Safety first: lessons from handling hydrogen in the maritime environment

Dr James Walker
Hydrogen Development Manager

Jerry Gibson
Hydrogen Operations Technician
Introduction and overview
Introducing EMEC

Tidal test site, Fall of Warness

Wave test site, Billia Croo

Hydrogen production, Eday
Innovating for ‘Net Zero’

- Our focus is on reducing the time, cost and risk associated with the development of clean energy technologies through learning by doing.
- We have developed a ‘living lab’ test and demonstration centre in Orkney where we are facilitating innovation in green hydrogen and working in partnership with key stakeholders to generate data and produce models to enhance understanding of emerging business cases.
- Through pushing boundaries we are informing future regulatory, standardisation and health and safety regimes.
Why hydrogen?

- Hydrogen first gained traction as a means of storing renewable power which would otherwise be curtailed.
- Once produced, hydrogen can be used to tackle decarbonising energy intensive applications.
- Heavy duty transport (ferries, aviation) and power system services are particularly relevant in islanded contexts.

**Orkney Demand**
- Live Demand: 15.69 MW
- Winter Peak Demand: 35.70 MW
- Orkney ANM: 9.009998 MW

**Orkney Generation**
- Non-ANM Renewable Generation: 20.446 MW
- Total Renewable Capacity: 57.10 MW
Hydrogen R&D Programme

1. Producing hydrogen via electrolysis
   We power our electrolysers using **tidal and wind** generation co-located at our test sites

2. Storing and handling hydrogen
   We have demonstrated inter-island transport of hydrogen, and developed **state-of-the-art mobile refuelling equipment**

3. Developing hydrogen use cases to support decarbonisation activities
   Our projects have tested new ways of using hydrogen, including in **transport**, in **vans, ferries and aeroplanes**, in industrial **heat**, investigating feasibility for use in **distilling**, and in providing auxiliary **power** to **ferries** while quayside
The Orkney Hydrogen Economy

Building Innovative Green Hydrogen Systems in Isolated Territories

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Maritime research focus
Orkney hydrogen activity inherently involves the maritime environment.
We are working to navigate and influence regulation

**HyDIME: ‘hydrogen diesel injection in the marine environment’**

- This project has focussed on systems development for the **retrofit** of a hydrogen:diesel hybrid engine, to be tested onboard a passenger ferry
- This project has faced **regulatory barriers** and we have learned a lot about this landscape and its interaction with energy research, development and innovation
Three main focus areas

- Informing regulatory evolution
- Equipment and technical solutions
- Training and working practices
Regulation is vital in keeping maritime activities safe

... but it can also make innovation difficult – and interesting!
Technical solutions can be made inherently safer

We have leveraged expert input in designing technical solutions to handle hydrogen safely onboard vessels

• We operate bespoke multiple-element gas container trailers, designed for island roads and shipping
• We use WEH Quick Connectors on trailers and all H₂ equipment in Orkney
• Innovative design for storage below deck TCS (tank containment space)
In HyDIME we have worked with partners to deliver **hydrogen safety training** to mariners, building upon International Code of Safety for Ship Using Gases or Other Low-flashpoint Fuels (IGF Code) competencies developed for handling LPG

- **Focus on hydrogen handling and bunkering**
Conclusions
Three main focus areas

- Informing regulatory evolution
- Equipment and technical solutions
- Training and working practices
Table 16: Synthesised qualitative assessment of required cluster features and outline of potential ammonia from fossil sources plus carbon capture and storage clusters (green = good; yellow = ok; red = not good; grey = data not available; ✓ ✓ = highly suitable location; ✓ = suitable location; ? = potentially suitable location)

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<th>Port</th>
<th>Low cost renewable electricity</th>
<th>Local demand for hydrogen for marine use</th>
<th>Proximity to an oxygen consumer</th>
<th>Proximity to adjacent hydrogen demand</th>
<th>Planned electrolyser projects</th>
<th>Potential hydrogen from renewable electricity cluster</th>
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Source: E4Tech and University Maritime Advisory Services, Clean Maritime Clusters Research Study, 2021.
... and we are realising that future together with various partners

All of our work is rooted in partnership
Thank you for your attention