OES PERFORMANCE METRICS

4 IEA-OES Evaluation and Guidance Framework

A key feature of the WES programme is clear guidance of project activity and informed decision-making, which facilitates efficient identification of the most promising technology solutions. Through extensive international collaboration, the WES stage gate process and its supporting evaluation metrics have been expanded and elaborated, placing them on the path to becoming global best-practice.

The IEA-OES Evaluation and Guidance Framework builds international consensus on a standard technology development pathway and evaluation process for ocean energy technology. This provides benefits to funders and technology developers, setting clear expectations for both parties.

The IEA-OES Framework, published in 2021, defines a set of technology development stages, associated engineering activities and an overarching set of metrics. This provides a high-level expectation for development and evaluation, the detail of which is provided by the growing set of IEC Standards and Technical Specifications. In partnership, the OES Framework and IEC standards create a continuous pathway from concept creation to market-ready technology demonstration, easing the route to investor confidence, certification, and insurability.

www.ocean-energy-systems.org

5 Quick Connections Systems

The overall objective of the Quick Connection Systems (QCS) programme is to reduce the duration, cost and risk of offshore operations for prototype wave energy converters by supporting projects to design and develop a quick connection and disconnection system between a device and its moorings and/or electrical system. The programme was run over three competitive stages, with three of the seven projects that originally entered Stage 1 successfully progressing to Stage 3 where they demonstrated their concepts. The successful Stage 3 contractors were:

- **Quoceant**

  The Q-Connect is a modular Quick Connection System for the marine energy sector. It enables rapid connection and disconnection of both moorings and electrical cables in a single operation and caters for a range of mooring types and connection positions. Developed for the wave sector, Quoceant are adapting the design for use in floating wind.

  www.quoceant.com

- **Blackfish Engineering**

  The C-DART mooring connector enables the quick, minimal risk and hands-free connection and disconnection of floating infrastructure. Originally conceived for combined mooring and electrical connections, C-Dart offers benefits across multiple applications and sectors, including marshalling and wet storage of Floating Offshore Wind foundations. It has been successfully demonstrated to TRL5/6 as part of the WES QCS programme.

  www.blackfishengineering.com

- **Apollo**

  A mooring and electrical quick connection system that drives down LCOE in floating renewables. Fully scalable, rugged and marinized, the PALM QCS works using a single pull in action from a winch. In-water trials during 2022 demonstrated the system to TRL 5. With commercial advantages at array-scale, the system is now being developed for 66kV applications.

  www.apollo.engineer

www.waveenergyscotland.co.uk
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WAVE ENERGY SCOTLAND

Driving the development of wave energy technology in Scotland

HIE
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Iomairt na Gàidhealtachd 's nan Eilean

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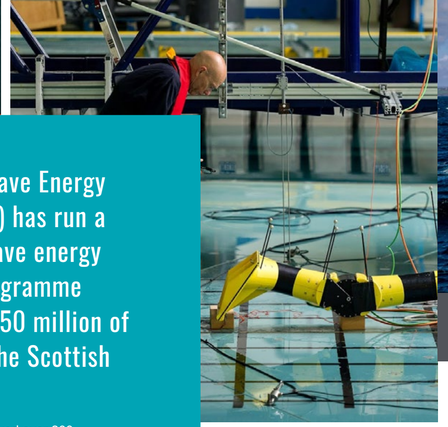

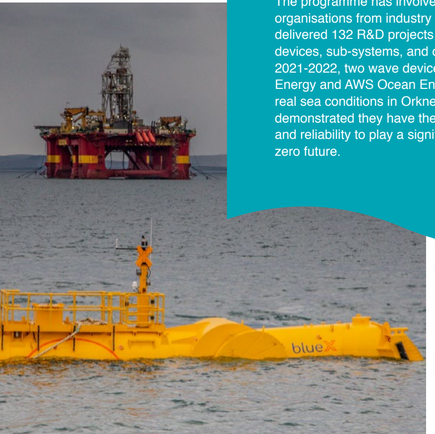

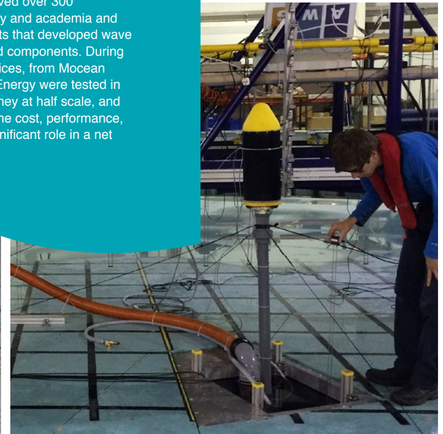

Since 2014, Wave Energy Scotland (WES) has run a competitive wave energy technology programme supported by £50 million of funding from the Scottish Government.

The programme has involved over 300 organisations from industry and academia and delivered 132 R&D projects that developed wave devices, sub-systems, and components. During 2021-2022, two wave devices, from Mocean Energy and AWS Ocean Energy were tested in real sea conditions in Orkney at half scale, and demonstrated they have the cost, performance, and reliability to play a significant role in a net zero future.

1. Novel Wave Energy Converter Programme

Mocean Energy:

Mocean Energy's Blue X wave energy machine returned to dock after a successful five-month test period at sea in 2021.

The first of a kind 10kW prototype began its test phase in mid-June 2022 and completed 154 days at sea, generating over 475kWh of energy, and operating in sea states up to 2.3m wave height [Hs max].

This year, Mocean Energy, in conjunction with Verlume, and consortium members Baker Hughes; Serica Energy; Harbour Energy; Transmark Subsea and Net Zero Technology Centre (NZTC) will deploy the device to a more exposed site off the east coast of Orkney. This project will connect the machine to a subsea battery module and demonstrate the capability to power a remotely operated autonomous underwater vehicle (AUV). Potential applications include the decarbonisation of offshore oil and gas plant and powering remote communities.

www.mocean.energy

AWS Ocean Energy:

Inverness-based AWS Ocean Energy commenced sea trials at the European Marine Energy Centre (EMEC) as part of the scientific testing for its Waveswing wave energy converter in March 2022.

AWS successfully demonstrated the capabilities of its innovative rubber seal technology and winch-based tidal compensation and survival mechanism during the test programme. A highlight of the project was seeing the Waveswing capture average power over 10kW, and peaks of 80kW during a period of moderate wave conditions.

The next steps include furthering design work on multiple absorber concepts that could be integrated with floating offshore wind infrastructure developments.

awsocean.com

2. EuropeWave

EuropeWave is an innovative R&D programme for wave energy technology run in collaboration with the Basque Energy Agency, EVE.

It combines almost €20 million of national, regional and EU funding to deliver a competitive multiphase pre-commercial procurement (PCP) programme to develop and demonstrate wave energy converter designs.

Of the seven concepts that entered Phase 1, the most promising five concepts have been selected to proceed to Phase 2 using a competitive 'phase-gate' process. This second phase is focusing on preparing a front-end engineering design of a scale prototype device capable of being deployed and operated at the open-water test sites of EMEC and BiMEP. A further 'phase -gate" process will select the most promising three designs to proceed to the final phase, starting in September 2023. The open-water trials are expected to begin in the Spring of 2025.

www.europewave.eu

3. Wave Energy and Floating Offshore Wind

Scotland is embarking on the creation of a huge supply chain and services network to satisfy the massive offshore wind capacity leased through the ScotWind programme. These steps bring potential for increased collaboration between the Scottish wind and wave energy sectors, which could deliver cost reductions, technical and socioeconomic benefits as well as the opportunity to enhance national energy security through a diverse generation portfolio. To investigate these opportunities further, WES has contracted Offshore Wind Consultants (OWC) to carry out a four-month study into the technoeconomic impacts of sharing of supply chains, physical infrastructure and services between wave energy and floating offshore wind systems. Scenarios under investigation range from co-development, through co-location to sharing a floating substructure.