



THE UNIVERSITY of EDINBURGH
School of Engineering

POLICY AND
INNOVATION GROUP
**UK OCEAN ENERGY
REVIEW**

2020



Supported by


wave energy
SCOTLAND

Policy and Innovation Group

The Policy and Innovation Research Group is part of the Institute for Energy Systems (IES), which is one of the six research institutes within the School of Engineering at the University of Edinburgh. The group combines expertise on technologies, energy system organisations and institutions, and the wider policy and regulatory context for energy. They apply a range of quantitative and qualitative research tools and methods including innovation systems, energy system modelling and scenarios, and transitions management. This leads to preparation of strategy and investment roadmaps for organisations' funding, public and private investment and government departments.

Find out more about the Policy and Innovation Group at <http://www.policyandinnovationedinburgh.org/>

This report has been collated and edited by Henry Jeffrey and Shovana Talukdar from the Policy and Innovation Group. This work also features in the International Energy Agency Ocean Energy Systems Annual Report 2020.

Acknowledgements

This report has been made possible thanks to the input from:

The Department for Business, Energy and Industrial Strategy
The Scottish Government
Crown Estate Scotland
Marine Energy Wales
Marine Energy Council
Wave Energy Scotland
The European Marine Energy Centre Ltd
SIMEC Atlantis Energy
Nova Innovation Ltd
Orbital Marine Power Ltd
Mocean Energy
Morlais Energy
Supergen ORE Hub
FabTest
DTOceanPlus
Fast Blade, University of Edinburgh
AWS Energy
ORE Catapult

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Cover Images: Wave Energy Scotland

Inside Cover: Eunice and the Northern Lights - Nova Innovation

1 OVERVIEW

Despite being a challenging year, 2020 saw continuous innovative cross-border collaborations, deployment of state-of-the-art projects and offshore tests being undertaken for the ocean energy sector. The UK is home to the first tidal stream arrays in the world and has already deployed more wave and tidal energy devices than the rest of the world [1]. The UK ocean energy sector continued to reach new milestones this year, with the European Marine Energy Centre (EMEC) achieving the world's first ocean energy Renewable Energy Testing Laboratory (RETL) designation, the highest international appointment for marine energy test laboratories awarded by the International Electrotechnical Commission – Renewable Energy System (IECRE). 2020 also marked the 1st year of the TIGER project (Interreg's largest

ever project, led by ORE Catapult) to evidence tidal stream cost reduction and Nova Innovation's world first tidal array successfully powering the Shetland Islands for over five years. With the fourth round of the Contracts for Difference (CfD) scheme of 2021 to be open for bids from the tidal sector, a dedicated policy and revenue support for ocean energy would deliver significant sustainable economic benefits. Also, separation of wind technologies into a separate category (Pot II) shall create more opportunities for ocean energy technologies. However, a reduction in technology costs is still required for the sector to compete with alternative low-carbon technologies and contribute towards achieving the UK's net-zero target.

Wave

In 2020, the wave energy sector continued to engage in innovative R&D to drive the sector towards design convergence and commercialisation:

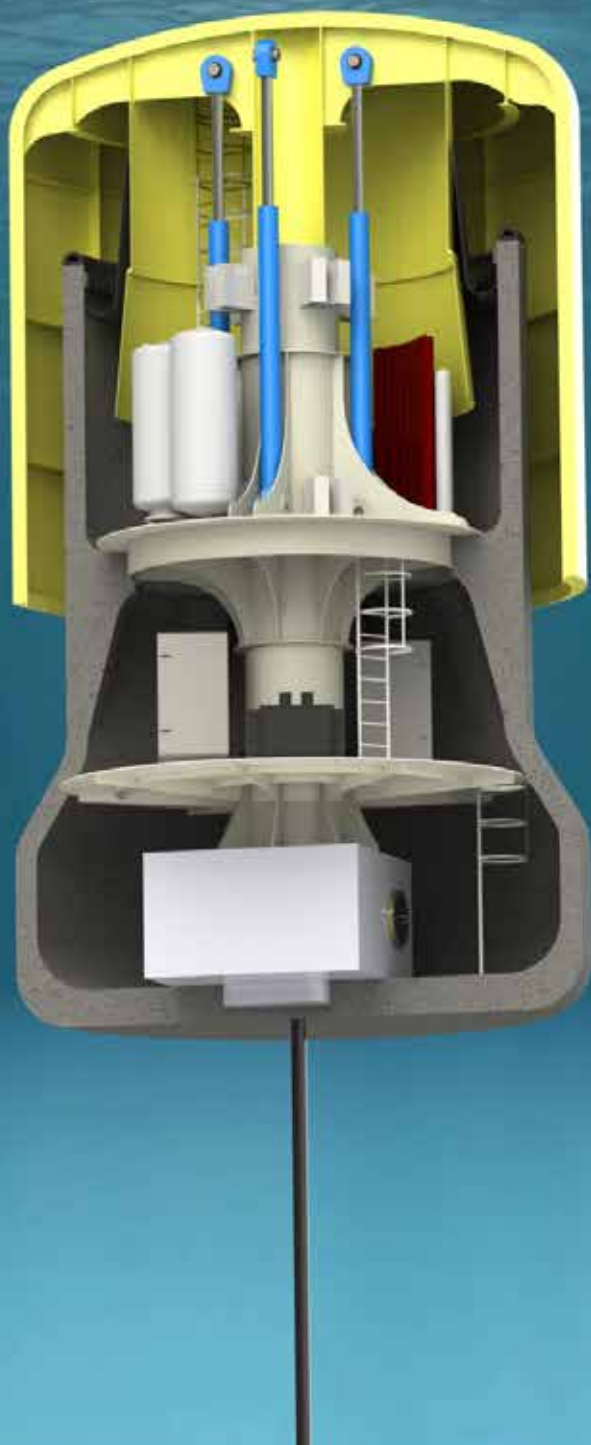
- Wave Energy Scotland (WES) continues to be the focus for wave energy R&D activity in the UK in terms of funding provision for wave energy innovation and demonstration. In 2020, the programme awarded £1.4 million to four projects developing quick connection systems to improve the installation efficiency and infrastructure of wave power devices.
- EMEC worked closely with the WES Novel Wave Energy Converter developers AWS and Mocean who are gearing up to test at EMEC in 2021. Throughout 2020, EMEC also partnered with Seabased Group to design and implement a testing programme which will support Seabased's certification goal, crucial to driving quality-controlled manufacture whilst reducing sectoral costs.
- The Welsh European Funding Office (WEFO) in Wales also continues to contribute significantly to wave R&D with £30.4M being allocated for wave energy development since 2014.
- In July 2020, Bombora transported the full scale 'cell module' structure, a key component part of the 75-meter-long subsea mWave, from the fabrication workshop to the assembly workshop.

Tidal Stream

In 2020, many tidal stream projects continued to progress towards commercialisation:

- Orbital Marine Power has been busy manufacturing the next generation technology, the O2, its first commercial turbine, due to be installed and tested at EMEC in 2021.
- Magallanes' test of their second generation, 2 MW tidal platform 'ATIR', as part of the H2020 Ocean_2G project led them to secure additional test site access support via the MaRINET2 and OceanDEMO projects. Following some routine maintenance taking place at Leith Imperial Dry Docks, the ATIR will return to EMEC's Fall of Warness tidal test site in early 2021.
- Towards the end of 2020 EMEC and Perpetuus Tidal Energy Centre (PTEC) signed a partnership to develop a large-scale tidal energy site off the Isle of Wight in England. The project provides a clear market signal to the tidal stream sector in the UK, committing resources and time to further the development and commercialisation of tidal stream devices. The partnership builds on work towards the development of the £41 million Interreg Channel funded TIGER project, which will ready five sites in France and the UK for tidal energy developments.
- Nova Innovation celebrated its 10th birthday with the successful expansion of the Shetland Tidal Array. In October 2020, the company confirmed the installation of its commercial direct-drive tidal turbine "Eunice", the first of three turbines set to double the size of the world's first Tidal Array as part of the EnFAIT project, making tidal energy a commercial reality. Additionally, in September 2020 the Scottish tidal developer also announced a \$4 million investment from Natural Resources Canada for Phase 1 of its 1.5 MW tidal array in the Bay of Fundy area of Nova Scotia, Canada.
- In October 2020, Minesto installed and commenced commissioning activities of its 100kW DG100 tidal kite system in the Vestmannastrandir strait, Faroe Islands. By December, it successfully delivered electricity to the Faroese grid facilitated by Power Purchase Agreement with the utility company SEV.

2 SUPPORTING POLICIES FOR OCEAN ENERGY



2.1 National Strategy

The UK Government's Department for Business, Energy, and Industrial Strategy (BEIS) retains overall responsibility for energy policy in the UK while powers related to planning, fisheries and the promotion of energy efficiency are devolved to the governments of Scotland, Wales, and Northern Ireland.

While preparing to host the 26th UN Climate Change Conference (COP26) in 2021, the UK has set out new plans to establish itself as the world leader in clean wind energy by creating jobs, slashing carbon emissions, and boosting exports [2]. To accelerate the progress towards the UK's net zero emissions by 2050, the government has announced "The Ten Point Plan for a Green Industrial Revolution" in November 2020, which plans to mobilise £12 billion of government investment and three times as much of private investment to create and support up to 250,000 green jobs [3]. As a part of the Green Industrial Revolution, the government also mentioned that the fourth round of the Contracts for Difference (CfD) scheme of 2021 will be open to bids from the tidal sector [4]. This is expected to not only double the capacity of renewable energy but also extend the investment and policy support provided to multiple technologies. Absence of a capacity specifically ringfenced for marine energy, makes it difficult for the sector to compete with the more advanced technologies. But the government has committed to look into the role of wave and tidal in the "Energy White Paper" published in December 2020 [5].

In June 2020, the Committee on Climate Change (CCC), the UK's independent climate advisory body published a series of very important publications. This includes the 2020 Progress Report to the UK Parliament, the 2020 Progress Report to the Scottish Parliament and the Sixth Carbon Budget report. [6] [7]

Following the COVID-19 pandemic, the report to the UK Parliament, "Reducing UK emissions: 2020 Progress Report to Parliament", sets out series of recommendations to the UK Government on securing a green and resilient recovery. Assessing the progress made by the UK since 2008, it prioritises the need for climate policy and investments to be made in the coming year to achieve the net zero ambitions across the whole UK economy.

(Source: AWS Ocean Energy)

Scotland

Scotland's climate change legislation includes a commitment to reduce Scotland's emissions by 75% by 2030 (compared with 1990) and to net zero by 2045. An update to Scotland's Climate Change Plan, published in December 2020, charts a pathway to emissions reduction targets out to 2032 and outlines the Scottish Government's approach to delivering a green recovery from the COVID-19 pandemic. The Scottish Energy Strategy sets out the Scottish Government's vision for the future of the energy sector to 2050 and maps out a transition which is consistent with the ambitions in Scotland's climate change legislation. The Energy Strategy is defined by a whole-system approach and includes a target to meet the equivalent of 50% of Scotland's heat, transport, and electricity consumption from renewable sources by 2030.

The Scottish Government continues to champion the ocean energy sector, supporting the research, development, innovation, and demonstration intended to maintain Scotland's position as a world leader in both wave and tidal energy. Since 2014 the Scottish Government has invested over £40 million in its internationally recognised Wave Energy Scotland programme which will see the deployment of two prototype wave energy converters in real-sea conditions in Scotland in 2021. In 2019-20 the Scottish Government awarded around £5 million from the Saltire Tidal Energy Challenge Fund to two innovative tidal energy projects which will be deployed in Scottish waters. The Scottish

Government also continues to support a working group which enables industry, academia, and the public sector to work together towards the further development of Scotland's marine energy sector.

Marine Scotland, the Directorate of the Scottish Government responsible for the management of Scottish seas, including planning and licencing of marine energy projects, published "The 2020 Sectoral Marine Plan for Offshore Wind Energy". This document sets out the most sustainable plan options for the future development of commercial offshore wind energy in Scotland [8]. The draft Plan Options provide the spatial footprint for the ScotWind leasing round, managed by Crown Estate Scotland.

Crown Estate Scotland (CES) is a public corporation which, as part of its duties, manages Scottish seabed leasing for renewable energy projects out to 200 nautical miles (nm). It delivered £12m for Scotland's communities in the 2019/20 financial year [9], which will be returned to The Scottish Government for public spending and to aid Scotland's green economic recovery. Crown Estate Scotland currently operates an open leasing application process for wave and tidal developers, for non-competitive sites up to a maximum of 30MWs. Additionally, in 2020 the Crown Estate launched the first cycle of ScotWind leasing, which will potentially award up to 8,600km² of the seabed for bids from offshore wind developers [10].



Aerial of EMEC Billia Croo wave test site (Credit Colin Keldie)



Pembroke port – Phase 1 site (Source: J.Abbott, MEW)

Wales

The Welsh Government is committed to unlocking the renewable energy potential from Welsh waters by supporting the delivery of marine energy projects. The Welsh Government has a 70% renewable electricity mix contribution target by 2030, a proportion of which should come from marine sources [11]. For this, the Welsh Government has allocated £100.4m of European Union (EU) structural funding over the next 5 years for marine energy through the Welsh European Funding Office (WEFO) [12]. The fund is aimed at establishing Wales as a centre for marine energy production by increasing the number of wave and tidal energy devices being tested including multi-device array deployments.

Marine Energy Wales (MEW) is the industry led stakeholder group representing the wave, tidal (stream and range) and floating offshore wind industries in Wales. MEW brings together project and technology developers, test centres, wider sectoral alliances, the supply chain, academia, and the public sector to establish Wales as a global leader in sustainable emerging offshore energy generation. Their vision is to create a thriving and diverse emerging offshore renewables industry in Wales that brings with it the combined benefits of climate change mitigation, reliable contributions to the national energy mix, jobs, and economic development in coastal, peripheral zones along with large-scale future export potential.

Over £123.7 million has been spent to date in Wales on the development of the marine energy industry. This figure is increasing annually with rising interest to invest in Wales and a strong policy drive to support the sector. The MEW 2020 State of the Sector Report details that a total of 16 developers are actively progressing projects in Wales with seabed agreements in place for over 532MW

of sites. Through the Morlais energy project in North Wales, the Marine Energy Test Area in Milford Haven and TIGER's Ramsey Sound site along with the ORE Catapult Marine Energy Engineering Centre of Excellence, Wales has an excellent world-class suite of Test and Innovation Sites. These will continue to attract not only the interests of UK based technology developers, but also further the inward investment successes already achieved from countries including Sweden, Canada, France, and Spain.

The 2020 developments recently announced through this organisation include:

- The Welsh Government, through the European Regional Development Fund (ERDF), will provide funding of £1.2 million to Nova Innovation towards its ground-breaking Enlli tidal energy project. The project will potentially transition "The Island in the Currents" to be the world's first blue energy island [13].
- Swansea-based Marine Power Systems (MPS) has secured a crowd funding support of over £2m in August 2020 apart from the £12.8m of EU funding awarded last year to support the next stage of project phase. With this, MPS is now set to build their first commercial wave demonstrator device in Wales [14].
- In June 2020, Pembrokeshire received the green light for a £60m funding for a marine energy project. The Swansea Bay City Deal project as part of the North Wales Growth Deal, will seek to deliver; The Marine Energy Test Area led by Marine Energy Wales and supported on the ground by EMEC from April 2020, a 90 square kilometre Pembrokeshire Demonstration Zone led by Wave Hub, modernised port facilities by the Port of Milford Haven and the Marine Energy and Engineering Centre of Excellence (MEECE) by ORE Catapult [15].

Marine Energy Council

The UK Marine Energy Council (MEC) was formed in 2018 by a collaboration of the leading wave and tidal developers, to engage with the Government and other stakeholders as a unified sector. Apart from technology and project developers, MEC members include supply chain companies, consultants, as well as leading industry associations, e.g., Renewable UK, Scottish Renewables, Marine Energy Wales, and the Offshore Renewable Energy Catapult (OREC).

The objectives of the MEC, which was formally incorporated in 2020, are to:

- progress from the OREC cost reduction advisory group, encouraging collaboration across the sector and supporting the policy positions for delivery of marine renewables; and
- lead the development of the sector both in the UK and internationally, as well as delivering a work programme to support the growth of the wave and tidal sector through the development of a UK market.

On September 2020, the MEC presented a detailed response to the UK Secretary of State for BEIS stating how the wave and tidal stream sector could generate a net cumulative benefit of £4.0bn by 2040 and £1.4bn by 2030, respectively. Moreover, strategic support for the wave and tidal sector would result in achieving three key objectives: a boost to UK manufacturing and jobs; practical application of the 'Green Transition' as a route to post-pandemic recovery; and a major export opportunity in technologies where the UK currently leads the world [16].

Urging the need for strong support, the MEC put forward three measures that would be influential in realising these opportunities: Contract for Difference (CfD) reforms, a strategic vision and support to technology developers through the Innovation Power Purchase Agreement (IPPA) [16].

2.2 Market Incentives

Contracts for Difference (CfDs)

The UK Government continues to offer revenue support to a variety of renewable energy technologies through the Contract for Difference (CfD) programme. Based on top-up payments to a strike price, CfDs offer long-term price stabilisation and are awarded via competitive auctions. Ocean energy technologies are however, yet to gain a CfD through the competitive auction process, primarily because they have been in the same CfD 'pot' as established, mature technologies such as offshore wind.

Last year during the third round of auctions in May 2019, twelve projects, of which six offshore wind, four remote islands wind and two-advanced conversion technology projects secured the contracts [17]. For the upcoming fourth round of CfD auction in 2021, BEIS has decided to allocate support for up to 12GW of new renewables projects. Through this, the government aims to double

the capacity of renewable projects deployed and provide support to the less 'established technologies' including floating offshore wind, Advanced Conversion Technologies and tidal stream. Also, separation of wind technologies into a separate category (Pot II) will enable ocean energy technologies to compete more fairly if further CfD reform is undertaken.

Seeking views from stakeholders and interested parties on proposed changes to the scheme, the government published its "Contracts for Difference (CfD): proposed amendments to the scheme" consultation document. Building on the consultation and the significant number of responses, a further 'Call for Evidence' was issued that sought views on the scope for deploying other innovative marine energy technologies such as floating offshore wind, wave energy and tidal stream energy.

2.3 Public Funding Programmes

In the last few years, the UK Government has made available some public funding alternatives to support the development of the ocean energy sector. Some of these programmes and initiatives are described in this section.

UK Research and Innovation (UKRI)

In operation since April 2018, UKRI brings together seven research councils to support and coordinate research and innovation in the UK. Independently chaired, UKRI has a £6 billion budget funded primarily through the Science Budget by BEIS [18]. The research councils and bodies operating within UKRI are the Engineering and Physical Sciences Research Council (EPSRC), Innovate UK, Arts and Humanities Research Council (AHRC), Biotechnology and Biological Sciences Research Council (BBSRC), Economic and Social Research Council (ESRC), Medical Research Council (MRC), National Environment Research Council (NERC), Research England, and the Science and Technology Facilities Council (STFC).

The UKRI provides a range of funding opportunities to individuals and groups in pursuit of excellent innovation and research. In the recent year, the UKRI announced funding calls in the fields of healthcare, circular economy, marine resources, climate resilience etc.

In May 2020, NERC and ESRC together announced research applications to address the objectives of the new Sustainable Management of UK Marine Resources (SMMR) research programme. Worth £12.4m, the programme is run in partnership with the Department for Environment, Food and Rural Affairs (Defra) and Marine Scotland [19]. In June 2020, the EPSRC announced another call to fund research proposals in Marine Wave Energy with an approximate funding of £4.5 million available to support 4-5 grant proposals [20]. The two calls closed in October and September 2020, respectively.

<https://www.ukri.org/>

Innovate UK

A member of UKRI, Innovate UK is a funding body that supports businesses in their development of new technologies and concepts, helping them to reach commercial success. Innovate UK awards grant and loan funding across all sectors to business-led and high-value innovation in the UK. The organisation also cultivates networks between innovators and investors, researchers, industry, policymakers, and future customers on a domestic and international scale [21].

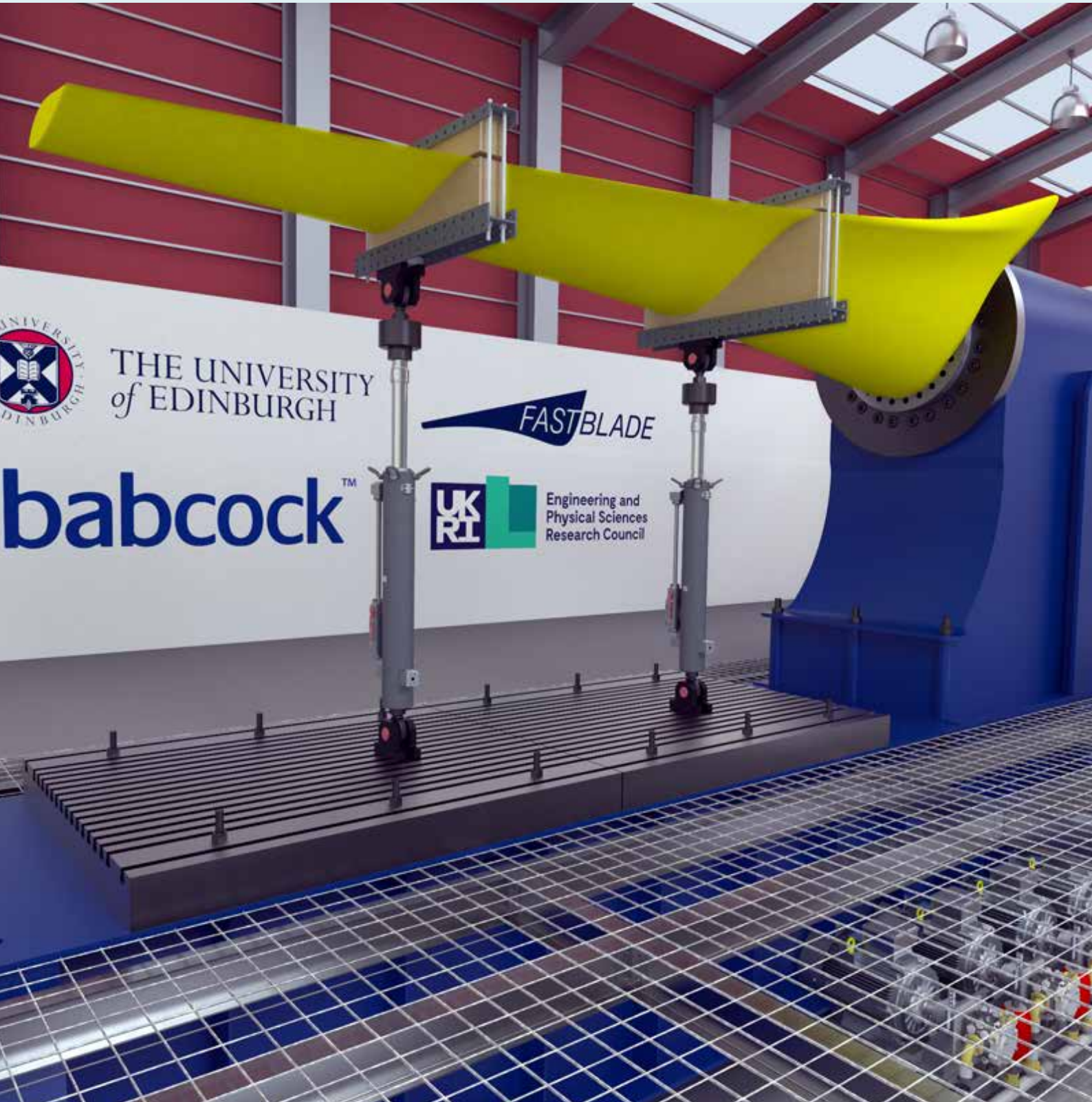
<https://www.gov.uk/government/organisations/innovate-uk>

Wave Energy Scotland

WES continues to use Scottish Government funding to support an innovative and unique approach to the development of wave technology. The WES programmes drive innovative technology projects towards commercialisation through a competitive stage gate process. The stages of R&D activities guide projects from concept to prototype testing. Funding calls have targeted development of wave energy devices, power take-off systems, control systems, quick connection systems and materials. Subsystem hardware from the programme has been demonstrated in Scottish waters during 2020, and preparations are being made for the deployment of two half-scale wave energy converters around Orkney, in Northern Scotland, in early 2021 [22].

<https://www.waveenergyscotland.co.uk/>

3 RESEARCH & DEVELOPMENT



3.1 Key R&D Institutions

This section contains an overview of the primary research institutions and their core project activity in 2020.



Supergen Offshore Renewable Energy (ORE) Hub

The Supergen ORE Hub was established in July 2018 with £5million of funding from the Engineering and Physical Sciences Research Council (EPSRC), and subsequently was awarded a further £4million in June 2019. Led by the University of Plymouth the Supergen ORE Hub brings together expertise from multiple UK institutions including University of Edinburgh, University of Aberdeen, University of Exeter, University of Hull, University of Manchester, University of Oxford, University of Southampton, University of Strathclyde, and University of Warwick. The mission of the Supergen ORE Hub is to provide research leadership to connect stakeholders, inspire innovation and maximise societal value in offshore renewable energy. Some key updates as announced by the organisation are as follows:

- In January 2020, the Supergen ORE Hub organised a workshop to develop a sector roadmap for wave energy, bringing the wave energy sector to the attention of policymakers and setting out suggested routes for its development considering the UK's net-zero carbon targets. The wave energy sector roadmap was subsequently cited in a £4.5m funding call on Marine Energy from EPSRC in Spring 2020. The sector roadmap and associated wave energy innovation paper can be found on the Supergen ORE Hub website [23].

- In July 2020, the Hub, through its second Flexible Funding programme, awarded almost £1.2 million to UK universities to support ambitious research projects investigating all aspects of offshore renewable energy (ORE) [24]. Flexible Fund awards complement existing ORE research, fill in gaps and transfer research findings across ORE sectors, based around addressing key research challenges as identified in the Hub Research Landscape. This second round of funding follows the £1 million awarded by the Hub in 2019 to ten projects in its first round of Flexible Funding [25].
- In autumn of 2020, the Hub, with the Supergen Energy Networks Hub and Supergen Energy Storage Network+, hosted a round of cross-hub workshops [26]. The workshops focussed on bringing together cross-disciplinary researchers and industry to discuss potential new research proposals that would address new challenges in Offshore Renewable Energy Transmission & Storage (Technology & Pathways) and Co-Design of Offshore Renewables with Network & Storage Vectors (Future systems). The three Hubs are subsequently providing seedcorn funding, via a competitive application process, to cross-discipline research groups to carry out pilot studies to enable new and adventurous research, ultimately leading to further grant applications through existing funding bodies.
- In October 2020, the Hub together with Aura, an initiative from the University of Hull, published a report that outlines an action plan centring on short, medium and longer-term initiatives to help improve equality, diversity and inclusion in the engineering sector, with a focus on the offshore renewable energy industry and academia. The report can be accessed on the Supergen ORE Hub website [27].

<https://www.supergen-ore.net/>



The ORE Catapult

Offshore Renewable Energy (ORE Catapult) is the UK's flagship technology and innovation research centre, combining research, development, demonstration and testing facilities with leadership, industrial reach, and engineering expertise. ORE Catapult accelerates design, deployment, and commercialisation of renewable energy technology innovation. By the end of financial year 2019/2020, ORE Catapult had supported 803 Small Medium Enterprises (SMEs) and engaged in 556 academic collaborations and 802 industry

collaborations [28]. Currently, ORE is involved in the Tidal Stream Industry Energiser (TIGER) project, ELEMENT (Effective Lifetime Extension in the Marine Environment for Tidal Energy) project, MONITOR (Multi-model investigation of tidal energy converter reliability) project and the Ocean Energy Scale-Up Alliance (OESA) partnership. All these projects are accelerating development and cost reduction [29].

<https://ore.catapult.org.uk/>

3.2 Key R&D Projects

Funding Ocean Renewable Energy through Strategic European Action (FORESEA)

EMEC has led the €11m Interreg NWE project, FORESEA, since it was launched in 2016. The project has been hailed an overwhelming success and was nominated for the 2019 EU Sustainable Energy Week Citizens' Awards. Having enabled 30 technologies to deploy across four European test centres (EMEC, DMEC, SEM-REV and SmartBay), FORESEA has enabled more

ocean energy technologies to be tested offshore than any other project, including CorPower Ocean, Orbital Marine Power, Naval Group and Whitford. The project was officially closed on March 2020 [30].

<https://www.nweurope.eu/projects/project-search/funding-ocean-renewable-energy-through-strategic-european-action/>

Floating Tidal Energy Commercialisation (FloTEC)

The FloTEC project, led by Orbital Marine Power and funded by the EC's H2020 programme, is an ongoing project running from January 2016 to August 2021. Building on the success of their 2 MW floating tidal technology, the SR2000, the FloTEC project is focussed

on the design, construction, and deployment of Orbital's commercial 'O2' technology and progressing a range of complementary innovations and activities including mooring load dampers, co-located energy storage design and environmental monitoring [31].

www.flotectidal.eu



Orbital's O2 at Dundee (Source: Orbital Marine Power)

Second Generation Technologies in Ocean Energies (Ocean_2G)

Funded by the EC's Horizon 2020 programme and managed by Magallanes Renovables, the Ocean_2G project was focused on testing, validating, and pre-certifying Magallanes' second generation 2MW tidal energy platform solution, the ATIR. Launched in 2017, the project undertook several key innovations followed by a series of test programmes to demonstrate the

operational performance of the prototype in open water conditions in Vigo, and then at EMEC where it was deployed in early 2019. The success of this project has led Magallanes to secure additional Horizon2020-funded, MARINET2 test site access, thus in early 2021 they will be returning to EMEC for further testing, moving their project towards commercialisation [32].

www.ocean-2g.eu



Magallanes Renovables ATIR installation (Source: Ocean_2G) Copyright Colin Keldie

3.2 Key R&D Projects



Enabling Future Arrays in Tidal (EnFAIT)

Funded by EU Horizon (H2020), the Enabling Future Arrays in Tidal (EnFAIT) project is a €20.2m project, which began in July 2017 and will run until June 2022. Led by Scottish tidal energy developer Nova Innovation, the project is a partnership of seven European companies and academic partners. EnFAIT builds on Nova Innovation's existing operational tidal array in the Bluemull Sound, in Scotland's Shetland Islands. It will extend the Bluemull Sound array from three to six turbines and demonstrate that high array reliability

and availability can be achieved using best practice maintenance regimes. In 2020, with three turbines already operating, the fourth next generation direct drive turbine was deployed. Two of the three operating turbines were recovered for maintenance and redeployed this year. The next two direct drive turbines will be installed in 2021/2022.

<https://www.enfait.eu/>



Eunice (Source: Nova Innovation)

EMEC hydrogen storage cylinders (Credit Colin Keldie)

Integrating Tidal Energy into the European Grid (ITEG)

Funded by the Interreg NWE programme, part of ERDF, the ITEG project has a total budget of €11m and is led by EMEC in Orkney. With EU funding of €6.46m, the project runs from 2017 to 2021 and aims to provide an integrated tidal and hydrogen solution for generating clean energy and tackling grid export limitations faced in remote areas. Hydrogen will be produced from excess tidal capacity. With project partners from the UK, France, Belgium and the Netherlands, the project aims to drive down the costs of pre-commercial ocean energy

demonstration by producing hydrogen using an AREVA H2Gen electrolyser, powered by Orbital's 2MW O2 - the next generation floating tidal energy converter. In June 2020, clean energy solutions provider, H2Tec Limited was chosen to perform program upgrades to EMEC's hydrogen production plant in Orkney that will in turn improve efficiency between the hydrogen plant and storage facilities at the Caldale site on Eday [33].

www.nweurope.eu/ITEG



DTOceanPlus

The EC H2020 funded DTOceanPlus is a €8m project running from May 2018 to April 2021. It is developing a suite of second-generation advanced design tools for the selection, development, and deployment of ocean energy systems. This builds upon the previous EU funded DTOcean project, which produced the first generation of freely available open-source design tools for wave and tidal energy arrays. The DTOceanPlus suite of tools will align innovation and development processes with those used in mature engineering sectors:

- Technology concept selection will be facilitated by new Structured Innovation tools
- Technology development will be enabled by a new Stage-Gate tool
- Deployment optimization will be implemented by new and improved Deployment and Assessment Design tools

Coding of key functionalities was completed in 2020, with the project now focusing on integrating the tools and verifying their accuracy. The suite of tools will be demonstrated and validated using the real-world technology deployment projects of the project's industrial and commercial partners, before being released in summer 2021. The project is led by Tecnia and comprises 16 EU partners, including, from the UK: The University of Edinburgh, Wave Energy Scotland, Energy Systems Catapult, Orbital Marine Power, and Nova Innovation [34].

<https://www.dtoceanplus.eu>

Strategic Environmental Assessment of Wave energy technologies (SEAWave)

The SEAWave project, co-ordinated by EMEC, aims to address long-term environmental concerns around the deployment of wave and tidal energy converters in the marine environment. Launched in 2018, the 3-year project aims to adopt multi-WEC environmental monitoring campaigns developed through gap analysis on WECs demonstrated in Scotland. The findings from the comprehensive environmental demonstration strategy will be distributed across various European networks to help understand the potential impacts of wave energy

deployments. The project is co-funded by the European Maritime and Fisheries Fund (EMFF) of the EU and is supported by a diverse range of project partners across UK, Portugal, Finland, Belgium, Sweden, and Ireland. In March 2020, a dedicated platform called MARENDATA was launched that will host range of information on resource characterisation, underwater noise, and video capturing seabed ecology and species behaviour from various marine energy test sites [35].

www.seawaveproject.com

Marine Energy Alliance

The Marine Energy Alliance (MEA) is a four-year European Territorial Cooperation project running from May 2018 to May 2022. The project has a total budget of €6 million and is financially supported by Interreg North West Europe, who provides €3.6 million of ERDF funding. The aim of MEA is to progress the technical and commercial maturity level of early-stage (TRL 3 – 4) marine energy technology companies with the overall goal of reducing the risk of device failure in subsequent

demonstration phases. In 2020, MEA reached another important milestone by awarding services to 23 small and medium-sized enterprises (SMEs) through its second call for applications. Through participation in MEA, companies will gain access to the project partners' world-leading expertise in marine energy development, including the European Marine Energy Centre (EMEC).

nweurope.eu

Ocean Power Innovation Network (OPIN)

A cross-sectoral and cross-regional collaboration for offshore renewable energy SMEs, the OPIN project is a 3-year initiative from 2019 to 2021. It is led by the Sustainable Energy Authority of Ireland (SEAI) and is represented by Scottish Enterprise (SE) and ORE Catapult as the UK partners. It has a total budget of €2.6m, where Interreg North West Europe (NWE) from the European Research and Development Fund (ERDF) provides €1.5m of financial support.

The OPIN project plans to support around 100 companies by transferring already established expertise, capabilities, and products from mature proven sectors into the ocean energy sector and thus reduce cost and initiate technology

development. The partnering countries involved in this project include the UK, Belgium, France, Netherlands, and Germany. OPIN will also create a forum for collaboration and technology exchange across the partner regions. Companies from regions with ocean energy expertise will interact with potential collaborators from regions that are world leaders in other technology fields (offshore wind energy, oil and gas, aerospace, automotive and manufacturing). OPIN will provide a mechanism to transfer expertise between these regions, addressing the disparities in innovation and economic development across north-west Europe [36].

<https://www.nweurope.eu/projects/project-search/opin-ocean-power-innovation-network/>

Ocean Energy Scale-Up Alliance (OESA)

Led by the Dutch Marine Energy Centre (DMEC), the OESA is a 3-year project running from January 2019 to December 2021. With a total budget of €6.2m, where Interreg NWE provides €3.1m of financial support, it is a European partnership of 13 international organisations specialising in offshore engineering, market development, ocean energy testing and technology development [37]. OESA aims to accelerate the development and deployment of ocean energy technologies through an innovative Pilot Accelerator Programme in the North Sea Region (NSR). The project involves accelerating the

deployment of 5 scaled-up ocean energy pilots worth 20 MW through strategic partnerships and international collaboration. In 2020, developers such as Floating Power Plant and Seabased worked with EMEC through the programme to align their current test campaign with IECRE standards and to prepare for certification, respectively [38].

<https://www.dutchmarineenergy.com/our-projects/ocean-energy-scale-up-alliance-oesa>

Tidal Stream Industry Energiser (TIGER)

The Tidal Stream Industry Energiser Project, known as TIGER, is an ambitious €45.4 m project funded by ERDF via the Interreg France (Channel) England Programme, running from July 2019 to June 2023. The TIGER consortium comprises of 18 partners from across the UK and France spanning turbine developers, ocean energy demonstration sites, research organisations, as well local and regional authorities. The four-year project will prove to be game-changing for the European tidal stream energy sector by identifying and de-risking innovations capable of accelerating cost reductions for tidal stream

energy. It aims to develop cross-regional partnerships while developing, testing, and demonstrating new technologies, installing up to 8 MW of new tidal capacity around the Channel region leading to new product and service development. As the biggest project across all Interreg programmes, it will establish tidal stream energy as a cost-effective source while driving growth within the energy mixes of France and the UK [39].

www.InterregTIGER.com

Ocean DEMO

Launched in January 2019 and funded by Interreg North-West Europe, the Ocean DEMO project is a €13m project. Built upon the FORESEA project, it aims to accelerate ocean energy's transition from single prototype to multi-device farms by providing free access to key European test centres: EMEC, DMEC, SEM-REV and SmartBay. Under its second call that ended in April 2020, ten technology developers were awarded the opportunity to participate in the project while in November 2020, twelve offshore renewable developers received support recommendation for project

participation under the third call [40] [41]. The OceanDEMO programme further had a successful Call 3 for applications this year, adding 11 technology developers to the project pipeline. Amongst them, Aqua Power, Inyanga Maritime, Leask Marine, Mocean Energy and Tidetec AS will be supported by EMEC. Although 2020 has been a challenging year for demonstration projects, OceanDEMO has planned deployments for early 2021.

www.oceandemo.eu

Selkie

Launched in 2019, Selkie is funded by the EU's Ireland-Wales co-operation programme and is led by University College Cork in partnership with Swansea University, Marine Energy Wales, Menter Môn, DP Energy Ireland and Dublin-based Gavin and Doherty Geosolutions. The € 4.2m project will see the development of a streamlined commercialisation pathway for the marine energy industry by establishing a cross-border network of developers and supply chain

companies in Ireland and Wales. Multi-use technology tools and models will be created and trialled on pilot projects before being shared across the sector. In June and in August 2020, Ocean Energy and Sabella were announced as successful wave and tidal energy developers respectively, to collaborate on the demonstration project [42] [43].

selkie-project.eu

SEACAMS2

The SEACAMS2 project supports developing economic opportunities in Low Carbon, Energy and Environment through specialisation in commercial application of research and innovation in marine renewable energy (MRE), climate change resilience and resource efficiency in

Wales. The £17m project, a partnership between Bangor University and Swansea University, is part-funded by the European Regional Development Fund and focuses on the convergence region of Wales.

ELEMENT

ELEMENT is a €5m EU H2020 project running from June 2019 to May 2022. It is led by tidal energy experts Nova Innovation, with the participation of ORE Catapult and University of Strathclyde, as UK partners of an 11-strong international consortium.

As part of the rapid progress being made with tidal energy technologies, the consortium has identified an opportunity to improve performance using artificial intelligence. In a world-first, the ELEMENT team is using behavioural modelling and machine learning to control tidal energy turbines to improve efficiency and reduce costs.

This approach will reduce the dependency on external instrumentation and sensors which can struggle to withstand the immense forces exerted by the tides. As well as improving reliability and lowering costs, the project will turbo-charge the collection and analysis of ocean data at tidal energy sites, providing valuable learnings that can feed into turbine designs in the future. By extending tidal turbine lifetime, improving efficiency, and increasing availability, the project is expected to deliver a 17 per cent cost saving on the levelised cost of tidal energy.

element-project.eu

MONITOR

MONITOR is an Interreg Atlantic Area project, running until 2021. It is led by Swansea University, and brings together the European Marine Energy Centre (EMEC), ORE Catapult, Magallanes Renovables S.L., Région Normandie, Sabella S.A.S., Universidade do Algarve, Université Le Havre Normandie, and University College

Cork. The project will identify critical parameters for blades and support structures and design a monitoring system aiming to lower engineering safety factors, thus lowering cost while also improving reliability.

<https://www.monitoratlantic.eu/>

Wave Energy Scotland (WES)

2020 saw continued progress in the WES stage gate research, development, and innovation programmes. Five power take-off projects have now completed large-scale testing, while the construction of two half-scale wave energy devices by Scottish companies is nearing completion. These devices will be deployed in the waters around Orkney in early 2021, representing a key milestone of the WES programme and utilising technologies developed in the other WES programmes. Elsewhere, development of two control systems is continuing with pace and novel structural materials have been demonstrated in various on and offshore tests. In

summer 2020, WES announced £1.4 million to support four projects developing Quick Connection Systems - an important opportunity to improve the speed, cost, and safety of operations at sea.

The WES programme has awarded nearly £41.6m to 95 projects and will now partner with EVE the Basque Energy Agency and Ocean Energy Europe to deliver EuropeWave - a new five-year collaborative programme that will channel €20m to the most promising wave energy concepts. The initiative is match-funded by the European Commission via its Horizon 2020 programme.



PECMAG Montrose (Source: Wave Energy Scotland)

4 TECHNOLOGY DEMONSTRATION



EMEC preparing wave rider buoy for deployment (Source: EMEC)

4.1 Test Centres & Demonstration Zones

Offshore test centres and demonstration zones enable the deployment of wave and tidal energy devices for R&D. A selection of these facilities is described below.

The European Marine Energy Centre (EMEC)

Established in 2003, EMEC remains the world's only United Kingdom Accreditation Service (UKAS) accredited test and research centre focusing on wave and tidal power development. With 13 grid connected test berths across 5 sites, EMEC has to date hosted the highest numbers of marine energy converters around the world. In 2020 EMEC achieved the world's first ocean energy RETL designation, the highest international designation for marine energy test laboratories awarded in August by the International Electrotechnical Commission – Renewable Energy System.

With regards to wave energy, EMEC continues working closely with AWS and Mocean who are gearing up to test their devices in 2021 at EMEC through the Wave Energy Scotland programme.

On the tidal energy front, EMEC continues to work with Orbital Marine Power through FloTEC, ITEG and OceanDEMO to progress the commercialisation of the tidal sector. Orbital signed up to a second EMEC tidal berth in March, with the aim of delivering their first floating tidal turbine farm by 2022. Moreover, Magallanes Renovables will return in 2021 to continue testing their ATIR platform. Over the summer of 2020, EMEC also signed a key partnership with The Perpetuus Tidal Energy Centre (PTEC) site, to develop a large-scale tidal energy site off the Isle of Wight, England.

The EMEC-led OceanDEMO and BlueGIFT projects, as well as MaRINET2, have continued to award opportunities for testing technologies in the sea at EMEC and other European test sites. Through the Marine Energy Alliance (MEA) project, EMEC has been working with 16 early-stage technology developers to de-risk development prior to demonstration at sea. Throughout 2020 EMEC delivered a range of services aimed at aligning early-stage testing with international standards and providing technical assessments. The RESOURCECODE project, led by EMEC, aims to

support investment and growth in the wave and tidal energy sector through the creation of an integrated marine data toolbox. The toolbox will consist of modelling and software tools, which will be made available via a new online platform. The toolbox is due to be launched in 2021 using 30 years of model data, creating the highest resolution wave model in North West Europe.

EMEC also supports the development of other test facilities around the globe, including Ireland, China, South Korea, and the USA. In 2020 EMEC was contracted by the Korea Institute of Ocean Science and Technology (KIOST) to support the development of their tidal energy test site at Jang-Juk Strait near Jindo Island, Korea. Thus, EMEC continues to share knowledge for the implementation of additional test sites nationally and around the world.

In addition, EMEC has continued to diversify into innovative waters. At EMEC's Billia Croo wave test site, Microsoft continued testing their subsea data centre through Project Natick, powered by Orkney's renewable electricity, and cooled by the ocean. 2020 saw the launch of ReFLEX Orkney, a project in which EMEC is lead partner and which is developing an integrated smart energy system in Orkney, increasing the system-wide use of clean energies. In December 2020, ReFLEX Orkney inaugurated a range of new low-carbon transport and power services exclusive to Orkney residents and businesses to further decarbonise the island's energy system, a major milestone for the project.

Apart from supporting the demonstration and validation of ocean energy technologies, EMEC also works on projects related to floating offshore wind, green hydrogen, and energy systems. 2020 saw the world's first hydrogen fuel cell-powered flight involving a commercial-sized aircraft, a project led by ZeroAvia and supported by EMEC through hydrogen provision.

<http://www.emec.org.uk/>

Wave Hub

Wave Hub is a pre-installed grid-connected site approximately 10 nautical miles (16km) off the north coast of Cornwall for the testing of large-scale offshore renewable energy devices. The site has a Section 36 electricity consent and holds a 25-year lease for eight square kilometres of seabed divided into four separate berths. Wave Hub is owned by Cornwall Council and operated by Wave Hub Limited. The site consent has been re-consented for floating offshore wind and is being sold off to a private buyer.

As a partner to the £60m Pembroke Dock Marine project announced in June 2020, Wave Hub Ltd will deliver the Pembrokeshire Demonstration Zone (PDZ), a consented

and grid connected offshore test site. With the modernisation of port infrastructures, the project will contribute towards driving down the cost of energy and achieving the net zero targets besides encouraging collaborations and innovations within the region [44]. In August 2020, Wave Hub led South West Floating Offshore Wind Accelerator, was chosen to bid for over £30 million of government funding provided through UKRI's flagship Strength in Places Fund. The funding will aim to fasten the construction of large scale floating offshore windfarms in the Celtic Sea from the mid-2020s onwards [45].

<https://www.wavehub.co.uk/>

FaBTest

FaBTest is a 2.8km² test site in Falmouth Bay on the south coast of Cornwall with 10 years proven track record. The relatively sheltered location of the bay from the west allows for marine energy converter concept devices and components to be tested, whilst being occasionally exposed to more significant weather from the east. The pre-consented site, leased from the Crown Estate, has

a 9 metre 1-in-100-year return period significant wave height, and is highly accessible from Falmouth Harbour. Most recently Marine Power Systems, followed by AMOG Consulting Ltd., demonstrated their 'WaveSub' and 'AEP' wave energy converters, completing power production and survivability tests in 2019 [46].

<http://www.fabtest.com/>

Marine Energy Test Area (META)

META is a test site led by Marine Energy Wales in the Milford Haven Waterway in Pembrokeshire. The Area comprises a variety of sites with consent and grid connection, which will facilitate testing of component, sub-assembly, and single-device stages. META aims to de-risk full-scale deployments, support innovation of global marine energy products and services, add value to the UK test centre network while supporting supply chain

initiatives. As one of the partners in the £60m Pembroke Dock Marine Project, META will enable technology developers to test their marine energy devices close to their base of operation. This will help drive the commercialisation of marine energy technology and enhance the UK's current industry proposition [47].

<https://www.meta.wales>

FASTBLADE

FASTBLADE is an innovative research facility that uses regenerative hydraulic technology to allow high-quality, low-cost accelerated testing of composite and metal structures including tidal blades, composite bridge sections and carbon fibre aircraft wing boxes. Developed by the University of Edinburgh, the facility will use a Digital

Displacement regenerative hydraulic actuation system to reduce the energy requirements of fatigue testing. As the world's first dedicated fatigue test facility for tidal blades, it will help secure Scotland's leadership role in marine energy [49].

<https://www.fastblade.eng.ed.ac.uk>

Morlais Tidal Demonstration Zone

The site in West Anglesey was primarily setup for its tidal resource and access to local infrastructure. At its full deployment it will allow 240MW of tidal energy to be transported to National Grid. This is enough to supply, on average, 180,000 homes. Morlais plan to use an adaptive management approach to deploy in lower amounts so that impact can be judged before future deployments are installed. The 35km² site is being sub-let for testing and

commercial demonstrating activities as one of the first array scale projects. The project is funded by the EU and Welsh Government funds. There are in total 10 developers signed up to deploy their technology in the MDZ. The project is at present in the consenting process and on consent award will begin the building of the infrastructure of substations and cabling linking the developers at sea to the National Grid [48].

<http://www.morlaisenergy.com/>



Looking out to the Morlais Tidal Demonstration Zone (Source: Morlais)

4.2 Arrays And Demonstration Projects

This section is a non-exhaustive list of key projects tested, installed in the sea, and operating in 2020.

MeyGen

The MeyGen array is owned and operated by SIMEC Atlantis Energy in Scotland's Pentland Firth. In December 2020, the MeyGen project confirmed it has surpassed 35GWh of generation onto the grid since project commencement. In August 2020, under the Saltire Tidal Energy project, a subsea hub was installed on their site, which will facilitate the buildout of the next generation of grid connected tidal turbines. The project aims to continue its success in 2021 and increase generation, availability and learning from the array [50].

<https://simecatlantis.com/projects/meygen/>



MeyGen Subsea Hub being lifted (Source: SIMEC Atlantis Energy)

Magallanes Renovables

Spanish tidal developer Magallanes Renovables' second-generation tidal turbine device, the ATIR, was successfully deployed at EMEC's grid-connected Fall of Warness tidal test site in February 2019. Funded by the Fast Track to Innovation pilot scheme, part of the EU's H2020 research and innovation programme, the device generated its first electricity into the UK national grid at EMEC in March 2019, and the device was temporarily removed from the site in 2020 to undergo maintenance in Leith and will be returning to EMEC's Fall of Warness tidal test site in 2021 for further testing [51].

<https://www.magallanesrenovables.com>



Magallanes and Leask Marine at the Fall of Warness, OpenHydro in background (Credit Colin Keldie)

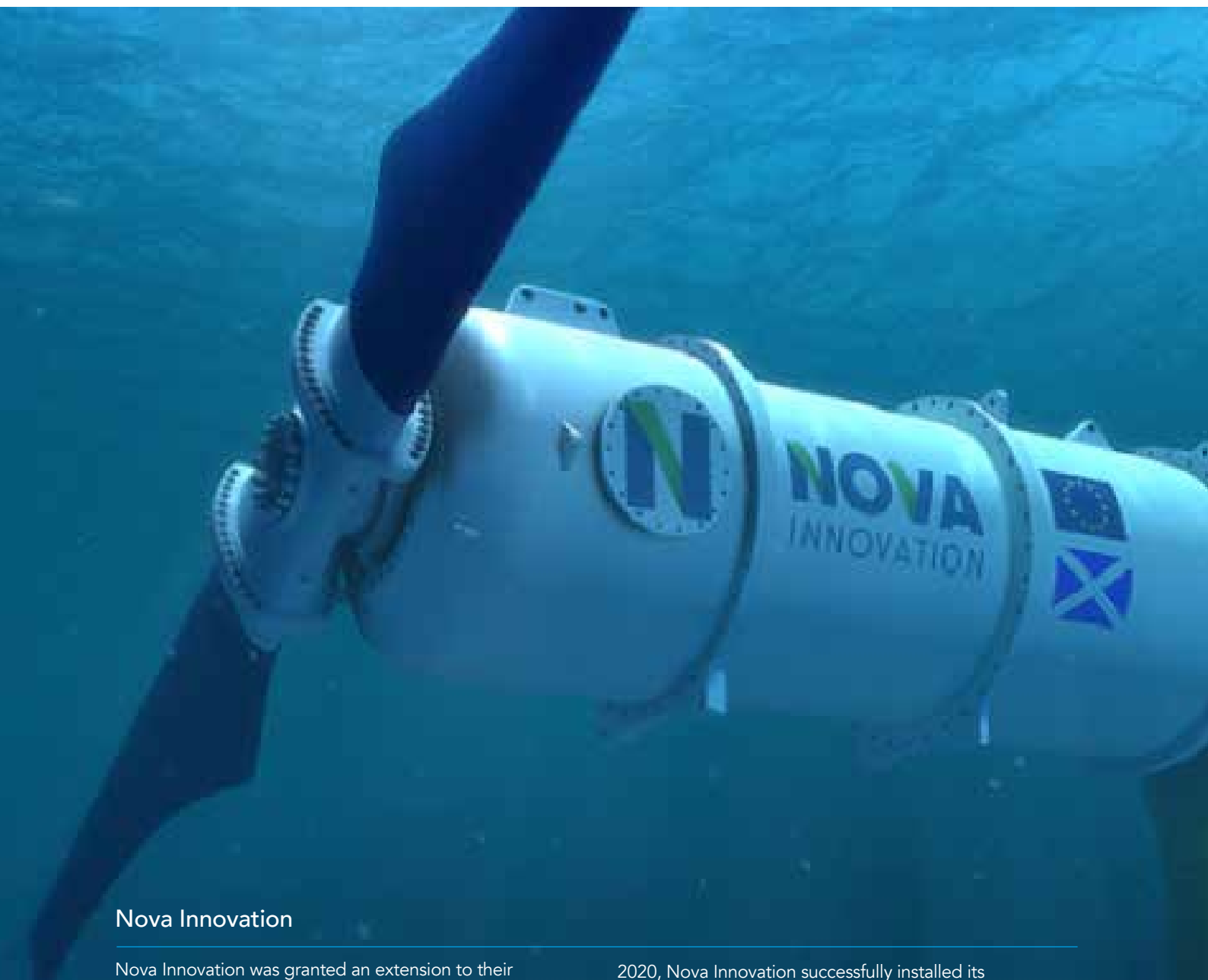
Minesto

Swedish marine energy developer Minesto received €14.9m of EU funding in May 2019, for the commercial development of Minesto's tidal energy scheme in Wales. After being upgraded to an enhanced PTO system, Minesto's DG500 kite system was commissioned at Holyhead Deep site offshore North Wales in September 2019. Minesto later retrieved the system back to carry out further tests and improvements at the site [52]. In October 2020, Minesto installed and commenced commissioning activities of its 100kW DG100 tidal kite system in the Vestmannastrandur strait, Faroe Islands. Following which, Minesto generated renewable electricity from the tidal flows using the Deep Green technology's unique principle of enhancing the speed of the kite through the water to power homes connected to the Faroese grid. In December 2020, it successfully delivered electricity to the Faroese grid facilitated by Power Purchase Agreement with the utility company SEV [53].

<https://minesto.com/>



Minesto initiates DG500 commissioning program (Source: Minesto)



Nova Innovation

Nova Innovation was granted an extension to their existing seabed lease by Crown Estate Scotland, significantly increasing the capacity of the Shetland Tidal Array site from 0.5 MW to 2 MW. This extension will enable Nova Innovation to progress their EnFAIT project with the installation of three additional Nova M100 turbines, each rated at 0.1 MW. This installation will double the generating capacity deployed at the site and increase the number of turbines in the water from three to six. In October 2018, Nova Innovation installed a Tesla battery in the Shetland Tidal Array to create the world's first baseload tidal power plant, capable of providing predictable, controllable, and renewable power to the grid. In July 2020, the developer also won a second contract with Wave Energy Scotland (WES) to deliver its innovative subsea electrical connector [55]. In October

2020, Nova Innovation successfully installed its state-of-the-art direct drive tidal turbine in Shetland that eliminates the need for a gear box and reduces the cost of tidal energy by 30 percent [54]. By December 2020, Nova Innovation's turbines had accumulated over 30,000 hours generating energy to the Shetland grid.

Internationally, in late 2019 the Scottish tidal developer was granted licence to deploy a 1.5 MW array in the Bay of Fundy area of Nova Scotia. In September 2020, the developer announced an investment of \$4 million from the Canadian government for Phase 1 of the Nova Scotia tidal energy project [56]. The Nova Scotia project will feature 15 of Nova's novel direct drive turbines.

<https://www.novainnovation.com/post/nova-innovation-celebrates-birthday-with-shetland-tidal-array-expansion>

Nova Innovation's Turbine (Source: Nova Innovation)

4.3 Planned Deployments

This section contains a non-exhaustive summary of wave and tidal projects expected to be deployed in 2021.

Wave

Bombora Wavepower

Australian wave energy developer Bombora Wavepower secured a £10.3m ERDF grant in 2018 to support the design and testing of a fully submerged membrane-style wave energy converter at Pembroke Dock. In October 2019, the developer received the first Marine Licence for a wave energy device in Wales, for the deployment and testing of 1.5 MW mWave wave energy converter technology off the coast of Pembrokeshire, Wales. Initially

scheduled to be deployed in mid-2020, the project had placed more than 70% of contract by January 2020 but was delayed due to the pandemic. In July 2020, the full scale 'cell module' structure, a key component part of the 75-meter-long subsea mWave, was transported from the fabrication workshop to the assembly workshop. The Pembrokeshire Demonstration Project is currently scheduled to be deployed in the first half of 2021 [57].

<https://www.bomborawave.com/>

AWS Ocean Energy

AWS has developed a fully submerged pressure differential absorber named the 'Archimedes Waveswing'. AWS was awarded £3.4m from the WES programme to develop a prototype and deploy and test in Orkney. AWS has been working closely with EMEC through 2020 in preparation to begin testing in 2021. Alongside validation of the device

performance and reliability, this large-scale project will provide valuable experience of manufacture, installation, operations, and maintenance for this promising technology [58].

<http://www.awsocan.com/>



Archimedes Wave Swing being fabricated by Malin Group in Renfrewshire (Credit: AWS Ocean Energy)

Mocean Energy

Mocean will deploy its “Blue X” prototype in early 2020 at EMEC in Orkney; the project is funded through the Wave Energy Scotland Novel WEC programme. Blue X provides learning towards Mocean’s “Blue Horizon” technology for utility-scale power and “Blue Star” device for subsea power applications. Following the WES testing, Blue X will

be used to demonstrate power to real subsea equipment including a residential AUV in the OGTC-funded Renewables for Subsea Power project. Mocean Energy’s innovation is in the WEC geometry – using AI-optimisation to design hull-shapes that significantly increase performance [59].

<https://www.mocean.energy/>



Mocean’s Blue X prototype in Scotland, prior to final fabrication and wet commissioning (Credit: Mocean Energy)

Marine Power Systems (MPS)

In August 2020, Swansea-based wave developer Marine Power Systems (MPS) obtained over £2m through a crowdfunding campaign, to build their first commercial demonstrator device in Wales. This is in addition to the £12.8m EU funds it was awarded in 2019 to support the

manufacture and testing of the full-scale WaveSub wave energy converter that would assist the development of the full-scale prototype for providing renewable energy in and around Wales [14].

<https://www.marinepowersystems.co.uk/>

Tidal

Orbital Marine Power

In 2020, Orbital Marine Power progressed construction of the world's most powerful tidal stream turbine, the O2 2MW for deployment at EMEC in 2021. The O2 will feature a range of innovations focussed on driving down the cost of tidal stream energy, including twin 20m rotor diameters - the largest swept area on a single tidal energy converter to date, pitching hubs for floating tidal energy and a new 'gull wing' leg retraction system to allow low cost, onsite access to the entire generating unit. The O2 project has received funding from the Horizon2020 Research and Innovation

Programme, the Scottish Government's Saltire Tidal Energy Challenge Fund, and Interreg North-West Europe.

The company also announced a new €5 million R&D programme, supported by the INTERREG France (Channel) England TIGER project, to identify and derisk further priority innovations capable of accelerating cost reduction for tidal stream energy to be rolled out on a continuous basis on future O2 units. Orbital also secured a second berth at EMEC in March 2020 to support its technology development and commercialisation programme [60].

<https://orbitalmarine.com/>



Orbital O2 Turbine (Source: Orbital Marine Power)

Nova Innovation

After the successful installation of their fourth tidal turbine 'Eunice' into the Shetland Tidal Array in 2020, Nova Innovation plans to install two more M100 0.1 MW turbines at Bluemull Sound in Shetland in 2021/22. After a period of operation, the device positions will be moved within the array in order to investigate turbine wake interactions for the first time in an in-sea tidal array [61].

<https://www.novainnovation.com/>



Eunice at Belmont Pier in Shetland prior to deployment and commissioning in October 2020 (Credit: Nova Innovation)

5 RELEVANT NATIONAL EVENTS

Some relevant events for the ocean energy sector that took place in the UK in 2020 include:

29th – 30th April 2020 – Marine Energy Wales Annual Conference, Virtual

13th – 14th May 2020 – All Energy 2020, Virtual

8th June 2020 – OPIN Intro to EU Tidal Stream Projects, Virtual

9th July 2020 – TIGER Supply Chain Opportunities Webinar, Virtual

1st – 3rd September 2020 – Scottish Renewables Annual Conference 2020, Virtual

3rd – 9th September 2020 – Orkney International Science Festival, Virtual

26th November 2020 – Scottish Renewables: Green Energy Awards, Virtual

The UK will also be hosting some important events in 2021 that are of interest for the ocean energy sector such as:

18th – 23rd January 2021 – Supergen Offshore Renewable Energy Hub Annual Assembly, Virtual

27th – 29th January 2021 – Marine Energy Wales Conference 2021, Virtual

23rd – 24th March 2021 – Scottish Renewables Annual Conference 2021, Virtual

18th – 19th August 2021 – All Energy 2021, Glasgow

5th – 10th September 2021 – 14th European Wave and Tidal Energy Conference (EWTEC), Portsmouth, England

1st – 12th November 2021 – Conference of the Parties 26 (COP 26), Glasgow

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