



— The European Marine Energy Centre and Orkney's Hydrogen Economy

Organisation: The European Marine Energy Centre Ltd (EMEC)

Region: Europe

Sector(s): Marine renewables, hydrogen, energy systems, research and development (R&D)



world-first
tidal-generated
hydrogen in 2017.

Summary

The Orkney Hydrogen Economy is not a single project. Rather, it's an ongoing expansion of the Orkney hydrogen landscape and the knowledge, learning and expertise that this brings through a variety of different infrastructures and projects.

In 2016, EMEC's first electrolyser was installed in response to grid constraints, to make use of the 'surplus' renewable electricity being generated on the archipelago. Since then, hydrogen projects, knowledge and roles have spread across the islands, covering the entire value chain and various end uses. Examples include maritime transport, aviation, distilling and heat; hydrogen production, transport and storage and the development of R&D installations. The knowledge economy has also spread to include roles from operations to marketing- specialised in hydrogen specifically- and even to the creation of a hydrogen safety training course in partnership with the local college.

While EMEC activity is leading this expansion, given the organisation's gained expertise in the field, the indispensable factor in hydrogen's drive forward is the local community. Local organisations within and outside the energy sphere, public bodies at local, regional and national levels and civil society in Orkney are engaged and open to trial and error in order to achieve change.

What will the next steps be? There is no way to know for sure. What seems clear is that hydrogen is in Orkney to stay, and the networks, infrastructures, roles, skills and opportunities that have emerged over the last five years will only increase. Engagement with local stakeholders will remain strong and fruitful, and innovation will take projects where they need to go.

Achievements

Between 2017-2019
almost

1/3

of EMEC's R&D activities
were hydrogen-specific.

- In the space of five years, the Orkney hydrogen economy has emerged: from the installation of an electrolyser in 2016 through to over £13M worth of hydrogen projects, the majority involving EMEC and often in collaboration with key local partners. These are spread geographically across the archipelago, and span the entire hydrogen value chain – from production to transport and end use.
- Results and lessons learnt from this vast portfolio of projects are infinite. Key milestones include: the world's first tidal generated hydrogen; the world's first hydrogen fuel cell powered flight involving a commercial-sized aircraft, and the design and delivery of the world's first hydrogen training for ferry operators in 2021.
- Between 2017-2019 around £2.3M of EMEC's R&D activities were hydrogen-led, over £2M of which focused on demonstration projects. Demonstration de-risks technologies and drives them closer to commercialisation.
- Importantly, there is now a hydrogen ecosystem growing in Orkney. Next steps will include identifying ongoing opportunities for EMEC and Orkney more widely in the hydrogen arena.

Enabling conditions

“

Innovation is a journey of
discovery.

Neil Kermode,
Managing Director, EMEC.

- The first ever development of hydrogen in Orkney was in response to a critical challenge of electricity curtailment suffered constantly on the islands due to power network constraints. To avoid 'turning off' renewable generators, a group of island organisations came together to propose the deployment of an electrolyser on the island of Eday in 2016. This electrolyser was installed with support from Scottish Government investment, and is powered using wind power capacity from Eday community wind turbine, which would otherwise be curtailed, and tidal power from EMEC's test site. In 2017, EMEC produced the world's first tidal-powered hydrogen and, as they say, the rest is history!
- A collaborative, proactive community is key to achieve effective engagement. Since 2000, the Orkney Renewable Energy Forum has played an integral part of the development of a renewable energy industry in Orkney. Within projects, not only is EMEC working with partners from across the value chain, sharing knowledge and reconciling interests, but different economic sectors and actors participate in such pioneering innovations. The latest examples of this are Orkney Distilling, in a project that evaluates the use hydrogen to produce heat for the distilling process; the development and delivery of a hydrogen safety course for ferry operators, led by Orkney College UHI's Maritime Studies department in collaboration with Orkney Ferries and EMEC; and the SATE project, which aims to set up a sustainable aviation testing area in Kirkwall Airport.
- EU funding has been absolutely key to EMEC's ability to collaborate in transformational projects such as ITEG and BIG HIT. The Scottish Government has supported important projects such as Surf 'n' Turf, Kirkwall Airport's CHP installation and flow-battery projects, while the UK Government has also provided innovation funds for projects such as HySpirits I & II, although these projects are at lower scale. Nonetheless, innovation funding is not enough to move from pilot stage into the mainstream. While these competitive grant bids are important for ongoing R&D, structured support and clear government signals are still missing in the UK.

Challenges

- The challenges faced in the regulatory arena have been particularly visible in the HyDIME project. In HyDIME, a project led by Ferguson Marine in collaboration with EMEC, ULEMCo and HSSMI, partners have been working on evaluating the technical feasibility of converting

a diesel auxiliary power engine on board an Orkney ferry to operate with a hydrogen-diesel fuel blend, in order to reduce ferry emissions. First-of-a-kind real world testing of this system on board a Shapinsay-Kirkwall ferry was anticipated for the project, however challenges associated with inflexibilities in regulation in the marine environment have limited the scope of possible project activities to ancillary exercises. This project exposed flaws in the translation of learning from the terrestrial to the marine regulatory environment and the slow development rate of the controlling frameworks.

- In terms of commercialisation and market development, a key challenge experienced in the evolution of the Orkney hydrogen economy has been the chicken and egg dilemma of building both supply and demand concurrently. Despite high ambitions for the role for hydrogen in Orkney's energy future, it is difficult to justify further investment in hydrogen supply capacity without being able to point to waiting sources of demand to offtake that supply. However, from the other side of the dilemma, de-risking projects which would deploy hydrogen-fueled vehicles or vessels is complex, without having a guarantee of fuel supply integrity. Government revenue support to reduce commercial risk in supply projects is thus integral to navigating this dilemma in the early stages of market development.

Key lessons learned

- Continuous, proactive collaboration between stakeholders is critical to developing a local hydrogen economy.
- Regulation is a critical barrier to the development of hydrogen. There is a need for public sector and regulatory bodies to engage with stakeholders and devise standards, safety codes of practice and regulations that are flexible enough to allow for pilot test projects, targeted such that they ensure the appropriate handling of hydrogen.
- Innovation is a journey of discovery, bringing people, ideas and networks together to make things happen. You might not end where you intended to, but you will end somewhere, and most importantly, you will have *moved*. The lessons learnt are key to developing a sector as novel as hydrogen is, creating a knowledge economy that benefits future projects.
- Through interconnected pilot projects, EMEC and Orkney have begun to build up hydrogen knowledge across the value chain, from production, through to storage, transport, supply and end use.

More information

For more information please contact: **Caron Oag, Senior Marketing Officer (Hydrogen), European Marine Energy Centre (EMEC), caron.oag@emec.org.uk**

Website: www.emec.org.uk

Twitter: [@EMEC_Ltd](https://twitter.com/EMEC_Ltd)

LinkedIn: [EMEC: European Marine Energy Centre](https://www.linkedin.com/company/emec)