

MARINE ENERGY

The Highlands and Islands – the world's premier location for marine energy research, development and commercialisation.





The OIG Giant II ship berthed at Arnish in the Outer Hebrides

MARINE ENERGY

PIVOTAL IN THE WORLDWIDE MARINE ENERGY SECTOR

OVERVIEW

For more than a decade the Highlands and Islands of Scotland have been at the very forefront of an increasingly global marine energy industry.

Located on the north-western edge of Europe, the region is home to incredibly rich wind, wave and tidal resources. Its long indented coastline harbours a network of established test and deployment sites, which together offer the world's most comprehensive route to develop, test and commercialise marine energy technologies.

Scotland has around 25 percent of Europe's tidal stream potential, equivalent to approximately 10GW, and 10 percent of wave resource with a potential of around 15GW. Add to this a history of oil and gas exploration and recovery, a legacy of transferable skills and infrastructure and the Highlands and Islands of Scotland is proving not only prominent, but pivotal in the worldwide marine energy sector.

The last few years have seen a period of extraordinary growth and change within the sector, in particular through the maturing of the tidal energy market and an increasing focus on technology development for the emerging wave energy sector.

Throughout this, Highlands and Islands Enterprise (HIE), the Scottish Government's economic and community development agency for the north and north-west of Scotland, is committed to supporting and encouraging the development and growth of the marine energy industry.

A maturing sector

Already marine energy has demonstrated its potential to generate sustainable economic growth in geographic areas where skilled employment can at times be hard to find. In Orkney, significant business is being generated in supporting the European Marine

Energy Centre (EMEC) and the technology developers attracted to the facility.

Real progress has been made since EMEC first opened in 2004. Numerous leading wave and tidal technologies have gone through their paces at full-scale, and more recently nursery sites have been established to allow scale testing of new technologies.

As the sector has developed, there is now a clear differentiation between wave and tidal industries.

Although our tidal sector is still developing, we have begun to see the consolidation of a number of leading firms together with a growing convergence in technology design. The flagship MeyGen project located in the Pentland Firth is on track to be the world's first multi-turbine, utility scale tidal array, whilst Orkney-based Scotrenewables Tidal Power is taking the lead in testing and refining their commercial-scale floating machines. In Shetland, Nova Innovation deployed its first tidal turbine – a 30kW device - in the Bluemull Sound in 2014. The company is developing the world's first community scale array of five 100kw devices at the same site.

While the wave energy sector continues to tackle technology challenges, certain players, notably Albatron, have enjoyed more recent success piloting technologies aimed at niche, off-grid consumers. It is clear that extracting wave energy reliably – particularly at utility scale – is a major undertaking, and the challenges it faces are not unique to Scotland.

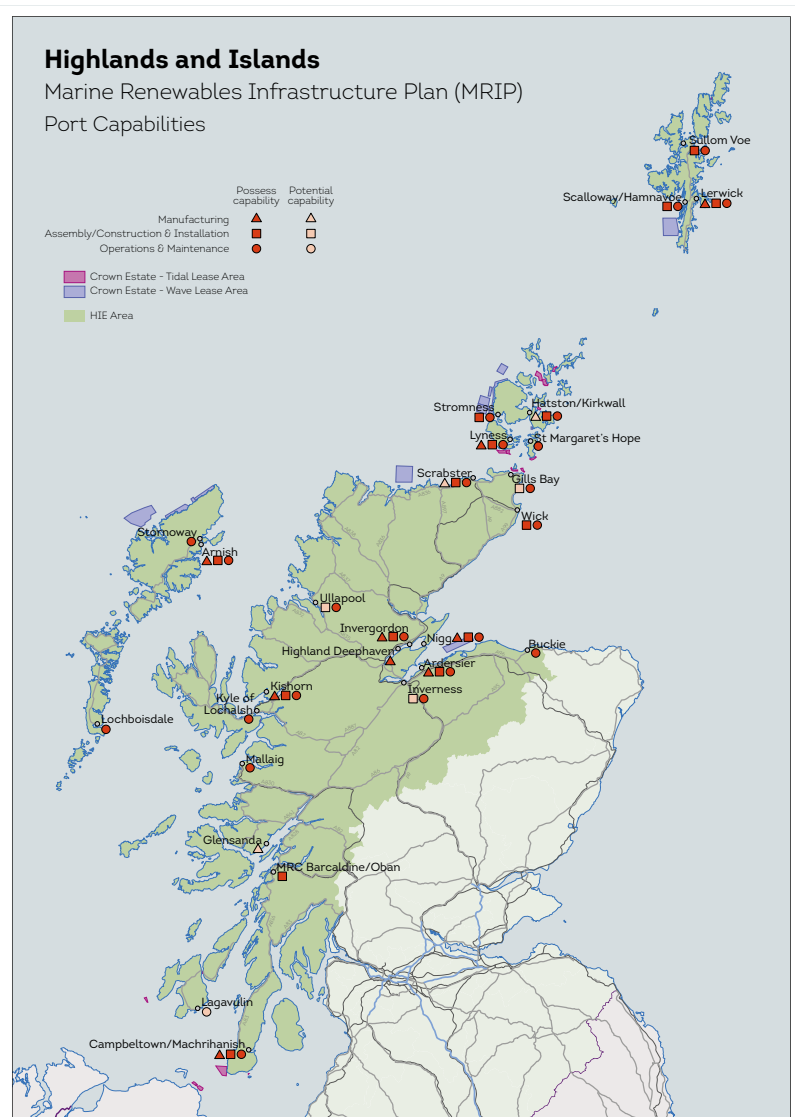
In response to this in 2014 HIE, at the request of the Scottish Government, established Wave Energy Scotland (WES) to support and accelerate the development of wave energy technologies.

NETWORK OF MODERN PORTS AND HARBOURS

INFRASTRUCTURE

To enable the marine energy industry to realise its full potential, modern port and harbour infrastructure is essential. To this end HIE and a number of other public and private partners have invested over £160 million to date in the strategic upgrade of ports and harbours across the region to support the offshore renewable energy sector. This includes improvements at Lyness, Hatston and Stromness Harbours in Orkney, Scrabster Harbour in Thurso, Arnish in the Outer Hebrides, Nigg in Easter Ross and Campbeltown in Argyll. As part of the development of a Marine Renewables Infrastructure Plan for the Highlands and Islands, HIE has continued to engage with a range of other key sites including Kishorn, Wick and Buckie, all of which may play a part in supporting the sector going forward.

Furthermore, HIE has also invested in forward supply units at Hatston to accommodate tidal developers testing at EMEC's Fall of Warness site. These combined infrastructure developments will help with continued testing and demonstration of devices, through to the manufacturing, installation, operations and maintenance of commercial-scale developments in the longer term.



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SUPPLY CHAIN

The region supports a strong and expanding supply chain, thanks to its long history of oil and gas exploration and recovery. In recent years, the Highlands and Islands has seen an increasing number of locally-based businesses diversifying to service the renewable energy sector.

Key companies active in the marine renewables sector include BiFab at the Arnish in the Outer Hebrides, marine engineering specialists James Fisher, JGC Engineering, Global Energy Group and Aquatera, an Orkney-based environmental consultancy and many other engineering, project management and research, development

and deployment companies based in the Highlands and Islands.

These firms, and many others in the region, now offer an end-to-end supply chain of complementary companies that develop, devise, test, manufacture, install, operate and maintain marine renewable energy technology from concept to full-scale commercial deployment. In addition, companies in this region are embracing international opportunities in the sector and are working actively in Japan, Chile, Canada and Ireland.

HIE SUPPORT

HIE supports businesses active, or with an ambition to be active in the sector, in a number of ways. Principally, this is undertaken through the account management process, where businesses are supported to deliver their growth aspirations through the use of a number of support tools including advice, market information and financial assistance.

In addition HIE works with Scottish Government, Scottish Enterprise and other partners to secure finance to support innovation, research, development and deployment in the marine energy sector.



The Scotrenewables Tidal Turbine being towed in to position by a MultiCat vessel, Orkney



Atlantis turbine



Nova Innovation's 30kW Nova 30 device

THE HIGHLANDS AND ISLANDS LEADING THE WAY

EMEC

Based in the superb wave and tidal conditions of the Orkney Islands, the European Marine Energy Centre (EMEC) has become the go-to test bed for many of the world's leading wave and tidal technologies seeking to reduce time, cost and risk for pre-commercial deployments. As the world's first and only accredited test laboratory of its kind, EMEC has successfully supported the deployment of more grid-connected devices at its full-scale wave and tidal testing facilities than at any other single site in the world.

As the sector has evolved, so too has EMEC, with the provision of nursery sites to allow new technologies to come forward and test at reduced scale. Over the last decade the centre has accumulated a wealth of knowledge alongside a vast repository of wave and tidal data, and this is being made available to developers and the broader research community to allow a structured approach to development including common standards for performance assessment and coordinated research leading ultimately to full-scale testing at sea.

EMEC has seen more than a decade of world leading innovation – from projects looking at EMEC's subsea cables to the generation of hydrogen at their test sites. Collaboration is to the fore. Projects such as the EU funded MARINET have helped accelerate the development of marine renewable energy by offering periods of free access, and training courses in testing techniques, whilst EMEC has teamed up with the FloWave Ocean Energy Research Facility at the University of Edinburgh to offer a structured approach from the test tank to the ocean for new energy ideas.

In addition, EMEC has developed more collaborative working internationally, furthering its ties with Japan and it is now provides advice on the development of a marine energy test facility in Nagasaki Prefecture. EMEC will advise on the infrastructure needed to develop a test site, from subsea cables, and grid connection to resource data instrumentation, as well as the wider infrastructure required in the region to support marine energy deployments.

MeyGen

The MeyGen tidal stream project, located in the Inner Sound in the Pentland Firth is on-track to become the world's first and largest tidal energy farm. The Phase 1a – a 6MW four turbine array – is fully funded and is advancing rapidly, with more than 50 jobs and 40 local firms involved in the construction of the ambitious scheme. A tidal turbine integration and assembly facility is proposed at the Nigg Energy Park to support the Scottish tidal industry.

The success of phase 1a will be a global milestone for marine energy and will mark the point where the industry has moved from research and development on a clear route towards commercialisation and electricity generation.

Nova Innovation

Nova Innovation Ltd has taken a different approach, developing smaller scale devices. The company deployed its first tidal turbine in April 2014 in the Bluemull Sound in Shetland – the 30kW Nova 30. The company is now developing an array of five 100kW devices to be deployed at the same site. This will be the world's first community scale tidal array.

Scotrenewables Tidal Power

Orkney based Scotrenewables Tidal Power continues to attract £multi-million investment to back its plans to build and test the world's largest floating tidal turbine. In 2015 the firm secured £5.7 million investment to complete its SR2000 (2MW) system; the first large

scale-machine the Orcadian company has built. Once launched, it will undergo a full programme of grid-connected testing at EMEC's Fall of Warness tidal site.

Wave Energy Scotland

Wave Energy Scotland is supporting and accelerating the development of wave energy technology in Scotland and was established in 2014 as part of Highlands and Islands Enterprise at the request of the Scottish Government.

Based in Inverness, WES brings together the best engineering and academic minds to deliver a range of projects aimed at resolving the issues that have hindered the development of wave energy technology to date.

In particular, WES has been created to address the challenges encountered by developers in Scotland, particularly the need to pursue rigorous research and development before commercialisation will bring a return to private investors. WES has already awarded a number of contracts for the development of innovative technologies to produce low cost, efficient and reliable components and subsystems which can form the basis of the cost effective generation of wave energy in Scotland. WES is currently running 30 projects and working with 80 organisations across the WES programmes.

Key to this is driving convergence in the sector and ultimately reducing the costs attached to commercialisation. The ultimate aim is to enable at least one wave energy device to reach the point where it has been rigorously tested and demonstrated, shows clear potential to be cost competitive with other offshore renewables, and is ready to be commercialised by the private sector. For more information please visit www.waveenergyscotland.co.uk

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