The role of test centres in supporting innovation and technology development

DG Mediavilla, N Wood

1. The European Marine Energy Centre, The Charles Clouston Building, ORIC, Back Road, Stromness, Orkney, KW16 3AW

Keywords— **Offshore testing, marine energy, hydrogen, innovation, development, demonstration**

I. INTRODUCTION

Having celebrated our 20th anniversary in 2023, the European Marine Energy Centre (EMEC) is the world's leading centre for demonstrating wave and tidal energy converters in the sea and is pioneering the development of green hydrogen and a clean energy economy. As a plug-and-play facility EMEC helps reduce the time, cost and risk of testing innovative sustainable technologies (Fig. 1). EMEC is the world's only accredited ocean energy test laboratory (ISO/IEC 17025) and inspection body (ISO/IEC 17020): the centre provides pre-consented grid-connected test sites in harsh wave and tidal regimes.

In this document we will share the impact of EMEC's work both nationally and internationally, willing to showcase the positive outcome of supporting and collaborating with technology demonstration research, development and innovation (RD&I).

Fig. 1. Pelamis P2 tested at EMEC's full scale wave test site, Billia Croo [4]

II. TESTING AT SEA

A test centre does a lot more than just provide some sea space for testing. However real-sea demonstrations steal the spotlight in the ocean energy sector – that is what investors want to see: commercial scale technologies demonstrating their worth in real-sea conditions. These offshore demonstrations are key to de-risking technologies and progressing them to commercialisation (Fig. 2). Test centres aid in reducing the cost of offshore deployments and streamline test programmes for technology developers and are therefore a key node for knowledge sharing within the sector.

Fig. 2. Orbital Marine Power O2 device deployed at EMEC's full scale tidal test site, Fall of Warness [4]

The push for offshore renewables to be part of the energy mix is increasingly evident. In the last two years we have seen some major shifts in policy at UK level: commitment to net zero, and the introduction of revenue support for offshore renewables. The Contracts for Difference (CfD) scheme is the UK government's main mechanism for supporting low-carbon electricity generation, boosting British energy security with cleaner, more affordable, diverse and domestically generated electricity [1]. Within the CfD, a pot of revenue support has been ring-fenced for tidal energy, which has unlocked great potential for tidal projects in the UK. National recognition of marine energy in the renewable mix is key to progressing technologies to commercialisation and test centres play a role in raising awareness of this through the real sea testing they facilitate.

Testing at sea has also been at the core of capturing lessons learned in the marine energy space. Combined with a need for transition away from oil and gas, there is potential for sharing of skills and experience across the offshore sector and test centres facilitate this. Test centres have the opportunity to draw upon this existing knowledge and are key to developing know-how for offshore renewable

projects in some of the harshest marine environments. A collaboration with Wave Energy Scotland (WES) and EMEC demonstrated the range of experience gained from real sea deployments at EMEC, capturing lessons learned from the Orkney supply chain and were made available to industry to build upon [2].

The challenges of progressing this sector toward commercialisation span a multitude of regulatory, financial, environmental and technical issues not just focused at full-scale prototype demonstration, but at component and sub-system level as well. Therefore 'learning by doing' is so important to identify opportunities to improve.

The development of a test centre gives rise to a vast array of RD&I projects aimed to support and develop the marine renewable industry and address these challenges [3]. For example, EMEC has been involved in projects looking at environmental monitoring, biofouling, corrosion, moorings, subsea cabling, reliability, performance testing, certification and decommissioning. The experience gained from these projects informs the next steps for RD&I, the industry and wider policy.

Test centres play a role in sharing these learnings with the marine energy community, and to other ocean energy test centres. The International WaTERS (Wave and Tidal Energy Research Sites) network was set up in 2013 as a hub to collaborate and share experience for the good of the marine energy sector. This includes an annual meeting of existing and planned test facilities across the globe to instigate collaboration, innovation and knowledge sharing among ocean energy test facilities. This initiative has led to several joint transnational projects now supporting the development of wave and tidal energy technologies (e.g. OceanDEMO and Blue-GIFT).

Beyond this, as well as being a catalyst for ocean energy development, the very existence of test centres acts as a magnet for wider low carbon innovations. For example: Microsoft recently completed testing an underwater data centre at the Billia Croo wave test site (powered by renewables and cooled by the sea); A new pan-island distributed innovation centre, funded through the Islands Deal, will support Orkney, Shetland and the Outer Hebrides to become leading communities in the energy transition. The Islands Centre for Net Zero is being developed by an islands-based consortium, led by EMEC, and including the three Islands' Councils, Heriot-Watt University, Aquatera and Community Energy Scotland; and there are now numerous projects in Orkney focused on developing a local hydrogen economy to decarbonise fuel for transport (Fig. 3).

Fig. 3. EMEC Hydrogen Production Plant on Eday [4]

III. THE IMPACT OF OCEAN ENERGY DEMONSTRATIONS

The development of a test and demonstration site for ocean energy in Orkney has had a profoundly positive effect at local, regional and national levels, as well as supporting the development of clean energy internationally.

EMEC's most recent economic impact assessment, spanning 2003-2023 undertook an independent economic audit to ascertain the value and benefit of ocean energy activities, attributed to the presence of the test centre, at local and national levels [4].

EMEC has demonstrated significant economic impact from R&D activities on a coastal community and beyond, highlighting the practical application of the levelling-up agenda, particularly considering green recovery needs. EMEC was set up in 2003 with £36 million public funding invested to date. By 2023, EMEC had generated £370 million GVA to the UK economy and supported 540 FTE jobs [4]. Of this total, £130 million GVA and 224, or almost 50%, of the jobs generated, have been in Orkney [4].

The average full-time salary for EMEC staff is around 8% higher than the median for the local Orkney and regional Highlands and Islands economies.

EMEC's track record shows that R&D in the marine renewables, green hydrogen and local energy systems sectors generates high quality jobs and considerable economic impact in the peripheral areas of the UK where this is most needed.

Ocean energy projects can effectively contribute to the UK government's levelling-up agenda. They will be built out in the UK's peripheral & coastal areas, where there are traditionally less R&D-intensive activities. 50-60% of the economic benefit in terms of GVA and jobs is expected to be generated in coastal areas. Moreover, at EMEC the opportunities and potential of combining ocean energy

technologies with green hydrogen production have been demonstrated (Fig. 4).

Fig. 4. EMEC's Mechanical Engineer reviewing flow battery plans on site [4]

The creation of high value jobs helps to retain and attract young people to Orkney. This has been achieved not only by EMEC, but the inherent level of innovation being undertaken across the archipelago in the energy sector. Over the years, we have witnessed an influx of interest and excitement across generations to form part of the Orkney innovation landscape, and we are proud to state that our team is diverse in nationalities and makes positive efforts around gender equality.

A key objective of all our actions must be to tackle the climate crisis through a just energy transition whilst ensuring a green recovery from the pandemic, spreading the benefits of these nascent industries across the country. Particularly rural or peripheral areas, which ordinarily have been left behind, now have an exciting, tangible opportunity with the energy transition to transform economically and socially.

These values depict the impact that EMEC has on the local, regional and national economies and on the industries themselves. They are also a clear demonstration of the potential that these industries have globally in today's markets.

REFERENCES

[1] Department for Energy Security and Net Zero. (2023). *Contracts for Difference* [Online]. Available: Contracts for Difference - GOV.UK (www.gov.uk)

[2] WES. (2017). *WES & EMEC gather Orkney supply chain's lessons learned* [Online]. Available: WES & EMEC gather Orkney supply chain's lessons learned (waveenergyscotland.co.uk)

[3] EMEC, "EMEC – Pioneering the Transition to a Clean Energy Future" [Online], 2023. Available: https://www.emec.org.uk/?wpfb_dl=389

[4] EMEC. (2023). *20 Years of EMEC Instigates UK Wide Economic Impact* [Online]. Available: https://www.emec.org.uk/20-years-of-emec-instigates-uk-wide-economic-impact/

[5] EMEC. (2023). *EMEC* [Online]. Available: www.emec.org.uk