Wave Tidal

ENERGY NETWORK

AUTUMN 2016 ISSUE 8 | £7.50

COMMUNICATION HUB FOR THE WAVE & TIDAL ENERGY INDUSTRY

WALES UPDATE

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SPOTLIGHT ON SCOTLAND

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Foras na Mara

A WELCOME CHANGE

We made the decision to join both our Energy Network magazines together for our last publications.

There was some concern that this may have not been wholly welcomed by our readership so we would like to let you know that everyone who we have met since, whether in person at events or by other means of communication have been nothing but positive.

The main positive reasoning given was that both wind and wave/tidal industries can now find out much more about each other simply by turning the joint magazine over and reading from there.

SUCCESS STORIES

We have also heard of companies in either sector getting in touch with their counterparts after finding out what their respective companies offer which means that collaborating companies grow and prosper.

Products and services can be different in the two sectors however we have found that many companies offer a very similar product or at least can adapt equipment or their offering to suit a particular challenge encountered.

NEW MAGAZINE FEATURE

We would therefore like to hear from any of the companies who have been collaborating across the sectors – we will then feature them in the magazine.

Please get in touch – remember genuine editorial is featured completely free of charge, without any conditions attached.

Duncan McGilvray
Editor | **Wave & Tidal Energy Network**

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SC Innovation

SKILLS BASE OF THE ENERGY INDUSTRY SUPPLY CHAIN CAN SUPPORT EMERGING SECTORS

NOF Energy's flagship exhibition and conference returns for its seventh-year in 2017 highlighting the diverse skills and expertise of the energy sector supply chain and the vital role it is playing in delivering a balanced energy mix.

ENERGY: A BALANCED FUTURE

Attracting industry executives and a diverse group of supply chain companies from the oil, gas, nuclear and offshore renewables sectors, Energy: A Balanced Future, which takes place on 7 and 8 March 2017, highlights future opportunities and challenges for the supply chain in UK and international markets.

NOF Energy, which is the UK's leading energy sector business development organisation, has championed diversification within the supply chain for more than a decade. It has successfully assisted its members with the transference of skills, technologies and competencies out of core sectors, such as oil & gas, into growing markets, including offshore wind.

NETWORKING OPPORTUNITIES

The conference and exhibition provides an ideal platform for suppliers to gain an understanding of prospects and requirements in emerging sectors through a strong line-up of industry speakers and networking opportunities.

Caroline Lofthouse, Business Development Manager at NOF Energy, said: *"We have always been at the forefront of sector developments at Energy: A Balanced Future, having discussed the future opportunities that will be presented by UK onshore gas for the last three years and, for the first time in 2016 focused on the inaugural tidal and Carbon Capture Storage projects planned for the UK.*

"2017 will be no different with sectors such as wave & tidal at the heart of discussions regarding offshore renewables opportunities."

EVENT RECEPTION

On the opening evening of the conference and exhibition, NOF Energy will host a networking reception for all delegates, speakers and exhibitors. Featuring food and drink from around the world, the networking reception is the ideal opportunity to meet existing and new contacts.

STRATEGIC PARTNER NETWORK

In addition to the opportunity to engage with around 450 energy sector professionals, delegates will be able to meet key decision makers including VIP guests and members of NOF Energy's Strategic Partner network.

The Strategic Partner network is made up of a group of operators, developers and main contractors from across the energy sectors, which are keen to access NOF Energy's membership to support their supply chain development programmes.

At the 2016 conference and exhibition, NOF Energy welcomed partners and VIP guests including WorleyParsons Europe, ODE, Amec Foster Wheeler, Lockheed Martin, WoodGroup Kenny, EDF Energy, GE Hitatchi PRISM, Babcock International Sellafield and Adwen Offshore.

EXHIBITION

Outside of the main conference hall, Sage Gateshead will be transformed into a vibrant and bustling exhibition hub featuring a broad cross-section of companies showcasing their products and services. The exhibition, which in 2016 included 70 companies, is one of the highlights of Energy: A Balanced Future and is open to delegates throughout the event.

Caroline added: *"The exhibition and conference is the ideal opportunity for companies looking to strengthen their position in the supply chain and take advantage of the inter-trading, relationship-building and partnering opportunities, which are consistently presented at Energy: A Balanced Future."*

NOF ENERGY

SCAN/CLICK
MORE INFO

OPTIMISING THE TIDAL LAGOON INDUSTRY

Tidetec AS, a Norway-based hydropower technology company, is displaying the new and innovative turbine turning mechanism prototype is now ready for sea water testing. ***"The technology displayed in Svelvik. Norway has the potential to disrupt the tidal turbine industry by optimising the economy in tidal energy projects."*** commented Arne Kollandsrud, Managing Director of Tidetec.

With this model prototype, the company demonstrates the feasibility of a perfectly optimised hydro turbine for bi-directional flow. This should be an eye opener for the classic turbine manufactures, like Alstom GE, Andritz Hydro and others who today use a classic Kaplan Bulb turbine in similar projects. The Tidetec solution significantly improves the efficiency of these type of turbines and thereby the economy of projected tidal lagoons or barriers.

The prototype is intended to simulate a large scale barrage or lagoon application for a low head hydro turbine. The turret will be tested in a tidal stream environment beginning next month. ***"The seawater tests will give us proof of concept and show that a turning classic low head hydro turbine can be the most efficient tidal lagoon or barrage turbine."*** explained Tidetec CTO, Joachim N. Amland.

UP TO 12% MORE POWER

The technology consists of a turret or turning mechanism, intended to house a hydro turbine. The turbine can be turned 180 degrees to get optimal efficiency of a hydro turbine in a tidal power plant. Most tidal power plants today generate power only in one direction. Projected plants with two-way production have sub-optimal production when the water flows backwards into the turbine.

EXPANDING MARKETS

This solution is aimed at the tidal range market with tidal barrages and lagoons. ***"We are very eager to see the conclusion of the Hendry Review, a UK governmental review of the Tidal Lagoon Scheme, to be concluded this Autumn. If the conclusion of this review is positive, it will kick off a large tidal lagoon industry in UK and open for exciting possibilities for Tidetec."***

FUTURE AMBITIONS

"Our next step is to provide our technology in a large scale project like Swansea Bay Tidal Lagoon or one of the next planned UK Tidal lagoon projects. To achieve this, we need to partner with one of the large turbine manufacturers aiming to win the tenders for these projects. Or possibly an industrial company, ready to disrupt the conservative hydro turbine industry" concluded Arne.

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MANAGING THE MOST EXTENSIVE TECHNOLOGY PROGRAMME OF ITS KIND IN THE WAVE ENERGY SECTOR

"By 2020 there will be wave energy devices that have come through our programme being deployed at the European Marine Energy Centre and they'll have the economics, reliability, costs and performance absolutely right," states Wave Energy Scotland (WES) Managing Director, Tim Hurst. *"This proof of concept technology will be attractive to investors and ready for commercialisation in partnership with large industrials and OEMs."*

It's a bold statement, but as Managing Director of WES, you'd expect Hurst to be confident about the likelihood of a commercially viable wave energy converter emerging onto the marketplace within a timescale that seems relatively short.

CONFIDENCE

Wave energy is, after all, a renewable energy sector still licking its wounds after the demise of some of its highest profile players. But Hurst and his team at the Scottish Government funded WES have good reason to feel confident.

Less than two years into the WES programme, which represents a collaborative, bottom-up rebuild of the route to commercialisation for wave technologies, real progress is being made.

From the outset, WES has focused on getting the basics right. Rather than merely plough public money into grants for high-risk device prototypes, the organisation has engaged in a far less glamorous subsystem focused procurement programme.

NUTS AND BOLTS STUFF

It's nuts and bolts stuff compared to the heady, hype-filled days of the past. For Hurst, it's the only way to approach the problem.

"Our aim is to support the development of systems and devices at different scales and methodically reduce the technical risks as they get closer to deployment at EMEC," he explains. "It's an approach you see in other industries, so why would we try to do something different?"

The WES annual budget is being carefully targeted through a competitive, pre-commercial procurement programme aimed at encouraging and supporting the most innovative solutions to the technical challenges facing the wave sector.

FUNDING STRUCTURE

WES' first call, for Power Take-Off systems in May 2015, sparked global interest and resulted in just over £6 million being awarded to 17 projects, led by Scottish developers and consortia, but including British, Belgian, Spanish, Italian and Swedish companies.

Of the ten projects that were at stage 1, four have just been announced as recipients for the next raft of funding, worth £2million.

WES' funding calls follow a standard pattern. They're first announced in the WES newsletter, with dates detailed closer to the launch via press and social media. WES also offers an opportunity to ask questions and hear about the call via an online webinar, with the chance to meet other interested parties at brokerage events. These are arranged online with B2Match, where participants can upload profiles and schedule meetings. The application process itself is through Public Contracts Scotland (PCS), a fully automated service where the specifications and other documentation are provided.

LATEST ANNOUNCEMENT

The latest announcement from WES brings the total investment by the organisation in wave energy technology development to £11.8 million across 39 projects in less than two years. In addition, the organisation is working to capture and document as much existing knowledge and information within the wave sector as possible to allow it to be shared with the next wave of innovators.

Tank testing Mocean's Novel Wave Energy Converter in the WES NWEC programme

COLLABORATION

According to Hurst, this collaboration is going to be increasingly vital if the industry is to realise its goals and unlock the full potential of wave energy. *"We're working with some 80 different organisations and consortiums and are particularly interested in technology transfer from other sectors,"* he says. *"By bringing in expertise from as many different fields as possible, we ensure a continual flow of fresh ideas and solutions."*

Hurst admits that the collegiate ethos of the WES model didn't initially win everyone over, with technology developers understandably concerned about the risks of sharing information and IP. *"There was quite a lot of reluctance at the start,"* he says. *"That was perhaps natural, but we're now seeing a lot more cooperation on the technology side, with device developers pairing up with subsystem and PTO providers. In turn, those pairings are marrying up with other organisations from outwith the sector, with people realising the benefits of not having to design everything themselves. It's something that we anticipate will become more and more prevalent as we move through the programme."*

GLOBAL LEAD

Despite the problems experienced in the past, Scotland is holding on to its global lead in the field of marine energy research and development, with the WES approach not going unnoticed internationally. Like their colleagues at EMEC in Orkney, the WES team are keen to facilitate the cross-fertilisation of ideas and creative solutions, to ensure Scotland maintains its centre of excellence reputation.

For example, a recent WES collaboration with the US Department of Energy has seen the wave energy community on both sides of the Atlantic deliver input on Wave Energy Converter system requirements and the formulation of performance metrics. *"Both organisations need to set targets for technology advancement and evaluate success for wave energy projects against established criteria,"* said Alison LaBonte, from the US Department of Energy. *"Collaborating on developing these metrics is not only helpful for funding agencies, but also the industry developers being asked to report to these metrics."*

NO ILLUSIONS

That kind of top-level international endorsement is encouraging for Hurst, but, whilst buoyant about the future, he is under no illusions about the scale of task ahead. *"We have to get the technology working, but we also have to make the case and demonstrate to people that that there is something here that's worth investing in,"* he says. *"We've set out a five year programme and at the end we will have a proof of concept device that shows wave power does work."*

Hurst concludes: *"It's not an easy thing to do, but ultimately, Scotland's wave energy resource is huge. It's a harder technical problem to crack, but the benefits are going to be greater if we do crack it, so it's worth that extra time and investment to get to that point."*

WAVE ENERGY SCOTLAND

SCAN/CLICK MORE INFO

SCAN/CLICK BROCHURE

SCAN/CLICK NEWSLETTER

RENEWABLE ENERGY STORAGE

A big opportunity in the North

Battery energy storage is a hot topic set to enable huge growth in Renewables. With a set of collaborative partners all in the North of the UK and fresh investment, AGM Batteries Ltd are making real headway in battery energy storage systems.

The company was originally set up in 1997 as a JV between AEA Technology (the UK owners of the original Li-ion patents), GS (GS-Yuasa) and Mitsubishi Materials and a very large Li-ion pilot plant was built in Scotland. The plant subsequently manufactured.

AGM's advanced Li-ion cells for defence and other specialist applications including automomous underwater vehicles used in the oil & gas industry. The business was acquired by the UKs AMTE Power in late 2013 and is now hard at work scaling up new battery technologies for production.

WORKING TOGETHER

Ian Whiting, Business Development Director & an AMTE Co-founder says that having worked together in battery R&D businesses, the founders knew it was difficult to bridge the gap between lab scale development & real world production. *"Not so many people know that Li-ion was invented in the UK or that the UK is still at the forefront of battery technology R&D. The issue has always been that there was simply nowhere to do the scale up to production. The AGM plant is well equipped and very flexible, allowing multiple chemistries to be produced to high quality standards, so we really couldn't miss the opportunity"* says Ian.

The range of product types is impressive with new variants of Li-ion, Na-ion and SuperCapacitor chemistries being produced. The company has also been successful in winning Collaborative funded projects that are helping bring the new technologies to market. They have two such projects targeted at high performance hybrid vehicles and electric vehicles with partners including Johnson-Matthey Battery Systems, Cosworth and others.

INCREASING INTEREST

In particular, the Na-ion technology is generating lots of interest for renewable energy storage, oil & gas, automotive and aerospace applications as it provides Li-ion performance but is safer and ultimately lower cost.

AGM has been pulling collaborative partnerships together for the last year and now have the basis of a complete supply chain for battery energy storage systems (cells, batteries, power conversion, control etc) suitable for wind, solar and tidal systems as well as smaller scale microgrids and residential energy storage.

AGM BATTERIES

REAL-TIME 3D SONAR OPERATION IN CABLE INSTALLATION PROJECTS

Cable installation for tidal projects is a challenging operation, with a continuous requirement to monitor the cable catenery (bend radius) and the cable position to ensure the cable is not damaged during installation and the cable as-laid position is accurately recorded.

The Coda Octopus Echoscope has been employed on three separate tidal construction projects and numerous windfarm construction projects to provide continuous real-time 3D imaging of the power cable during installation. The Echoscope is a unique 3D imaging sonar which generates an instant image of the subsea operation on the topsides PC. Use of the Echoscope significantly reduces the reliance on ROVs to monitor the cable touch-down and enables continuous working with no down-time due to low visibility conditions, thereby saving time and money.

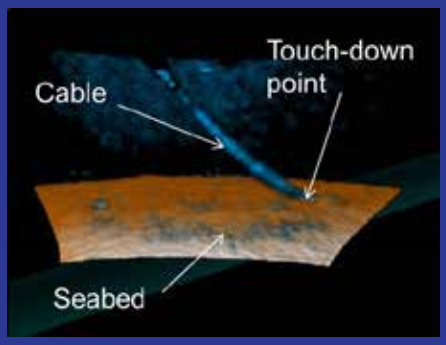


Fig 1 - Cable Visualisation using the Echoscope

2016 has proved to be a busy year for offshore renewable projects with the Echoscope supporting both tidal and offshore wind projects. Over the summer period the Echoscope has been used in three out the four UK offshore windfarm construction projects. Previous large projects have included Humber Gateway, Belle Isle and London Array.

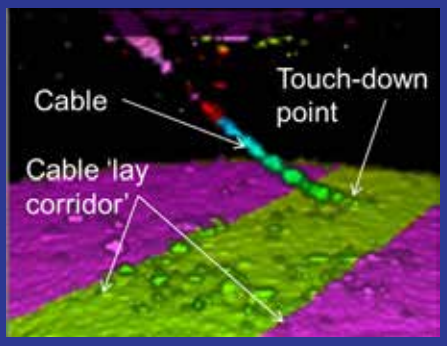


Fig 2 – Cable lay corridor visible with the cable data

In addition to monitoring the touch-down point, the Echoscope software Underwater Survey Explorer (USE) Models+ function can be used to insert a geo-referenced model of the cable lay corridor. This gives a continuous visual reference for the installation operator to confirm the cable is being laid within lateral positional tolerances on the sea-bed, reducing the chance of expensive re-work.

The Echoscope operator can record the cable touch-down point as the cable is laid. The accuracy of this record has been confirmed by subsequent ROV surveys, again saving money on the requirement for as-laid survey. The as-laid position can be output to 3rd party navigation packages such as QINSy, EIVA and Winfrog for display on the navigation screen.

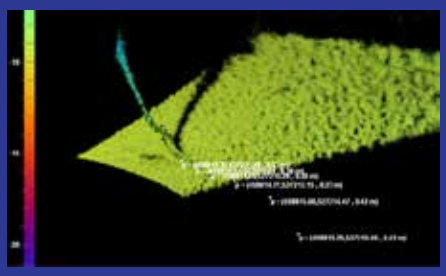


Fig 3 – Cable touch-down point recorded during the cable installation

The Echoscope was successfully used by LD Travocean in the installation of a hybrid electrical/fibre-optic cable between Quiberon and Belle. The 150mm diameter cable touch-down point was continuously monitored and recorded in water depths up to 35m.

On completion of the installation, the Echoscope was used to complete an as-laid bathymetric survey, removing the need for a separate multi-beam survey thus saving the operator time and money. The image below shows the cable lying on the sand-waves of the seabed.

Fig 4 – As-laid bathymetric survey of laid cable

CODA OCTOPUS

SCOTLAND – THE MARINE ENERGY SUCCESS STORY

As the natural home of marine energy, the Highlands and Islands again hosted the Scottish Renewables' Marine Conference in Inverness in September, which served to demonstrate further the continuing advances being made by the industry. In this past year there have been several landmark achievements in Scotland, bringing innovation, investment and jobs.

MEYGEN PROJECT

First Minister Nicola Sturgeon, officially unveiled the £51 million MeyGen project in September, the largest tidal stream energy development in the world, with the first turbine now ready for installation. Following final assembly at Nigg Energy Park, it will be installed in the Pentland Firth this Autumn. With plans to grow out to 398MW in the next decade, it is expected to produce enough electricity to power 175,000 homes. This project will cement Scotland's reputation as a world leader and is predicted to generate £275 million for the nation's economy.

CENTRES OF MARINE ENERGY INNOVATION AND EXCELLENCE

Orkney and Shetland are also firmly established as centres of marine energy innovation and excellence. Orkney, already renowned for marine energy being host to EMEC, is now supporting a testing programme for the world's largest tidal turbine by Scotrenewables.

EMEC will also accommodate its 26th and 27th devices this year including SME's PLAT-O. In Shetland, Nova Innovation Ltd successfully commissioned its second of three 100kW turbines at the Bluemull Sound, becoming the world's first fully operational grid-connected offshore tidal array. Off the west coast, niche opportunities for the wave sector are successful being developed by Albatern through collaboration with the aquaculture sector.

INTERNATIONALLY RECOGNISED

Audrey MacIver, Head of Energy at Highlands and Islands Enterprise, believes: *"The Highlands and Islands region is home to some of Europe's best wind, wave & tidal resources and is internationally recognised for the advancement of offshore renewable technologies.*

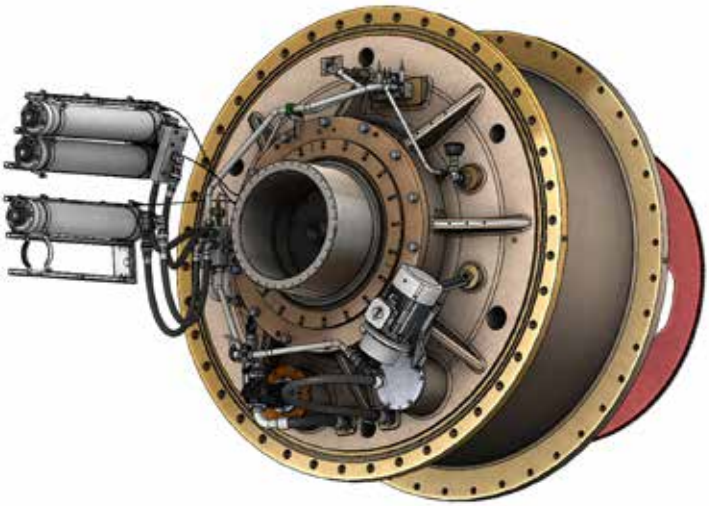
"We are determined to continue harnessing our unrivalled natural resources across the region. The industry is committed to working together to provide opportunities for the local supply chain and to increase levels of innovation and development, there is a lot to be excited about, both in the short and long term within the marine energy industry."

HIGHLANDS AND ISLANDS ENTERPRISE

ENGINEERING SUCCESS

We introduce Parker Hannifin a Fortune 250 global leader in motion and control technologies. For 100 years the company has engineered the success of its customers in the mobile, industrial and aerospace markets.

They now bring that engineering expertise to the ocean power market again. We hope you enjoy reading about a specific tidal turbine and its foreseen benefits to the industry.



THE ATLANTIS TIDAL TURBINE AR1500

The ocean power market and specifically the tidal energy market segment is one of the most promising emerging renewable energy segments and in contradiction to the leading and more well-known renewable energy sources of wind and solar power, tidal power has the quality of widespread predictability!

VARYING ENERGY TECHNOLOGIES

An unusual aspect of ocean energy is the approach of the market's technology developers to capture the power of the ocean – there is not, as yet, a standard approach as we see in the mainstream wind and solar industries. Some technology developers are aiming to convert wave motion into electrical power and connect to the grid, where others are looking to supply off-grid smaller amounts of electrical power. Yet more are using the water's movement to pump sea water back to shore for water processing purposes (reverse osmosis for drinking water).

The tidal segment of the ocean power industry, because of its predictability, is actually ideal to provide electrical power to the grid. However, even here we see numerous approaches and device designs being utilised to accomplish this.

COMMON FACTORS

Three common factors across the tidal power industry projects are the need for financial investment, the massive dedication by the technology developers needed to bring the technology to prototype phase and the milestone of launching a full scale device into the water.

This milestone is now imminent with the launch one of the industry's leading technology developers with their latest tidal turbine, the Atlantis Resource's AR1500 tidal turbine!

In the footsteps of the AR1000, the new AR1500 turbine is a 3 bladed, seabed mounted device with a rated capacity of 1.5MW at 3.0 m/s tidal flow. It is designed to withstand the extreme environmental conditions expected in the Pentland Firth in Scotland and the Bay of Fundy in Canada, where Atlantis Resources are planning its deployment.

TURBINE FEATURES

This new turbine, as Atlantis Resources proudly state, has some interesting new design features such as:

- Variable pitch rotor blades, to allow maximum energy capture
- Integrated gearbox and bearing-less permanent magnet generator
- Fast deployment and connection system; nacelle deployment less than 90 minutes
- 360 degree yaw capacity and survival lock system
- Multiple, fully redundant electrical systems for long term subsea operation

PARKER'S INVOLVEMENT

It is with three of these design features that Parker has had close involvement: the design and build of the variable pitch system, the yaw drive and the lubrication oil filtration system on the gearbox. The image of the gearbox with the oil lubrication system attached, accompanying this article, represents just one of the areas of Parker's involvement.

In the next issue, we will go into the details of the design and build phase of the turbine, which, as you will read, is a good example of a truly global project with strong industrial players.

CALUM MCCONNELL
GLOBAL BUSINESS DEVELOPMENT MANAGER - RENEWABLE ENERGY
PARKER HANNIFIN

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SCAN/CLICK RESOURCE GUIDE

MAKING A NOISE FOR SCOTLAND – A MARINE ENERGY HUB FOR INTERNATIONAL COLLABORATION

Scientists from the Scottish Association for Marine Science (SAMS) recently attended the Scottish Renewables Marine Conference in Inverness to report on activities within the MERIKA project (Marine Energy Research Innovation and Knowledge Accelerator).

COLLABORATION

SAMS were accompanied by their collaborators in the £3.3million EU FP7-funded project, including three colleges of the University of the Highlands and Islands (UHI) and seven European partners. MERIKA aims to build research capacity, upgrade infrastructure, and reinforce international collaboration with stakeholders across the marine energy sector.

MEYGEN PROJECT

MERIKA Research Fellow in Marine Planning and Renewable Energy at SAMS, Lucy Greenhill presented at the event on the organisation's contribution to the project so far. A key highlight was the work of acoustic ecologist Dr Denise Risch, who has been recording underwater noise at the site of the world's largest tidal stream project; Meygen. The Meygen project is currently under construction and is set to deliver tidal power to Scotland later this year.

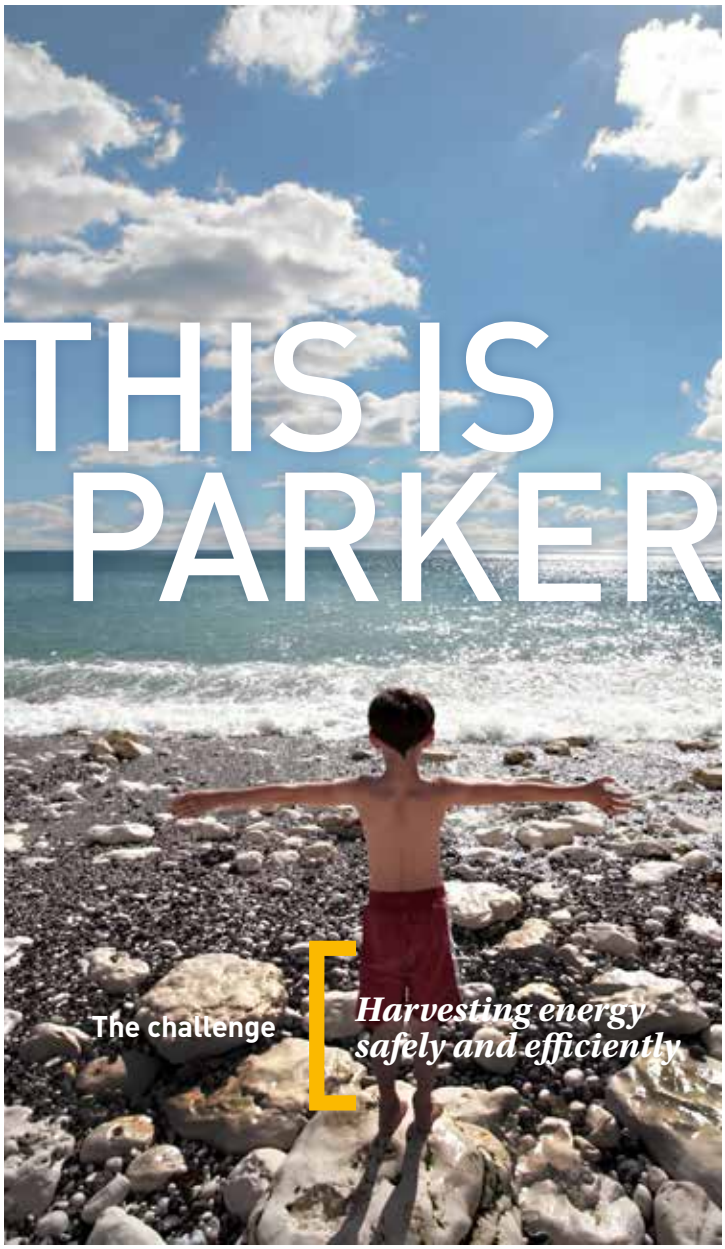
FIELD TRIPS

Dr Risch led a team of SAMS scientists on three field trips to the Pentland Firth, deploying floating hydrophones ('Drifting Ears') to measure ambient noise levels at the site where, in October 2016, the first four tidal turbines will be deployed by Meygen. Noise assessment prior to turbine deployment is necessary for assessing how the environment has changed and the implications for animals using this habitat once the turbines have been deployed.

INDUSTRY BENEFITS

MERIKA project outputs from the Meygen site surveys include evaluating the implications of underwater noise caused by operational tidal turbines. This is of critical benefit to the wider industry, through reducing uncertainty and easing consenting in future projects. MERIKA is set to conclude in July 2017, having developed marine energy research and innovation in the Highlands and Islands of Scotland.

SCOTTISH ASSOCIATION FOR MARINE SCIENCE



Partnering with Parker in the development of tidal energy technologies provides the security of long maintenance free working lives. Our dependable product solutions reflect Parker's commitment to the tidal energy industry and to solving the world's greatest engineering challenges.

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FOCUSING ON SPECIFIC CHALLENGES AND POTENTIAL AREAS OF INVESTIGATION

Tidal power has traditionally suffered from relatively high cost and limited availability of sites with sufficiently high tidal ranges or flow velocities, thus constricting its total availability.

However, many recent technological developments and improvements (most of which qualified for R&D tax relief), both in design (e.g. dynamic tidal power, tidal lagoons) and turbine technology (e.g. new axial turbines, cross flow turbines), indicate that the total availability of tidal power may be much higher than previously assumed and that economic and environmental costs may be brought down to competitive levels.

WAVE & TIDAL POWER

Wave power is of course, distinct from the diurnal flux of tidal power and the steady gyre of ocean currents, but both wave & tidal power generation encompass a range of more specialised sub-disciplines, each with a more specific emphasis on certain fields of application and particular areas of technology.

These include mechanical engineering, electrical engineering, electronic engineering, instrumentation, control and automation (ICA), civil engineering, materials science and more. The eligibility for R&D tax credits in the wave & tidal sector is huge.

SPECIFIC CHALLENGES FACING THE INDUSTRY…

- Commercial viability – low cost technological solutions required
- Minimising corrosion
- Increasing the device's flexibility of operation for improved efficiency
- Increasing durability and performance of drive trains for more efficient electrical energy conversion
- Innovative solutions to increase the reliability of transmission cabling
- Improve the effectiveness and reduce the cost of cable protection
- Improved installation techniques (and the safe range of working conditions)
- Improved condition monitoring techniques
- Lessening the environmental impact on marine life (and the impact of marine life on hardware)

POTENTIAL AREAS OF INVESTIGATION…

- The design, manufacture and testing of prototypes
- Issues associated with scalability: e.g. increasing size from prototype to 'first-in-class'
- Improvements manufacturing processes - introducing effective design for manufacturability (DFM) in order to facilitate the manufacturing process
- Improvements to material properties, such as increase in yield or tensile strength, increase in toughness, corrosion resistance and resistance to fatigue
- Developing accurate computer models to evaluate stresses and strains, or fluid flow
- Introducing effective failure modes and effects analysis (FMEA), for identifying all possible failures in the design, manufacturing or assembly process, alongside improved methods of physical testing of designs, e.g. non-destructive testing techniques
- The integration of components, machinery and / or processes, advancing the technology to 'above industry' standards

TESTIMONIAL

Matthew Finn, Senior Business Development Manager at the European Marine Energy Centre (EMEC) recently commented on Jumpstart who have submitted this informative article…

"The R&D claim process was completely new to us and our position was complicated due to a variety of external funding streams used to support our research activities.

"However Jumpstart's clear understanding of the scheme and how to apply it made the whole process relatively straightforward.

"They provided exceptional customer service with their Technical Analysts travelling up to our site in Orkney for the face-to-face meetings and they were able to provide sound technical insight into our projects, securing successful submissions to HMRC."

Jumpstart are R&D tax relief specialists and have been helping businesses in the wave & tidal energy sector claim the tax credits they deserve for the last 8 years.

JUMPSTART

DEVELOPING FLOATING TIDAL TECHNOLOGY

Scotrenewables Tidal Power was founded in Orkney in 2002 to develop its floating tidal technology. Its ambition was to deliver a multi-MW utility scale turbine but with an installation and maintenance strategy executed solely with low cost, locally based vessels. This approach would minimise cost and risk at all stages of the project lifecycle and ensure local economic benefits throughout the operation of array projects.

FLOATING TIDAL GENERATING PLATFORM

To this end, the company developed a floating tidal generating platform. The floating design, with retractable turbine blades, allows the turbine to be towed to and from site with modest sized workboats. Most of the turbine's power conversion equipment is located within the floating hull itself and can therefore be accessed for maintenance using a small crew transfer vessel.

The technology has now been tested at more than 10 increasing scales. This summer, the company launched its first commercial scale turbine, the SR2000. Rated at 2 MW, it is the most powerful tidal turbine in the world to date and could supply the electricity needs of up to 1000 homes. The turbine is undergoing final checks ahead of installation at the European Marine Energy Centre, Orkney for a test programme of up to four years.

TECHNOLOGY DEVELOPMENT SUPPORT

Technology development to date has been supported by investment from Total, ABB, Fred. Olsen Group, DP Energy and the Scottish Government through the Renewable Energy Investment Fund. The SR2000 project has also received support from Scottish Enterprise's WATER2 fund for marine energy devices and HIE.

Earlier this year, the company led a consortium of key suppliers and development partners to secure a €9.8m European grant towards commercialisation of its technology through the Horizon2020 research support programme. The 'FloTEC' project will deliver a number of cost reduction innovations in areas such as power conversion and energy capture.

Scotrenewables hopes that its technology will deliver a step change cost reduction to the entire tidal energy sector and be a key enabling low carbon technology.

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EMEC UPDATE

New technology deployments, innovative research projects, and the development of a pioneering energy storage system are just some of the exciting developments that are taking place at the European Marine Energy Centre (EMEC).

NEW TIDAL TECHNOLOGIES

Building on the 25 wave and tidal energy devices that have already tested at EMEC, the world-leading centre has welcomed two new tidal technologies to Orkney this year.

Sustainable Marine Energy's PLATO tidal platform, complete with two SCHOTTEL SIT turbines, arrived in Orkney in March 2016 and Scotrenewables towed their 2MW floating tidal energy converter – the SR2000 – from Harland and Wolff in Belfast to Orkney in June. Both companies are gearing up to install their technologies at EMEC's Fall of Warness tidal test site later in the year, where they will join OpenHydro who continue to test their 7th generation tidal turbine in their test rig.

Preparations are also underway for 2017 deployments with new clients Tocardo planning to demonstrate a 20-year pre-commercial array at the Fall of Warness, and CorPower and Laminaria signed up to test at EMEC's wave test sites.

INDUSTRY STEP CHANGE

"There are a lot of new ideas out there and it's great to see the next generation of wave and tidal energy technologies making their way to our test sites." explains Eileen Linklater, Client Relations Manager at EMEC. *"We've witnessed a step change in the industry over the last couple of years, and that's led to some really exciting opportunities for EMEC. Having worked closely with developers on various funding proposals, we're now involved in projects supporting technology development from concept to real sea demonstration and ultimately, to commercialisation."*

For example, EMEC is supporting the coordination of LAMWEC, an OCEANERA-NET funded project looking to prove the survivability of the Laminaria wave energy converter. EMEC is leading the performance assessment and dissemination work packages. Another OCEANERA-NET project – RiaSoR (Reliability in a Sea of Risk) – is nearing completion with the development of a methodology to improve reliability in marine energy converters.

NEW FUNDING PROGRAMME

EMEC has also launched a new funding programme - FORESEA (Funding Ocean Renewable Energy through Strategic European Action) - to provide ocean energy technologies free access to North-West Europe's network of test centres: EMEC (Scotland); SmartBay (Ireland); SEM-REV (France); and the Tidal Testing Centre (the Netherlands). The second call for applications is due to be launched in later this year.

PIONEERING PROJECT

Beyond device testing, site works are well underway at EMEC's Caldale substation in Eday, awaiting the imminent arrival of its 0.5MW electrolyser which will be used to convert tidal energy into hydrogen in a pioneering project looking to overcome grid and energy storage issues facing the renewables sector.

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TEAM RENTAL GEO 3D MOTION

LEARNING FROM THE WIND INDUSTRY

We met up with Chris Marchant, Head of Cables & Offshore Development responsible for subsea cables and renewable energy at Intertek, a global supply chain services company specialising in advisory, testing, inspection and certification services.

Intertek provides technical and risk-based services for many bluechip companies and organisations including renewable energy developers. The consultancy business positions itself as advisory to the asset owner, developer and investor but this does not preclude support for the contractor where appropriate.

PROFESSIONAL BACKGROUND

Chris is an Electrical Engineer by profession, a Chartered Engineer and a member of the Institution of Engineering & Technology. Following graduation from Loughborough University of Technology, he started his career at the CEGB (Central Electricity Generating Board) where he joined the Electrical Section of the Drax FGD Project Management Team. This 6 year £600m retrofit project on the largest coal-fired station in Northern Europe was the first desulphurisation plant to be constructed in the U.K. Those were the days before public fear of carbon dioxide emissions when the effects of 'acid rain' on native forests were the primary driver behind the E.U. large combustion plants directive.

EARLY MAJOR PROJECT EXPERIENCE

To gain hands-on experience on such a major project just after graduating with an engineering degree was important for Chris and remains a key feature of professional development that he strives to replicate for all new recruits to the industry.

Fortunately for his team at Intertek, the mix of work available provides them direct exposure to large-scale, big budget, infrastructure projects such as offshore windfarms and submarine cable interconnectors. Intertek's activities range from feasibility studies, planning and site investigations to design, technical specification, procurement and project management. Working with flexible resources from Intertek's network of Associates, project activities also extend into factory inspection, offshore supervision and commissioning.

WAVE & TIDAL

Intertek's involvement in wave & tidal to date has focussed largely on the conceptual design and modelling support for environmental impact assessments in the UK, including the proposed Swansea Bay Tidal Lagoon and Ramsey Sound projects, both located in Wales.

Intertek was previously involved in an early tidal stream resource assessment, which employed a very basic analysis of hot spots for development covering a vast range of areas. The team is now developing a much more comprehensive modelling support tool that not only examines the maximum tidal stream energy in an area, but also scrutinises the practical aspects of suitability for the deployment of energy capturing devices based on other parameters, such as water depth, seabed slope and distance offshore.

INDUSTRY VIEWS

When asked about where he saw the wave & tidal industry at the moment Chris likened it to where the offshore wind industry found itself about fifteen years ago, when the first commercial-scale offshore wind projects using horizontal axis three blade turbine generators were just entering service in Northern Europe against a backdrop of regulatory uncertainty that threatened to

choke off the investment necessary to ever achieve economies of scale.

Chris highlighted that Intertek's track record in the UK offshore wind includes involvement in most, if not all, of the licensed zones. He affirms that expertise delivered to many of the earlier offshore wind projects contributed to making available the wealth of knowledge of offshore industry practice, but at a cost that was affordable to the nascent industry.

The offshore wind industry has now industrialised and is challenging all expectations in its ability to commit to new projects at ever lower unit cost. To the offshore wind industry, an end to subsidies is not the existential threat that it once was.

Whether wave & tidal can maintain its balance on the 'technology readiness/ economies of scale' tightrope remains to be seen but there are encouraging signs emerging from the demonstration projects already underway that commercially viability is within reach. Intertek is able to support this anticipated growth using optimisation tools and assessment methods backed by the latest research in marine science and mathematical modelling.

FUTURE

A further theme for the company in the future is asset management support during the operations and maintenance phase of offshore infrastructure. The emergence of financial investors owning such assets heightens the need for technical expertise to manage assets safely and reliably. Intertek has the technical capabilities and experience to be that partner, given their understanding of the issues surrounding this industry, which will ultimately help to protect those assets.

INTERTEK

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DUNCAN MCGILVRAY
EDITOR
WAVE & TIDAL ENERGY NETWORK

"6 YEAR £600M RETROFIT PROJECT ON THE LARGEST COAL-FIRED STATION IN NORTHERN EUROPE"

Llywodraeth Cymru
Welsh Government

WELSH GOVERNMENT BUSINESS SUPPORT

In the final instalment from the Welsh Government in the series of features on the Wave & Tidal industry in Wales, we will be looking at some of the ways the Welsh Government helps businesses who are investing in projects in Wales.

Many of the Welsh projects featured in the last three issues have benefited from support from the Welsh Government. Support has been offered to these businesses in a number of areas including…

- Finance
- Skills and Training
- Starting up
- Innovation
- Marketing
- ICT

REASONING

The drivers behind why the Welsh Government offers this kind of support are very simple. Strong, innovative and competitive businesses are essential for the economy of Wales, therefore, they are a pro-business government, working closely with companies to create growth and jobs in every part of Wales. Their aims are to achieve balanced and sustainable growth, to attract inward investment and to increase employment.

FEATURE HIGHLIGHTS

In this feature we will be looking at an exciting new project from Wave-tricity. 'The Ocean Rower' which has just secured £4m worth of support from the Welsh European Funding Office, on the subject of EU funds we will be showcasing a couple of innovative new EU backed schemes to support the manufacturing sector and circular economy in Wales.

> "STRONG, INNOVATIVE AND COMPETITIVE BUSINESSES ARE ESSENTIAL FOR THE ECONOMY OF WALES"

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OCEAN ENERGY EUROPE

And finally, in November the Welsh Government will be attending Ocean Energy Europe which this year is being held in Brussels. They will be showcasing some of the best Marine Energy related businesses and working alongside their Trade Team, they will be undertaking a programme of targeted business development activities to attract potential new customers to Wales.

As you can see – Wales is open for business.

WELSH GOVERNMENT

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£4 MILLION FUNDING AWARD

Wave-tricity Ltd recently announced that it has secured a £4 million funding package from The Welsh European Funding Office under the European Regional Development Fund for West Wales and the Valleys Operational Programme.

COMMERCIALLY VIABLE DEVELOPMENT

Wave-tricity Ltd is an innovative wave energy development company with a mission to develop a commercially viable, real world, wave energy convertor. In an area that is gathering more and more momentum, the company is looking to grow and advance its technology and operations in Pembroke Dock. This exciting move will add to the body of marine energy expertise that is growing in the region with the support of the Welsh Government and European funding.

KEY MILESTONE

Matthew Fairclough-Kay, Wave-tricity's Managing Director said, *"This announcement marks a key milestone for the company. Everyone on the Wave-tricity team is looking forward to starting operations in Pembrokeshire and to bringing the prospect of clean wave energy a step closer to commercial success.*

"The support of the Welsh Government demonstrates a clear commitment to sustainable economic growth. This, allied to a strong base of local expertise, signals a bright future for marine energy in Wales. It's great to be on board."

The funding, which is matched by a substantial investment by Wave-tricity, will enable the Company to continue development of its robust, low maintenance, wave energy conversion technology. This will see the realisation of a device that can produce clean electricity for all from an endless resource and will underpin a wide range of product capabilities.

OPERATION SET UP

Over the coming weeks, Wave-tricity will be setting up operations in the Royal Dockyard at Pembroke Dock where they will be testing and developing their technology both ashore and afloat in the Haven Waterways. The company has already made excellent links with both public and commercial organisations in the area and is looking forward to building upon these relationships and bringing significant financial and knowledge investment into the area.

RECRUITMENT

The move will also bring new jobs. Wave-tricity is looking to increase their team and bring local talent into the mix. The recruitment drive will seek to fill a range of full time roles based in Pembroke Dock, with required skills ranging across engineering and operations disciplines.

EXCITING TIMES

These are exciting times for Wave-tricity and offshore renewable energy in Wales. The new Wave-tricity website is being developed now and you can follow the company on Twitter. Keep in touch to track development, as well as business and employment opportunities.

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EU-BACKED INITIATIVE TO BOOST MANUFACTURING IN WALES

A £14.7m EU-backed initiative to maximise world-class research expertise within Welsh universities to help boost Wales' manufacturing industry was announced recently by Finance Secretary Mark Drakeford.

INDUSTRY COLLABORATION

ASTUTE 2020, backed by £10m from the European Regional Development Fund and £4.7m from participating universities, will see a team of world-class academics and highly-qualified technical experts collaborate with industry to tackle a series of manufacturing challenges to develop sustainable, higher-value goods and services for the global market.

These collaborations will be designed to meet industry needs with experts helping businesses develop cutting-edge research and apply advanced engineering technologies to drive productivity and growth.

SUPPORT

Led by Swansea University alongside Cardiff, Aberystwyth and the University of Wales Trinity Saint David, the project will support a diverse range of companies across North and West Wales and the South Wales Valleys, from automotive and aerospace to medical engineering.

Professor Drakeford commented: *"I'm delighted EU funds are helping Welsh businesses to improve their productivity by exploiting the expertise in our academic institutions and adopting leading-edge technologies to achieve commercial success and economic growth.*

"This is yet another example of the importance of EU funds for our economy. Our priority is to get the best deal for Wales in the forthcoming negotiations over the terms of the UK's exit from the EU. This includes safeguarding all the funding to which Wales has access.

We must also ensure Wales continues to benefit from investment in regional economic development beyond our EU membership so businesses and communities receive the support they need."

IMPROVING BUSINESS AND OPPORTUNITIES

Collaborations through ASTUTE 2020 are expected to see businesses improving their manufacturing methods and performance of a variety of goods, such as medical blood pumps, wind turbines and aerospace components.

Professor Johann Sienz, ASTUTE 2020 Project Director, concluded: *"We are delighted to receive EU funds for ASTUTE 2020, which will focus its resources on working collaboratively with industry to provide support in areas which offer the best economic opportunities for the manufacturing industry to improve economic prosperity."*

ASTUTE 2020

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SUPPORTIVE PEMBROKESHIRE

Any business needs a highly supportive environment if it is to innovate. Pembrokeshire provides that level of support for the marine energy sector.

Pembrokeshire has vast experience of the energy sector with the county first having been identified by the oil industry because of the natural deep water port of Milford Haven. Over the years the oil industry's involvement saw a sophisticated supply chain develop; on the land side with a range of specialist engineering services and on the marine side a range of services developed around the port, from boat builders to experienced crews for tugs and workboats.

In the last twelve years the oil industry has been joined by gas in the form of LNG (Liquefied Natural Gas). As gas liquefied at -160C the local engineers gained experience working with specialist materials that retain their strengths at these low temperatures, this complements their skills on working with high pressure and temperature technologies.

MOVING ON

A little over ten years ago Pembrokeshire County Council began to support and promote the county and its seas for marine energy and before the formation of Marine Energy Pembrokeshire the County Council organised the first few marine energy conferences in the County.
As marine energy technology developers showed a growing interest in the tidal and wave conditions around South West Wales the Welsh Government joined forces with the County Council and the Port of Milford Haven to sponsor Marine Energy Pembrokeshire. As a result of this initiative companies can now get highly specialist support and advice from Marine Energy Pembrokeshire, whilst the County Council and others supports both technology developers and the ever developing supply chain.

HAVEN WATERWAY ENTERPRISE ZONE

Much of this work is fronted by the Haven Waterway Enterprise Zone, where Pembrokeshire County Council, in partnership with Welsh Government, Business Wales and others organise Breakfast meetings where one or two speakers share thoughts with the audience. Subjects covered to date include marine energy projects, Egnedol's Blackbridge biomass project, high speed rail and rail electrification, nuclear projects, co-operative working and various certification and skills updates.

BRIDGE INNOVATION CENTRE

Another part of the support package is the Bridge Innovation Centre. Owned and managed by Pembrokeshire County Council the 'BIC' as it is affectionately known to locals offers office and workshop space for innovative businesses. And, in addition to meeting facilities, hot desks etc. the BIC also offers a FABLAB where companies and individuals can experiment with CAD and 3D printing equipment. This is an ideal facility for rapid prototyping where ideas can become reality in a very short space of time and concepts tested and modified to make them practical.

TRAINING

Training and skills development is also vital and in this area Pembrokeshire College as well as private training contractors offer a wide range of courses and Pembrokeshire - trained engineers are widely recognised throughout the energy sector.

PORT OF MILFORD HAVEN

The Port of Milford Haven is the vital heart of the Pembrokeshire Energy industry. The key is having unrestricted deep water access at all states of the tide. This enables the port to handle the largest oil & gas tankers afloat, thus in turn demands the very best support services with tugs, workboats, boat builders and marine engineers all being locally available.

SWANSEA BAY CITY REGION

Pembrokeshire is also a part of the Swansea Bay City Region, where technology innovation is encouraged and supported with Swansea University playing a key role.

COMPREHENSIVE PACKAGE

All these players combine to provide a comprehensive package of support that can be tailored to suit the needs of individual businesses as they develop their technologies and move into test and demonstration phases.

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PEMBROKESHIRE COUNCIL

The Port of Milford Haven is the UK's largest energy port and a champion of the region's emergent marine energy sector.

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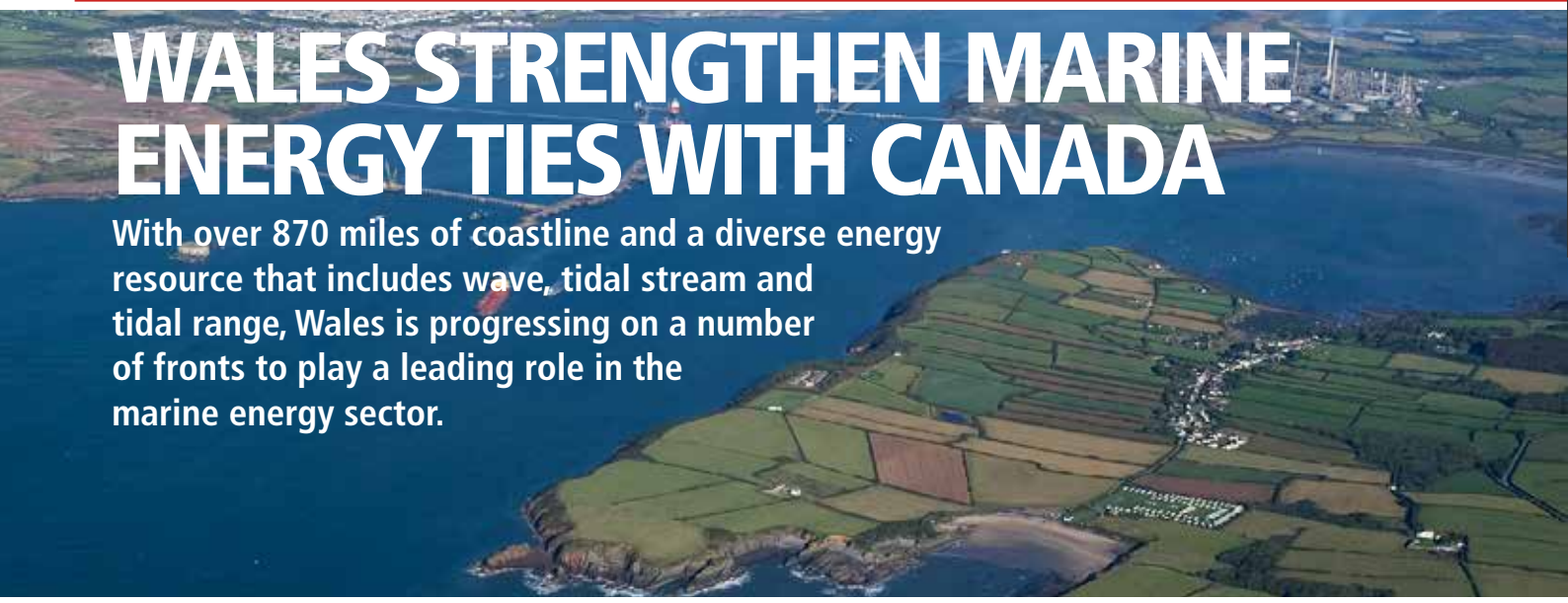

With over 870 miles of coastline and a diverse energy resource that includes wave, tidal stream and tidal range, Wales is progressing on a number of fronts to play a leading role in the marine energy sector.

This resource along with its ports, supply chain and grid connection possibilities have attracted a number of international developers who are also exploring the opportunity of tapping into the €100.4 million of structural funding prioritised for marine energy in Wales.

COMPANIES BENEFITING

Companies that have already benefited from this funding include Marine Power Systems, Minesto and Wave-tricity and this will see them build, deploy and test their devices in Wales. Wales has the second highest tidal range in the world and plans are in place to utilise this, with Tidal Lagoon Power developing the world's first tidal lagoon power plant in Swansea. Work is also progressing on the two array scale Demonstration Zones designated by The Crown Estate, a wave energy site off Pembrokeshire and a tidal stream site off Anglesey.

CANADA

Another country also making positive steps to create a strong, sustainable industry of its own is Canada, which is home to FORCE - a grid-connected test site with 64 MW capacity. There is significant wave, tidal and river current resources across the country and several developers have targeted the Bay of Fundy as a site for development. Global tidal energy leaders such as OpenHydro, DP Energy, Atlantis Resources, SCHOTTEL and Tocardo are planning on deploying devices there over the next few years.

COLLABORATION

Much of the development in these two nations can be put down to the hard work and dedication of two not-for-profit partnership organisations - Marine Energy Pembrokeshire and Marine Renewables Canada. They have recently signed an agreement to share knowledge and collaboratively support the development of marine energy industry globally.

COMMITMENT

The two organisations have been key drivers for marine energy in their respective nations and have many of the same aims and objectives. This agreement demonstrates the commitment to a worldwide marine energy industry and the economic and low carbon opportunities associated with the emerging sector. Perhaps most importantly, it marks an important step towards positive collaboration between the two nations, by sharing lessons learned and benefiting from each other's experience.

BENEFITS MOVING FORWARD

On this relationship David Jones, Project Director of Marine Energy Pembrokeshire commented: *"The ultimate goal is to create a new low carbon global industry, where skills and knowledge are exportable worldwide. With significant progress being made by Morlais on the tidal Demonstration Zone off Anglesey, Tidal Energy Ltd's deployment in Pembrokeshire and a number of upcoming wave projects, Wales is developing those skills. Collaborating with Marine Renewables Canada and sharing experiences will be a real benefit moving forward."*

Although divided by the Atlantic Ocean, Canada and Wales share many common qualities and this new collaborative approach will aim to build on the work that has already been accomplished by each.

Elisa Obermann, Executive Director of Marine Renewables Canada concluded: *"As a new industry, marine renewable energy still faces many challenges – not just in Canada, but across the globe. By working together, Marine Renewables Canada and Marine Energy Pembrokeshire can help industry collaborate on key issues, build partnerships and share information that will support advancement of the global industry."*

MARINE ENERGY PEMBROKESHIRE

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> "THE FUND IS A NON-REPAYABLE GRANT FUND AND WILL SUPPORT WELSH BUSINESSES"

GROWTH AND PROSPERITY FUND

The Welsh Government has formally launched £5 million Growth and Prosperity Funding to support SMEs in Wales to create and safeguard jobs.

The fund is a non-repayable grant fund and will support Welsh businesses to grow and increase employment and will prioritise those who are seeking to start or increase exporting and exploiting superfast broadband.

THE FUND IS AVAILABLE IN 2 PHASES...

PHASE 1

- First element of the fund (£2 million) will be available for smaller projects between September 2016 and March 2017. Eligible costs are capital costs
- Applications must be completed and received by the 30 January 2017 and clients must have purchased and paid for the asset in full by 31 March 2017
- Companies will receive up to 50% match funding between £5,000 and £50,000 with this being the maximum amount of support

PHASE 2

- Businesses applying for this second element of funding (£3 million) will need to show they will be able to raise the majority of funding from the private sector and projects will need to be complete by March 2018
- Expression of interest for the larger fund was accepted up to 17 October 2016 when projects representing the best value for money were invited to apply for funding
- Businesses which have been invited to full application stage will be required to submit these by 16 January 2017
- Companies will receive between £50,000 and £500,000 with this being the maximum amount of support

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GROWTH FUND

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MAKING THINGS WORK IN HOSTILE ENVIRONMENTS

At the heart of SC Innovation's culture is the determination to solve engineering problems in challenging and hostile environments. SC Innovation is part of Devon based SC Group, which was formerly known as Supacat.

The company started out in the 1980s as a small specialist engineering company developing rugged all-terrain vehicles and last year launched as the new brand for delivering engineering solutions to the renewable energy, marine and specialist vehicles sectors.

As the company grew, so its sector experience and technical versatility had expanded. Today two of its 6x6 high mobility transport vehicles have been chosen by the Bloodhound SCC team as the support vehicles in its World Land Speed Record attempt across a South African desert.

SOLVING ENGINEERING CHALLENGES

Solving engineering challenges to keep equipment and systems operating under the most extreme physical conditions has a wide application. The transition into offshore came via a near shore project for the RNLI. In 2005 the company was invited to collaborate with the RNLI's own engineering team to develop an all-terrain transport solution to launch and recover its new Shannon Class lifeboat over Britain's most demanding beaches.

The resulting launch & recovery system developed the company's marine environment expertise, which it offers to customers and partners facing engineering challenges in the offshore wind, wave & tidal energy sectors.

AGILE OEM ABLE TO SCALE UP OR DOWN

Employing 200 employees and powered by a 40 strong engineering team, SC Innovation is a rare combination of being an SME but also an OEM with design, test and manufacturing services as well as compliance systems usually only available in a much larger corporation. This gives it the agility and competitive cost base to prioritise both large and small subcontracted engineering projects, such as a fabrication to protect sensitive equipment in a harsh environment. It also means it has a strong collaborative culture, built on experience in managing and being a part of complex supply chains.

CAN DO ATTITUDE

Engineering Director, Steve Austen, a Chartered Engineer, Naval Architect and Fellow of the Institution of Mechanical Engineers, joined the company two years ago from the RNLI and as a customer had been impressed by the `can do` attitude. "The culture is innovative, we always aim to come up with a better design and faster. We feel a real sense of responsibility to the customer, which means being there to support a project throughout and in particular, when the inevitable wrinkles need ironing out."

As an example, his engineers are just starting work on developing an

unpowered tracked variant of the lifeboat launch & recovery system. The new system will be a low cost version for lifeboat stations where the 4-track drive system, which delivers the exceptional traction for climbing steep gradients and coping with rough shingle, is not required.

MECHANICAL AND ELECTRICAL ENGINEERING CAPABILITIES

The company's engineering capabilities are in mechanical and electrical engineering, structural analysis, structural optimisation, fluid structural simulation and test and validation, including full system prototype build. The business has an established production capability, carrying out low rate, high quality builds. If volume production is required it forms an alliance with that capacity as it has done with Babcock and Tata for vehicle programmes.

CONVERSION TO WAVE ENERGY

The springboard for SC Innovation's entry into renewable energy came from Fred. Olsen, who five years ago approached them as a strategic partner to turn a concept for a wave energy converter into a practical design. The BOLT 2 'Lifesaver' project was part funded by the Technology Strategy and involved industry partners in the South West as well as the University of Exeter.

SC Innovation also built 'Lifesaver' and closely supported the project from prototype through to installation as the first device at the FabTest site near Falmouth. After two years of full scale sea testing the company refurbished the converter's 'intelligent systems' at its Dunkeswell, Devon headquarters facility and at its newly acquired sister SC Group company, Blackhill Engineering.

HEAVY ENGINEERING

The latter has added heavy engineering to the company's offering, and a specialisation in large fabrication and machining.

Through its involvement in offshore technology SC Innovation came up with the concept of a multi-role offshore windfarm support vessel as 'one boat to replace many', having analysed the requirements of the new generation of offshore windfarms. It collaborated with naval architects Incat Crowther to translate the concept into a detailed design to produce the SMV24, a DNV 1A1 HSLC R1 windfarm service vessel class 1, which is now operated by James Fisher Marine Services in a wide range of support roles.

SUPPLY CHAIN COLLABORATION

New engineering challenges will emerge as the offshore wind and wave & tidal sectors develop and expand. Head of SC Innovation, Joe Wilcox, sees Operations and Maintenance and logistics as one area where the sector can achieve incremental improvements. ***"Innovation and new thinking together with a collaborative approach to supply chain engagement can bring large benefits to the sector. This is where SC Innovation has the flexibility to offer a diverse range of services, whether it's a structural analysis package, a fabrication or an original equipment design."***

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MORE INFO

SC Innovation

SPEEDING UP THE TIDE

The vast energy resource of tidal currents has attracted many inventors and investors over the years. But although almost everyone is focusing on large structures that requires fast tidal streams, the truly large tidal and ocean current resources in the world's oceans are of low-velocity character. So what do you do if you want to produce electricity out of these slower streams, but conventional technology is insufficient? You take the ancient principle of flying a kite – and you put it in the ocean.

THE PAST

It all started as a turbine study within the aircraft manufacturer Saab's R&D department. Engineer Magnus Landberg studied the economics of scale of wind turbines and different turbine concepts, especially vertical axis configurations. Given the enormous structures needed to sweep a large enough area in the air, he started looking for alternative, lightweight solutions. This eventually led him to the idea of attaching a turbine directly to a blade and deploy it in a far more energy-dense renewable resource – tidal currents. The embryo to Minesto's Deep Green concept was created.

THE PRESENT

Today, Deep Green has developed into a unique, proven technology for harvesting energy from low-velocity tidal and ocean currents. It consists of a subsea kite moored to a seabed foundation. By means of a rudder and servo and control systems, the kite is steered in a predefined, eight-shaped trajectory. This means that the water flow rate through the turbine can be multiplied several times. An innovation in its truest sense, Minesto's tidal kite Deep Green is the only known technology for cost-efficient electricity production from slow streams.

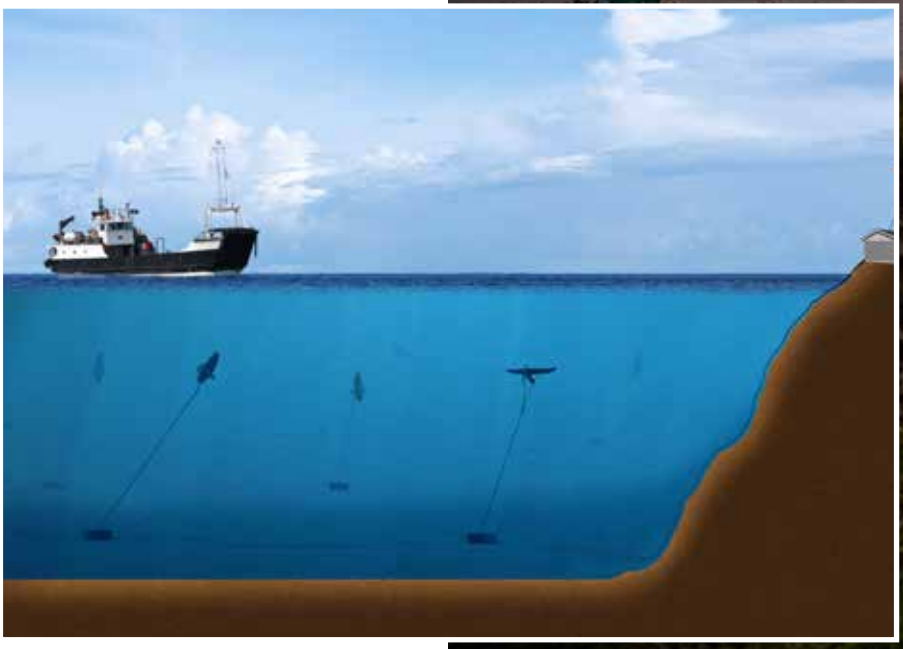
THE BRINK OF COMMERCIALISATION… THE FUTURE

A little over ten years has passed since the idea was born and the concept now stands on the brink of commercialisation. Quarter-scale ocean trials have been ongoing at Minesto's state-of-the-art test and demonstration facility located in Strangford Lough, Northern Ireland for more than four years.

Next step is to build and install the first full-scale demonstrator. In the Holyhead Deep, some six kilometers off the coast of Anglesey in Northern Wales, Minesto holds a seabed lease from the Crown Estate for a site. In the summer of 2017 a 12-metre wide Deep Green subsea tidal kite will be installed there, at a depth of 80–85 metres.

INVESTMENT

In May 2015, Minesto secured a €13m investment from the European Regional Development Fund through the Welsh Government for the commercial rollout of Deep Green in Holyhead. Back then, Minesto's only tie to Wales was via consultants. A little over one year later the Minesto UK head office has been established in Holyhead, engaging about ten full-time employees.



WIN-WIN RELATIONSHIP

"Holyhead has, like many other industrial and sea port cities on the British countryside, endured many years of stagnant development. The region has seen big companies with low or no long-term commitment come and go. This is the first time a foreign investor has come in and taken office on Market Street in Holyhead." commented Anglesey-born Osian Roberts, Project Controller at Minesto.

Hence Minesto's establishment in Holyhead is a welcomed injection on Holy Island. But what it comes down to is a win-win relationship, added Dr Martin Edlund, CEO of Minesto:

"As well as having great access to port and assembly facilities in nearby Holyhead, the tidal resource in the Holyhead Deep, with a water flow of 1.0–2.2 m/s are ideal for our Deep Green concept." said Dr Edlund. *"This is the best location in the world for us to demonstrate the technology."*

ON TRACK TO DELIVER

For the last three years Minesto has worked together with consultants to complete engineering studies and environmental impact assessments, based on extensive surveys of navigational safety, seabed habitats and geology.

"We have also consulted widely with the local community and stakeholders to give everyone an opportunity to ask questions or comment on our plans. So far, we have received constructive and positive feedback." said Dr Sian George, responsible for development of the site at Holyhead Deep. Dr George is pleased with the progress so far.

"We are on track to secure the infrastructure, consents and planning approvals we need to deliver our goal; to demonstrate the Deep Green technology at the Holyhead Deep, which will provide the perfect platform for scaling up at this site in the future."

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START SMALL – THINK BIG

In the tidal power industry 2016 is promising to be a breakthrough year, with the sector moving from prototype devices to fully operational arrays. Nova Innovation is proud to be at the forefront of this drive having deployed the second Nova M100 turbine in the Shetland Tidal Array in August, making this the world's first operational offshore tidal array.

REASONING

The purpose of these early arrays is to demonstrate reliability and safety and to drive down the lifetime cost of energy of tidal power in order to attract the investment required to allow the sector to grow. The key to achieving this is the accumulation of operational hours for array devices.

DEVELOPING AND PROVING DEVICES

This has motivated Nova Innovation's focus on developing and proving devices at the 100 kW scale – relatively small scale compared to some other developers. Ten 100 kW devices will accumulate operating hours ten times faster than one 1 MW device. As a result, problems can be identified and rectified sooner and improvements can be incorporated into new devices, accelerating the evolution of the technology through 'learning by doing'.

Focusing on small-scale devices has reduced capital requirements and our engineering and financial risks. It has allowed us to use small vessels, reducing the cost of offshore operations. It has also enabled the company to be nimble, growing rapidly from inception in 2010 to deployment of the world's first offshore tidal array within 6 years.

The result is a product – the Nova M100 device – that can be deployed in deep or shallow offshore tidal, estuary and river sites.

STRATEGY

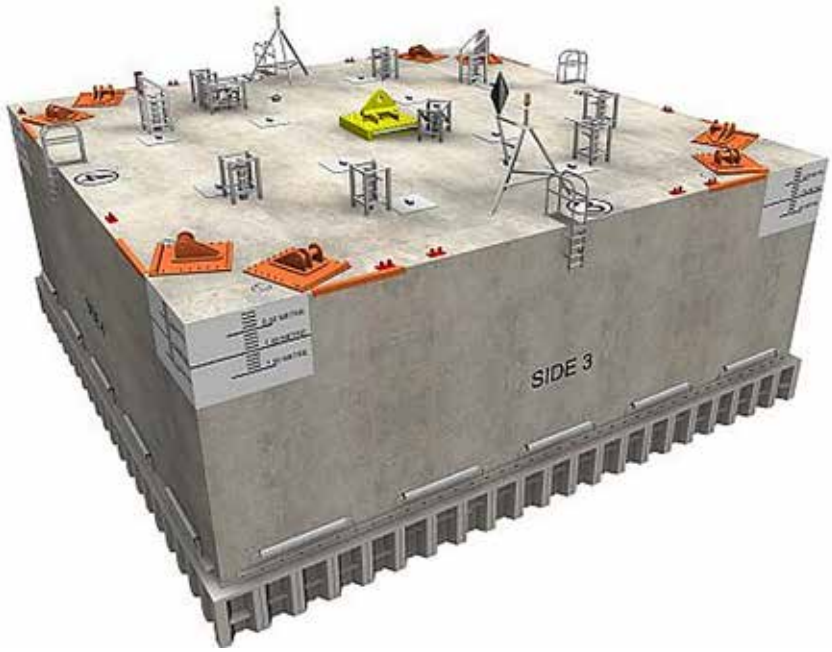
This strategy follows the trail successfully blazed by the Danish wind industry in the 1980s. While companies such as General Electric in the USA and Howdens in the UK moved rapidly to MW-scale prototypes, the Danes focused on developing, deploying and improving reliable and efficient wind turbines at the 100 kW scale.

As a result, Danish firms came to dominate the global wind market, with turbines scaling up gradually through time as the technology matured. History does not repeat itself, but it does rhyme, and we believe that a similar strategy will prove successful in tidal power. Our philosophy is: 'Start Small, Think Big'.

NOVA INNOVATION

REDUCING COSTS

> "THIS IS DRIVEN BY THE HIGH COSTS OF OFFSHORE JACK-UP VESSELS"



Minimising the Levelised Cost of Energy (LCOE) is one of the key targets for any renewable energy project. Keeping control of costs, especially in the build and installation stages, is essential and for wave & tidal energy, the more so as offshore costs can run away easily.

In the past cost reductions have been based on the concept of minimising every little element of the supply chain which doesn't always achieve the gross cost reductions sought after. Indeed pressing your supply chain to cut their costs may may cause unintentional consequences.

OFFSHORE INSTALLATION

One of the key costs of any offshore renewable project is the offshore installation process. This is driven by the high costs of offshore jack-up vessels such as those used for installing and assembling offshore windfarms. Avoiding offshore lift operations requires taking a completely different approach. This has challenged the wave & tidal community where some out-of-the-box thinking has been seen in recent times.

Using buoyancy or the principle of water to lift and carry structures is not new. Indeed this has been done many times before but adapting and integrating this method into the installation of tidal & wave energy devices has been slow to take off to date.

BUOYANT GRAVITY BASE STRUCTURES

Ocean Resource has been involved in developing low cost structures using buoyancy principles for many years. Recently they have found growing interest in the use of their buoyant gravity base structures for anchoring offshore tidal & wave devices. These provide a low-cost route for installation and if designed properly, can also reduce the overall CAPEX cost.

HOLYHEAD DEEP PROJECT

Minesto have chosen a buoyant gravity base (GBS) for their Holyhead Deep project off the coast of North Wales. It will be interesting to see how this helps them minimise the installation costs for this project.

Minesto's GBS design will be constructed adjacent to the shoreline and then floated using the tide to lift it. It will then be towed to site using its buoyancy. It will be lowered to the seabed using water ballast and is designed to be stable throughout to process which makes this an excellent cost-efficient solution with low risk.

It is hoped that this approach for tidal energy foundations, when proven, will allow Minesto to re-use the concept for further projects and will demonstrate to the tidal energy industry an alternative low cost route for anchor design and installation.

OCEAN RESOURCE