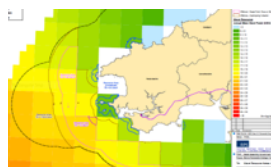




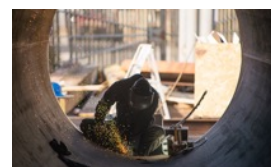
SUPPORTING MARINE ENERGY IN WALES



INVESTMENT BY PROJECT DEVELOPERS TO DATE £34.5 MILLION



EACH £1 OF PUBLIC FUNDING HAS LEVERAGED £3 OF PRIVATE INVESTMENT



174 PERSON YEARS OF EMPLOYMENT SUPPORTED

MARINE ENERGY IN WALES

INVESTMENT/JOBS/SUPPLY CHAIN



Economic benefits for Wales

In late 2014, Marine Energy Pembrokeshire carried out a survey of the marine energy industry in Wales. The purpose was to calculate the economic contribution of the sector to date, to understand future development plans, and what this could potentially contribute to the low carbon economy in Wales. The analysis covers wave, tidal stream and tidal range energy. Already in Wales, technology and project developers have spent £34.5 million, directly creating over 99 person years of employment, rising to 174 person years when including Welsh academic research. This contribution increases, when total gross value added effects are considered within the wider supply chain and demonstrates the important contribution the sector has already made to the economy.

The total Marine Energy spend is £45.4 million including Welsh Universities and research projects.



Tidal stream, wave and tidal range. A diverse resource bringing multiple benefits

Foreword

There is no doubt that the marine energy sector represents a once in a generation opportunity to secure a new predictable low carbon economy that will help deliver economic growth, energy security and diversity of supply, and assist in meeting important climate change targets. In February 2015, a report for the UK Marine Energy Programme Board, chaired by the Energy Minister the Rt Hon Amber Rudd MP, highlighted that the UK could capture a slice of the global marine energy market worth up to £76 billion and, separately that this could contribute around £4 billion cumulatively to UK GDP by 2050.



On a worldwide scale there are more marine energy projects being developed in the UK than any other country creating approximately 1,700 high skilled jobs which has the potential to grow to over 20,000 in the next decade.

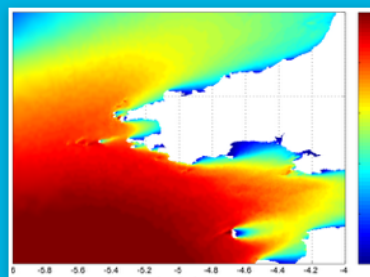
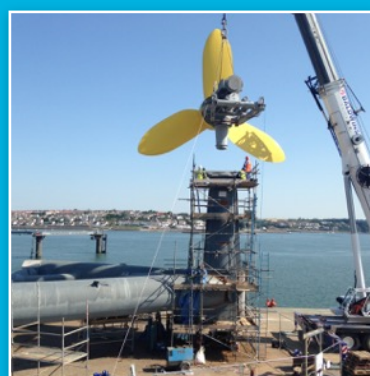
It is good to see that the sector is having a positive effect on the low carbon economy in Wales providing skilled green jobs and growth in a challenging economic climate. Already in Wales, technology and project developers have spent £34.5 million, directly creating over 99 person years of employment, rising to 174 person years when including Welsh academic research. It is important to note that these are direct impacts; the contribution is increased when total gross value effects are included from the wider supply chain. So far the supply chain in Wales has been involved in this new sector at levels of almost 50% of expenditure for tidal stream and 60% for wave energy. It is indeed a positive message to hear developers stating how they intend to engage with this supply chain in the future.

With €100.4 million of EU Structural funding prioritised for the delivery of marine renewable energy in Wales over the next 5 years, the country is well placed to play a leading role in the worldwide marine energy sector.

Martin Murphy, Chair, Marine Energy Pembrokehire



The potential for 6.4GW of installed capacity



Marine energy technology and project developers along with Welsh academic research have created over 174 person years of employment.

50% of the supply chain for tidal stream has come from Wales.

Total investment in Welsh marine energy projects

Tidal stream energy, including developments by Tidal Energy Limited (TEL), Minesto, MCT (project currently on hold), along with the development of the West Anglesey Demonstration Zone have contributed a total of £18.5 million into the economy. Combined with tidal range this figure rises to £33.5 million.

Wave energy developers, including Marine Power Systems, Marine Energy Ltd and Wave Dragon along with the development of the South Pembrokeshire Demonstration Zone have contributed over £1 million of investment.

Combining the investment into wave and tidal energy along with publicly funded Welsh research projects brings the total to £45.4 million spent in Wales on the development of marine energy.

Employment

Marine energy technology developers and associated Welsh project development has directly created 99 person years of employment to date. Alongside Welsh marine energy related academic research, this figure rises to over 174 person years of employment.

Supply chain

During the life cost of projects to date almost 50% of the supply chain for tidal stream energy has come from Wales. Mustang Marine Ltd has built and assembled TEL's DeltaStream device at its facilities in Pembroke Port demonstrating that Wales is accumulating both the required skills and experience in the marine renewables sector. Of the 49 principal contracts procured by TEL during their project development, 22 were supplied by Welsh Supply Chain companies. Minesto have chosen Wales as the location for its UK Headquarters based on the vast resource, access to grid and support from Government. In the coming years Minesto will install 10MW in North Wales resulting in over 30 direct jobs. This is predicted to increase to over 100 jobs when wider supply chain benefits are taken into account.

Wave projects, although representing a lesser total investment have retained 60% of their supply chain within Wales. Tidal range energy, currently standing at 10% for the project development stage, are aiming for a minimum of 50% of their supply chain to be sourced from Welsh companies. Marine Power Systems are also aiming for a minimum of 50% Welsh supply chain content, with 8 Welsh based engineering contracts named as development and procurement partners to date, in various stages of contractual engagement.

Using figures reported in previous research on the expected economic impacts of marine energy on the Welsh economy¹ would suggest that every £10 million of investment in resources such as wave power and tidal stream could be associated with total gross value added effects in Wales of around £2.5 million (i.e. including direct, supply chain and associated household effects). Similarly the same research would also suggest that each £10 million of marine energy investment would be associated with around 75 person years of employment once direct, supply chain and household effects are taken into account.

¹ Fanning, T, Jones, C and Munday, M. Regional Employment Returns from Wave and Tidal Energy: A Welsh Analysis. Regeneris Consulting and the Welsh Economy Research Unit, 2014

The potential

A study by Regeneris and Cardiff University² highlighted the huge impact the wave and tidal stream sector could have in Wales. This was done using three illustrative development scenarios:

1. A 30MW wave installation and a 30MW tidal stream installation has the potential to support over £70 million of GVA across Wales, based on total investment of £150 million. It could also provide 2,000 person-years of employment associated with development and installation, with a further £2 million in GVA and 50 FTE jobs per annum throughout the period of generation.
2. 300MW in marine energy capacity (two 30MW wave installations and eight 30MW tidal stream installations) would deliver just over £300 million of GVA for Wales. It could provide 8,500 person-years of employment during development and installation phases. The operational phase would support £7.8 million in GVA and 180 jobs per annum across Wales.
3. The final, very substantial roll out of 1GW in wave and tidal energy could deliver £840 million of GVA impact to Wales (based on a total investment in Wales of the order of £1.5 billion in 2013 prices) and deliver 24,000 person-years of employment. For the 1GW Scenario 3, Regeneris estimates that £20 million of GVA and 440 FTE jobs per annum would be supported across Wales through generation activities

For tidal range energy a separate report 'The Economic Case for a Tidal lagoon Industry in the UK'³ estimates that Tidal Lagoon Swansea Bay project will involve an investment of £1,046 million (in 2014 prices) stating that close to half of this investment will be retained within the Welsh economy. Approximately 1,900 jobs will be created at the height of the construction programme with annual operation of the lagoon amounting to approximately 181 FTE jobs.

The opportunity

The West Wales and the Valleys region has been awarded the highest level of support from the European Union for the Structural Funds programming round 2014–2020. Marine Energy is a priority area and has attracted funding of €100,428,444 with an intervention rate of 69.43%.

Strategic objective (3.1) is to increase the number of wave and tidal energy devices being tested in Welsh waters and off the Welsh coast, including multi-device array deployments, thereby establishing Wales as a centre for marine energy production.



²The Economic Impact of the Development of Marine Energy in Wales, Renegeris Consulting and Welsh Economy Research Unit at Cardiff Business School, 2013

³The Economic case for a Tidal lagoon Industry in the UK, Centre for Economics and Business Research (CEBR), 2014



Development progress and future plans

Alongside the considerable investment to date, interest in Wales by technology developers continues to grow and has the potential to make a significant contribution to the low carbon economy. The following section provides a summary of industry's plans to develop their technology in Welsh waters.

Tidal Energy Limited : Ramsey Sound

The deployment of Tidal Energy Ltd's (TEL) 400kW DeltaStream demonstration device in Ramsey Sound is imminent with the device fully constructed and commissioned. The multiple patented DeltaStream design consists of three independent 400kW nacelles mounted on a triangular frame which sits on the seabed and weighs around 400 tonnes. For this project, one 400kw turbine will be installed for a 12 month demonstration period, with a view to scaling up to the full scale device later in 2016.



The project is being used to prove the capability of DeltaStream as a tidal stream generator and will provide evidence on how the device interacts with the environment around it. During its deployment, the device will be connected to the local distribution network, allowing the electricity generated by it to contribute to the renewable energy targets of the Welsh Government. TEL has signed a deal with EDF energy to sell them electricity for the duration of the project.

Ramsey Sound was chosen as an ideal location for the project after an extensive site selection programme. Initially the investigation covered the whole of the UK, identifying 24 potential sites. The Ramsey Sound site was chosen because it is sheltered from prevailing wind and wave conditions, it has good water depths close to the mainland, it has fast tidal streams reaching up to 3 m/s on spring tides, has a suitable grid connection and there are good port facilities and marine engineering capabilities nearby.

Tidal Energy Limited : St David's Head

Tidal Energy Limited's St David's Head project is a joint venture between Tidal Energy Ltd and Eco2 Ltd to develop a 10MW commercial array project in St David's Head, Pembrokeshire. Prior to fabrication, design of the array turbines will use the real-time test of the prototype in Ramsey Sound to optimise the business case required to construct the St David's Head project by 2017 and to further develop the technology.

The project will comprise of up to 9 DeltaStream units, and will include the provision of inter array cabling, sub-sea electrical infrastructure and sub-sea export cable(s) offshore, as well as an onshore package control room/substation and the associated electrical infrastructure works to allow connection to the local distribution network. St David’s Head has been selected as the site for the deployment of the demonstration array following careful consideration of a number of sites based on physical, environmental and policy constraints.

Minesto

The Crown Estate, manager of the UK seabed, has awarded an ‘Agreement for Lease’ for a commercial demonstration site for electricity production from tidal currents to marine energy company Minesto. Minesto will prepare consent application for the site near Holyhead Island in Wales prior to the construction of a 10MW marine energy array in 2017, which will supply electricity to approximately 8,000 households.



Minesto will now further develop the project, which includes in depth environmental studies, detailed seabed mapping, cable routing and commercial activities. The Holyhead Deep site is located approximately seven kilometres from the shore where the water depth is 80-90 meters. The tidal currents are 1.5-2.5m/s. The area has been carefully selected to maintain separation from shipping lanes and to minimise the impact on other sea users.

Tidal Lagoon Swansea bay



At 320MW installed capacity, with first power expected in 2018, (subject to achieving planning consent), Tidal Lagoon Swansea Bay will be the largest marine energy development in the world. Developed by Tidal Lagoon Power Limited, it will have a 495GWh output each year and it is estimated that it will power 155,000 homes for 120 years – that’s about 90% of Swansea Bay and 11% of Wales’ domestic use. Although the Lagoon is the first of its kind, all component parts of the project have been proven elsewhere in the world.

Tidal Lagoon Swansea Bay represents a £1 billion investment which will include an international watersport centre that will host a variety of national and international events, from triathlon to sailing, and an Offshore Visitor Centre that will work with local schools and colleges, as well as welcoming 100,000 tourists to Swansea Bay each year. It will also include the creation of new habitat, sea reefs and seabed sanctuaries where oysters, lobsters, mussels and fish can replenish themselves; the reintroduction of species through an onsite hatchery.

Applications for development consent and marine licensing were submitted on 7 February 2014. A decision from the Planning Inspectorate is expected in early 2015. The Tidal Lagoon Swansea Bay has been named in the National Infrastructure Plan 2014, as published by HM Treasury.

Marine Power Systems Ltd

Marine Power Systems Ltd (MPS) was founded specifically to develop the WaveSub wave energy converter – a second generation device with many advantages that address the challenges of extracting wave energy. The WaveSub has undergone sea trials and tank testing at small scale, and recently a detailed project to model the cost of energy was completed with favorable results. MPS has completed two Phases of the development of the technology:

Phase 1 delivered a proof of principle prototype device that has undergone successful sea trials and energy generation tests at the world renowned National Renewable Energy Centre (NaREC) in Newcastle. The operating principles and ability to generate energy were proven by this prototype.

Phase 2 was a detailed desk engineering project to fully understand the cost of energy that the WaveSub was likely to deliver. This project comprised: an energy generation simulation exercise, design feasibility and costings of the power take off system and structure; and the production and costing of a maintenance plan for the WaveSub.

Phase 3 will see Marine Power Systems design, build and test a ¼ scale prototype at sea. This phase is underway, with the detailed design currently taking place. MPS have selected a number of industry expert project partners and subcontractors who are integral to delivering this phase. Testing is due to commence in 2015.

Marine Energy Ltd

Marine Energy Ltd is a privately owned marine energy development and generation company with a mission to identify, develop, own and operate suitable sites for deployment of marine wave energy parks for renewable electricity generation. Marine Energy Ltd is in the process of making applications for a

project to deploy a 10MW pre-commercial wave energy power park on a site off the Pembrokeshire coast in Wales.

The expected electricity generation is 50,000 MWh per year from the Pembrokeshire 10MW wave energy project. The power output will be exported via a 33kV sea cable to the on-shore power distribution grid owned and managed by Western Power Distribution Ltd.

The company will deploy “Seabased Wave Energy Converters” (WECs), which are designed with a unique patented three phase, permanent NdFeB magnet, linear generator uniquely developed to be utilised in ocean bed arrays and directly driven by point absorbers on the ocean surface. The WECs form part of an integrated wave energy power generation system capable of delivering Grid Code compliant power to the on-shore grid.

NOTE: This update on development progress and future plans for tidal stream, wave and tidal range details information in the public domain. There are a number of other developers who have an interest in Wales but prefer not to share projects plans at this stage.



Demonstration Zones

The Crown Estate has identified areas of seabed around the UK which are suitable for wave and tidal test and demonstration activities. In recognition of its abundant marine renewable energy resources, Wales has been awarded both wave and tidal demonstration zones. These sites have been leased out by the Crown Estate with the goal of accelerating technology development.

South Pembrokeshire Wave Demonstration Zone

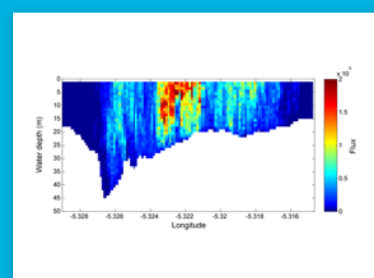
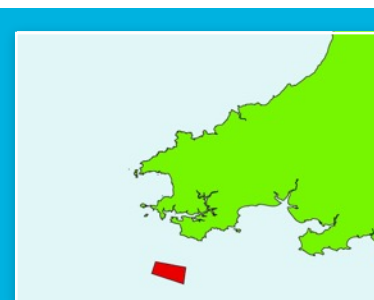
The Pembrokeshire Demonstration Zone is located 13km off the South Pembrokeshire coast. Third Party Management for the site is a collaborative approach being led by Wave Hub and partners including Marine Energy Pembrokeshire, Pembroke Port and Pembrokeshire County Council.

The zone, with an area of seabed of 90km² and a 19 kW/m wave resource has the potential to support the demonstration of wave arrays with a generating capacity of up to 30MW for each project. It is situated between 13.2km and 21.1km offshore with a mean water depth of 53.4m.

West Anglesey Demonstration Zone

The zone has a good tidal current resource, a relatively low wave regime, comprises of 37km² and is generally based around the promontory of Holy Island. This zone was identified because it offers appropriate tidal energy potential and access to necessary infrastructure, including ports and electricity grid.

Morlais Marine Energy was established by Menter Môn following its appointment as the managers for the West Anglesey Demonstration Zone by The Crown Estate. The motivation for applying to be the Third Party Manager was to establish Anglesey as a marine energy hub and secure maximum added value for the local economy.



“The announcement is an important step which helps to define Wales as a key location for marine energy deployment and leads the way for commercial renewable energy ventures” Rt. Hon Carwyn Jones AM, First Minister for Wales

Marine Energy Pembrokeshire - Supporting the Wave and Tidal Industry in Wales

Established in 2010, Marine Energy Pembrokeshire is a partnership between technology developers, the supply chain, academia and the public sector working in collaboration to establish Pembrokeshire and Wales as a “centre of excellence” for sustainable marine energy generation.

The Marine Energy Pembrokeshire working group contains all wave and tidal developers who are interested in Welsh Territorial Water alongside Welsh Government, The Crown Estate, Pembrokeshire County Council, Welsh European Funding Office, Natural Resources Wales – Marine Licensing, Pembroke Port, RenewableUK, Marine Management Organisation, Anglesey Energy Island, the Energy Technology Institute, Offshore Catapult, Low Carbon Research Institute, Seacams, Innovate UK, Menter Mon and Wave Hub. The working group meets regularly in Cardiff to explore sector barriers, to share best practice and support development opportunities.

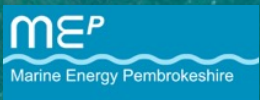
Sector support

Marine Energy Pembrokeshire provides a range of support to its members. Current work streams include promoting Welsh capability and attracting businesses to Wales; bespoke business advice; marine energy research coordination; developing UK collaborative partnerships; consenting guidance and recommendations; support and promotion of the Pembrokeshire Wave Demonstration Zone. Marine Energy Pembrokeshire has also hosted fully booked annual industry seminars since 2010 with targeted candidates attending from around the world.

Summary

This report has highlighted that the marine energy industry has already had a positive effect on the Low Carbon Economy in Wales providing green jobs and growth in a challenging economic climate. Technology and project developers have spent £34.5 million, helping to create over 174 person years of employment. The Welsh supply chain has been involved in this new sector at levels of almost 50% for tidal stream and 60% for wave energy.

Wales already has world class ports in close proximity to significant resource areas, transferable energy skills and relevant research facilities. With €100.4 million of EU Structural funding prioritising marine energy, increasing international interest, Welsh based marine energy developers and Demonstration Zones for both wave and tide, Wales is well placed to play a leading role in the worldwide marine energy sector.



Owned and operated by the Port of Milford Haven