Scotts Electrical	www.scottses.com
Smiths Engineering	www.smiths-engineering.com
Travan Engineering	www.travanprecision.com
Williams Industrial Services	www.wis-ni.com
Woodburn Engineering	www.woodburnengineeringltd.co.uk

Case study:

Harland & Wolff Heavy Industries

Harland and Wolff Heavy Industries Ltd, part of the Fred Olsen Group, offers a full range of services from consultancy through basic design to detailed engineering, manufacturing and continued support throughout the product lifetime.

The company is active across the heavy engineering sector with divisions focused on:

- **Offshore wind farm logistics**
- **Ship design and ship repair**
- **Design engineering, and manufacture of offshore foundations and sub stations**
- **Heavy marine engineering**
- **Ship and offshore structures decommissioning**

Harland & Wolff Heavy Industries case study (continued)

Operating from its facility in the port of Belfast, Harland and Wolff has one the largest building docks in the world (556m x 93m) supported by two 840t gantry cranes and also the biggest dry dock in Europe. The 30,000m^2 fabrication halls have vast capacity with doors 40m wide by 18m tall, meaning that most oil and gas and marine structures can be completed and outfitted under cover.

The heavy marine engineering division undertakes the design and build of renewable energy devices and prototypes including wave and tidal energy converters, helping developers advance their concepts from prototype to full production manufacture.

Harland and Wolff has already been involved with the development of three marine energy devices; in 2006 it built a prototype single-point absorbing wave energy converter, Wavebob, which underwent sea trials in Galway Bay. Marine Current Turbine's 1.2MW Seagen tidal turbine, the world's first commercial scale tidal energy generator, was assembled by Harland and Wolff along with its foundation and in 2010 Scotrenewables contracted with the company to build its SR250 full scale 250kW prototype tidal turbine. Harland and Wolff is in negotiation for the fabrication and assembly of the 2MW SR2000 floating turbine device, Scotrenewable's first full scale tidal system.

Harland and Wolff is well-equipped for decommissioning activity at the end of the wave or tidal array's life. Importantly, it has a dry dock which can accommodate even the largest structures and a high degree of mechanisation strips costs out of the deconstruction process.

Manufacturing & components

Overview

Wave and tidal devices have a wide range of manufactured components in the structure, in the composite blades and power train, in electrical systems for power control, in take off and transmission and for the foundations to secure the sea bed connection.

The structures are mostly large steel fabrications and Northern Ireland has strengths in advanced manufacturing systems for the construction, materials handling, aerospace and ship repair and conversion sectors.

The series manufacture of marine energy devices may use concrete for structural components, offering the benefits of lower cost and corrosion resistance. The demand for structural concrete and ballast material can be met by member companies of the Quarry Products Association Northern Ireland and the contracting companies operating in Northern Ireland's construction sector.

Foundations are typically 200t and need to be fabricated as close to site as possible. Northern Ireland companies such as Harland and Wolff have a track record of delivering similar structures including jacket foundations for the offshore wind industry. Companies such as McLaughlin and Harvey and RPS are working on innovative solutions to reduce the cost of attaching devices to the ocean floor.

The blades for tidal devices usually comprise composite or metal material. The expertise of companies such as Creative Composites are being brought to bear in collaborative R&D projects in this field and new developments can be supported by the Northern Ireland Advanced Composites and Engineering Centre (NIACE).

Company listing

Company	Website
ADS NI	www.adsgroup.org.uk
Blaney Gears	www.blaneygears.com
Bruce Engineering	www.bruce-eng.co.uk

Company	Website
CM Precision Components	www.cmprecision.co.uk
Cooke Brothers	www.cooke-bros.co.uk
Creagh Concrete	www.creaghconcrete.com
Creative Composites	www.creativecomposites.co.uk
Currie Engineering	www.currieengineering.co.uk
D Engineering	www.d-eng.com
Datum Tool Design	www.datum-design.com
Dontaur Engineering	www.dontaur.co.uk
ESL Engineering	www.eslengineering.co.uk
Eurocables	www.eurocables.co.uk
Eurofab Engineering Structures	www.eurofabengineering.co.uk
Europa Valve	www.europavalve.com
Fisher Engineering	www.fisher-engineering.com
F P McCann	www.fpmccann.co.uk
Harland & Wolff Heavy Industries Ltd	www.harland-wolff.com
M.Hasson& Sons Ltd	www.hassons.com
J W Kane Engineering	www.kaneprecisionengineering.com
John Huddeston Engineering	www.jhe-group.com
Lagan Group	www.lagangroup.co.uk
Laser Prototypes (Europe)	www.laserproto.com
Marlborough Engineering	www.marlborough-eng.com
McGrath Group	www.mcgrath-group.com
McGreevy Engineering	www.mcgreevyengineering.co.uk
McLaughlin & Harvey	www.mclh.co.uk
Macrete	www.macrete.com
Moyfab Engineering	www.moyfab.com
Moyola Precision Engineering	www.moyola.com
NI Advanced Composites & Enginering Centre	www.niace-centre.org.uk
Nicholl Engineering	www.nichollengineering.co.uk
PF Copeland	www.pfcopeland.com
Power Team NI	www.powerteam.eu.com
Precision Gear Company	www.pregear.co.uk
Project Design Engineers	www.pde.co.uk
Relinea	www.relinea.com
Smiths Engineering	www.smiths-engineering.com
Smyth Steel	www.smyth-steel.com
Travan Engineering	www.travanprecision.com
Tyrone Fabrication	www.tfl.eu.com
Whale Pumps (Munster Simms)	www.whalepumps.com
Woodburn Engineering	www.woodburnengineeringltd.co.uk

Vessels

Overview

Vessel requirements vary for each project, depending on the stage that the project is at and the device and foundation arrangement used. By their very nature, marine energy devices are installed in locations with a high tidal flow or wave regime, which places demands on the vessels that can work in this environment.

Many manufacturers are also investigating float-out-and-sink deployment methods using smaller vessels that are more readily available in Northern Ireland.

A range of supporting vessels is needed during construction and operation, mainly for crew transfer. Harland and Wolff designs and builds appropriate craft for these purposes and Red Bay Boats manufacturers a range of rigid inflatable boats and composite vessels. Member companies of the collaborative network, Total Marine Support Services, such as Ian Newell Boat Building, develop and build transfer and survey vessels while Seasource is contracted to supply vessels and crew for survey and guarding duties to a number of offshore energy clients in UK and Irish waters.

Company listing

Company	Website
Agri-Food and Biosciences Institute	www.afbini.gov.uk
Belfast Lough Pilotage Services	www.belfastpilots.com
Carlingford Lough Pilotage Services	www.carlingfordpilots.co.uk
McLaughlin & Harvey	www.mclh.co.uk
McMullan Marine Services	
Red Bay Boats	www.redbayboats.com
Sea Source	www.sea-source.com
Strangford Moorings	www.strangfordmoorings.co.uk
Total Marine Support Services	

Surveying

Overview

Wave and tidal farms have similar requirements to offshore wind farms, and the following types of survey are typically needed in the development phase:

- Resource assessment: quantifying waves and tides, which is a vital process in identifying the best location for arrays and in forecasting yields
- Wildlife surveys: fish and sea mammals are a particular concern for tidal arrays, given the underwater moving parts
- Coastal processes: for near-shore arrays in particular which can impact on the movement of water and sediment
- Geophysical and geotechnical: this is critical for devices with sea bed connections and for cable routes.

Northern Ireland has capability in the Agri-Food and Biosciences Institute (AFBI) which operates a research vessel and in companies such as Applied Renewables Research (ARR), Pure Marine Gen and RPS which have undertaken both wave and tidal resource assessments. The Marine Energy Research Group at Queen's University Belfast has significant capability in this area and continues to undertake the marine biological survey requirements for Marine Current Turbines' SeaGen in Strangford Lough.

Company listing

Company	Website
Agri-Food and Biosciences Institute	www.afbini.gov.uk
ARR	www.arrltd.co.uk
Pure Marine	www.puremarinegen.com
Queen's University Belfast	www.qub.ac.uk
Red Bay Boats	www.redbayboats.com
RPS	www.rpsgroup.com
Sea Source	www.sea-source.com
Top Survey Ltd	www.top-survey.com

Deployment

Overview

The deployment of marine energy devices involves foundation or mooring installation, often with gravity base or with piling, device installation, cable laying, onshore grid connection and other commissioning activities.

A variety of vessels is used which must be able to work in high tidal flows (for tidal sites) and be mobilised in relatively short weather windows.

The first marine energy arrays are likely to have as much electrical infrastructure as possible onshore, meaning that onshore civil contractors could present competitive solutions to the offshore marine industry. Northern Ireland has particular strength in this area through its civil engineering sector including companies such as McLaughlin and Harvey, Graham Construction and Farrans Construction. Offshore substations are needed for wave and tidal farms exceeding 100MW in capacity.

Company listing

Company	Website
McLaughlin & Harvey	www.mclh.co.uk
RPS	www.rpsgroup.com

Case study:

McLaughlin and Harvey

With more than 150 years of experience, McLaughlin and Harvey building and civil engineering contractors operates across the UK and Ireland with offices in Belfast, Glasgow and London.

The offshore division incorporates McLaughlin and Harvey's marine energy operations and it provides a full range of services to the offshore renewable industry, from full design and build capability to offshore deployment and operations and maintenance.

McLaughlin and Harvey has a proven ability to deliver the most challenging installation projects in remote and difficult offshore locations, using readily available marine plant and equipment.

McLaughlin and Harvey case study (continued)

The company has been involved in the tidal energy sector since 2005, having carried out installations of tidal energy devices worldwide using tried and tested sequences and methodologies. Among these is a range of projects with OpenHydro, including the installation of the demonstration devices at EMEC in Orkney and the Bay of Fundy in Canada. McLaughlin and Harvey also installed the gravity base foundation for Minesto's Deep Green underwater kite at Strangford Lough. This project was delivered in three weeks from appointment to completion including design changes, steel fabrication, precast concrete casting, site mobilisation, vessel procurement, trial erection, commissioning and deployment.

In parallel to these deployment successes, McLaughlin and Harvey has developed new methodologies for the cost effective installation of foundations. The first phase of a research and development project into the installation of subsea foundations using remote ground anchor drilling technologies, part funded by Invest Northern Ireland, is now completed. The company has built a full size subsea drilling test rig, based on a single leg of the overall system, and has been testing the drilling technology. The resulting system will be suitable for a range of sea bed conditions and is applicable to all tidal energy devices. The second phase involves scale testing of a three or four leg foundation and this is expected to be completed within 2014.

In 2014 McLaughlin and Harvey will also be involved in research and development projects into the use of specialist grouts for subsea connections and for the installation of drilled foundations in deep water sites (greater than 100m depth).

Ports, port operations & land based support

Overview

Northern Ireland has a long heritage in port operations, particularly in the 800 hectare Belfast Harbour which celebrated its 400th anniversary in 2013.

Both wave and tidal devices have significant requirements for port facilities for manufacturing, assembly, installation and operation. This includes lay down area and storage adjacent to the quayside. Tidal turbines require a significant port water depth to accommodate construction of the devices; the 2MW SeaGen device will have two rotors of 20m diameter, for example. For manufacture and installation wave energy devices are likely to need a significant length of quayside, with the Pelamis P2 machine requiring a quay length of 180m for example.

For most operations and maintenance strategies for future wave and tidal arrays, significant workshop areas with quayside access will be needed to accommodate the frequent servicing of devices and components. Owners, manufacturers and contractors will draw on a range of port-based services, including cranage, vessel maintenance, chandlery and stevedoring.

Company listing

Company	Website
Barton Industrial Services	www.barton-industrial.com
Beattie Crane Hire	www.bchc.ltd.uk
Belfast Harbour	www.belfast-harbour.co.uk
Belfast Ship Stores	www.belfastshipstores.com
Belfast Lough Pilotage Services	www.belfastpilots.com
Carlingford Lough Pilotage Services	www.carlingfordpilots.co.uk
CEI Collins Engineers	www.ceicollinsengr.com
Cimpina	www.cimpina.com
Comada NI	www.comada.co.uk
David Ferran & Sons	www.davidferran.co.uk
G Heyn & Co	www.heynshipping.co.uk
Glover Crane Hire	www.glovercranehire.com
Harland & Wolff Heavy Industries Ltd	www.harland-wolff.com
Hulltec	www.hulltec.com
Jamison & Green	www.jamisonandgreen.co.uk
Jenkins Shipping Company	www.jenkins-shipping.com
John Burke & Co	www.belfastshippingagents.co.uk/john_burke.htm
Mo Team	www.moteam.co.uk
Port of Coleraine	www.ports.org.uk/coleraine
Port of Kilkeel	www.ports.org.uk/port.asp?id=312
Port of Larne	www.portoflarne.co.uk
Port of Londonderry	www.londonderryport.com
Quality Freight	www.qualityfreight.com
Ridgeway Renewables	www.ridgeway-online.com
Survitec Group	www.survitecgroup.com
Svitzer Marine	www.svitzer.com
Total Marine Support Sevices	
Warrenpoint Harbour	www.warrenpointharbour.co.uk
Waterfront Services/MF Ewing	www.belfastshippingagents.co.uk/members

Case study:

Belfast Harbour

Established in 1847, Belfast Harbour Commissioners is the port authority in Belfast and operates the principal maritime gateway on the island of Ireland. Covering an area of over 800 hectares it is one of the UK's largest ports handling a record 19.6 million tonnes of cargo in 2012.

The port has demonstrated its commitment to the renewable energy sector by developing the UK's first purpose-built logistics terminal for the offshore wind industry, leased to DONG Energy and under use for the build out in the east Irish sea of ScottishPower Renewables' and DONG Energy's West of Duddon Sands offshore wind farm, which began construction in 2013.

The facilities at Belfast Harbour include Ireland's longest deep-water quay, Stormont Wharf, at over 1km long. It has over 40 ha of strategically located waterfronting development sites available for large-scale manufacturing and logistics activity for the offshore renewables sector. The port's main shipping channel provides 24x7 access, with a maintained depth of 9.3m providing access to berths of depths up to 11.5m.

One of the largest facilities in the port is operated by the world famous, Harland and Wolff Shipyard. Harland and Wolff's facilities include extensive dry dock facilities, with over 100,000m2 of storage areas and two permanent heavy lift gantry cranes each with a lifting capability of up to 800 tonnes.

Over recent years Belfast Harbour has capitalised on these facilities to become one of the UK's leading renewable energy hubs suitable for supporting offshore wind and the wave and tidal energy sector. Crucially, Belfast Harbour has demonstrated to the renewable energy sector, its expertise and track record of delivering major port infrastructure projects on budget and within required timescales. These attributes make it a sought-after port partner for the marine renewable energy sector.

As a result, Belfast Harbour is rapidly establishing itself as the leading hub port in the UK for offshore wind and marine renewable energy industries with high profile tidal turbines such as Marine Current Turbines' 1.2MW SeaGen and Scotrenewables SR250 both being assembled by Harland and Wolff in Belfast Harbour.

Future opportunities for Belfast Harbour include providing facilities for large scale marine energy device manufacturing and providing the marine logistics base from which to execute wave and tidal energy projects in Northern Ireland's territorial waters, Scottish territorial waters and further afield.

Invest NI

Invest Northern Ireland - Support to develop the Wave & Tidal Sector in Northern Ireland

Invest NI offers an extensive range of support to help companies based in Northern Ireland get involved in and take advantage of the fast growing Wave & Tidal sector. This support covers the key areas of strategy development, market entry, research & development, skills enhancement and supply chain development and is delivered by a team with extensive expertise in offshore energy. Invest NI works directly with businesses and in collaboration with partners across Northern Ireland to drive the industry forward.

Business & Marketing Strategy

We will help your business to structure its planning for growth and export success;

Market Entry

Invest NI implements a targeted Export programme and supports companies to visit key events and markets in the UK and Europe to enable them to present their capability to overseas buyers and to win business;

Research & Development

This assistance can help your business develop new products, processes and services. We also encourage you to work collaboratively and can link your business with other businesses, colleges, universities or other organisations;

Supply Chain Development

Assistance to help companies understand the requirements of potential customers and how you can address their needs. This programme is supported by regular engagement with key stakeholders and development of strategic partnerships to present the overall proposition of Northern Ireland in the Wave & Tidal sector;

Access to Finance

Northern Ireland has a number of initiatives to help companies access finance to support export-led growth plans.

For further information go to **investni.com**

Notes

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Invest Northern Ireland

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