EMEC HYDROGEN

Safety first: lessons from handling hydrogen in the maritime environment

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Introduction and overview

Introducing EMEC

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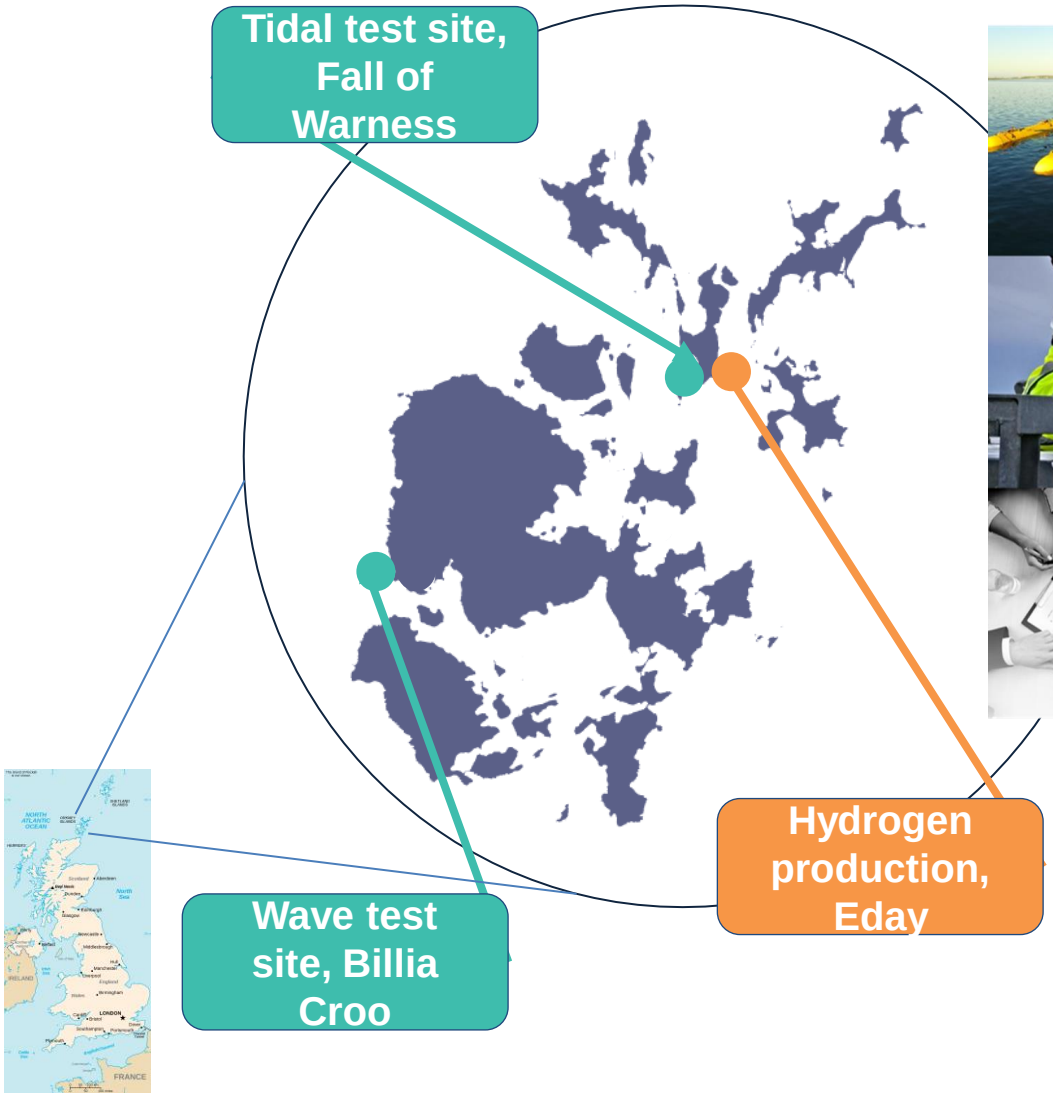
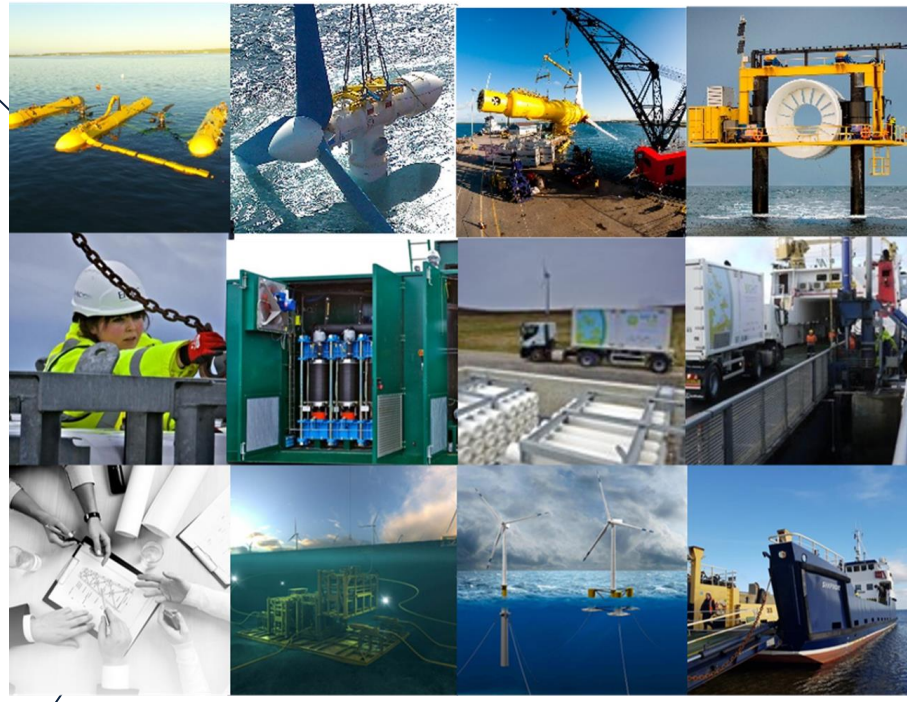
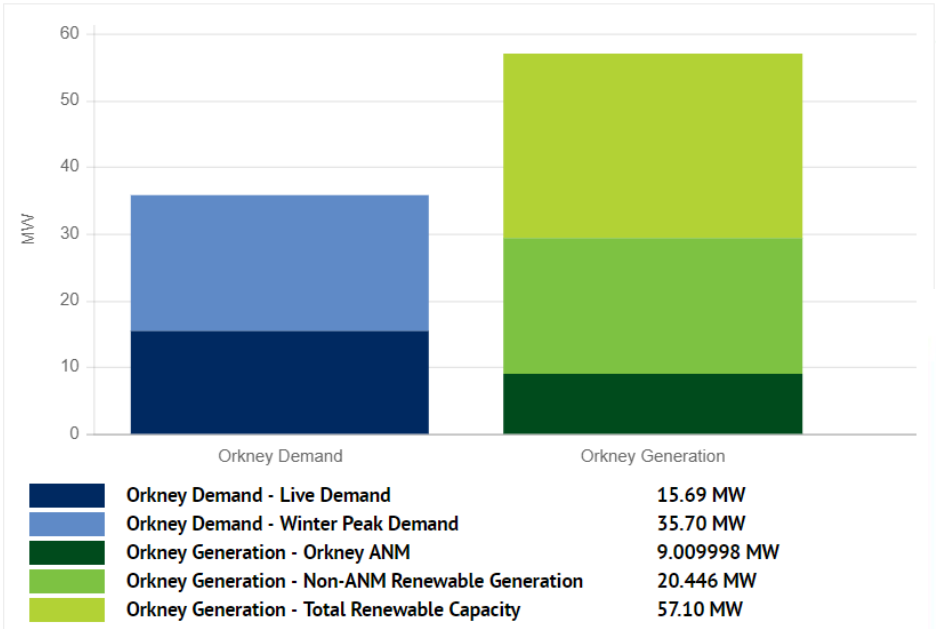




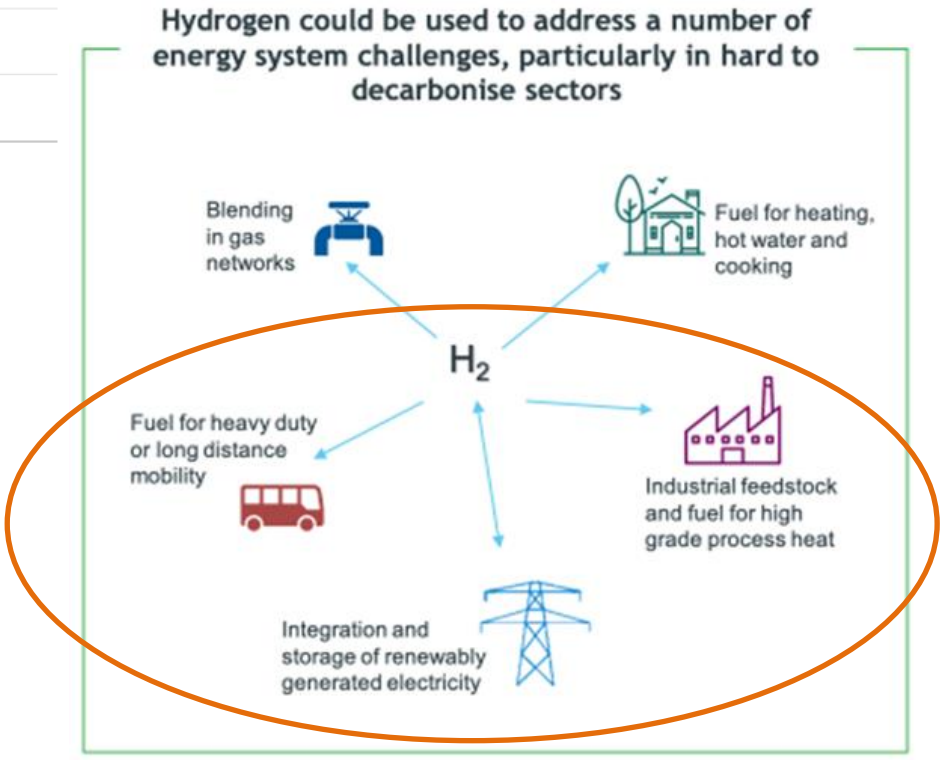
Innovating for ‘Net Zero’

- 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?



- Heavy duty **transport** (ferries, aviation) and **power** system services are particularly relevant in islanded contexts



- 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**

Hydrogen R&D Programme

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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

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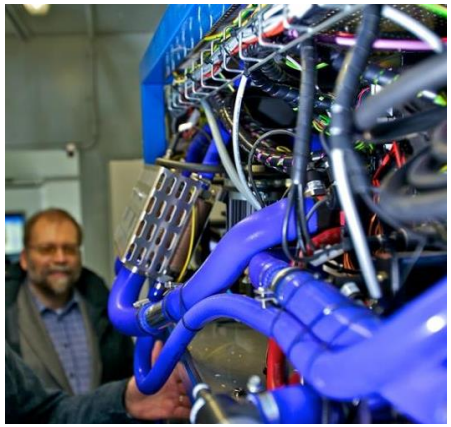
SURF 'N' TURF
Tide | Wind | Hydrogen

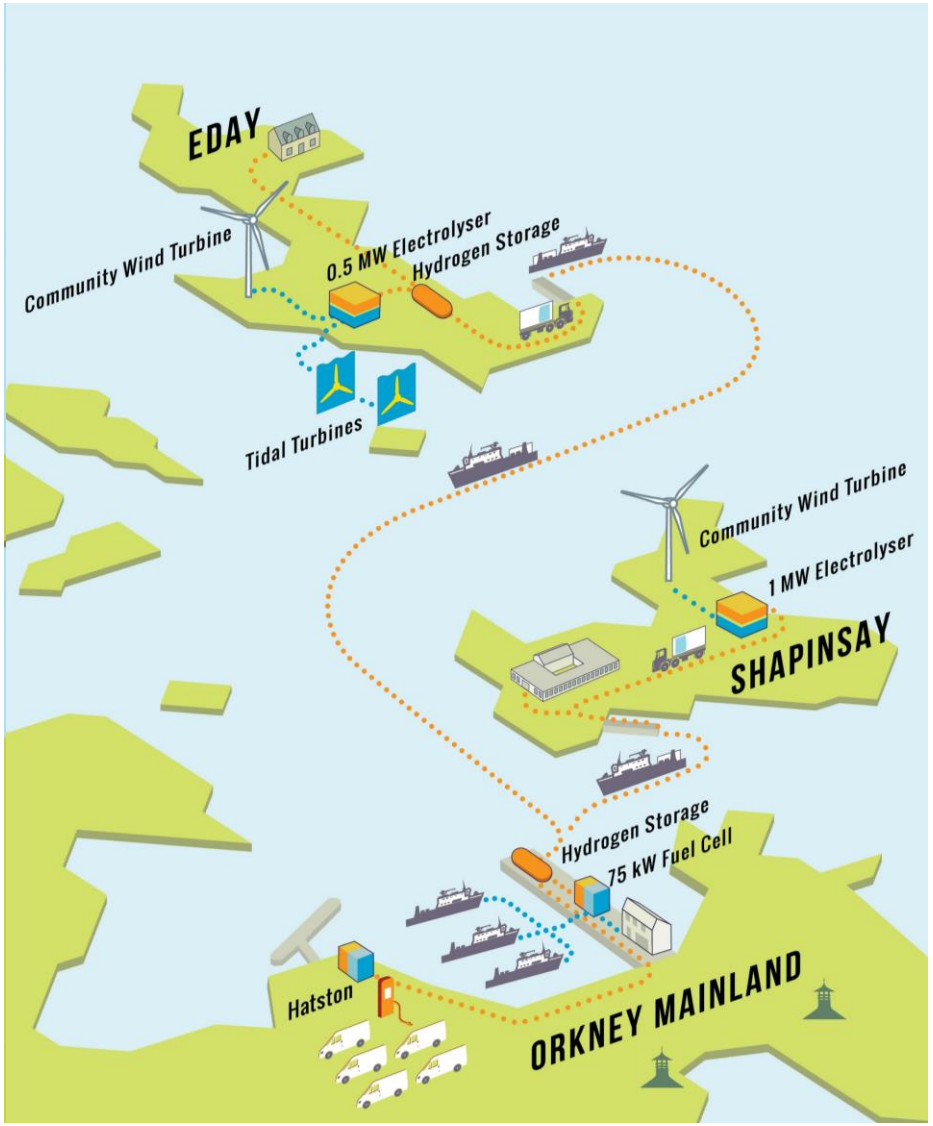
BIG HIT
Building Innovative Green Hydrogen Systems in Isolated Territories



The Scottish Government
Riaghaltas na h-Alba

Community Energy Scotland

FCH
FUEL CELLS AND HYDROGEN JOINT UNDERTAKING



Maritime research focus

Orkney hydrogen activity inherently involves the maritime environment

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SURF 'N' TURF
Tide | Wind | Hydrogen

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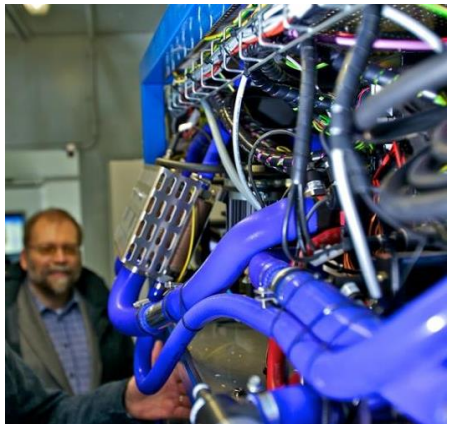

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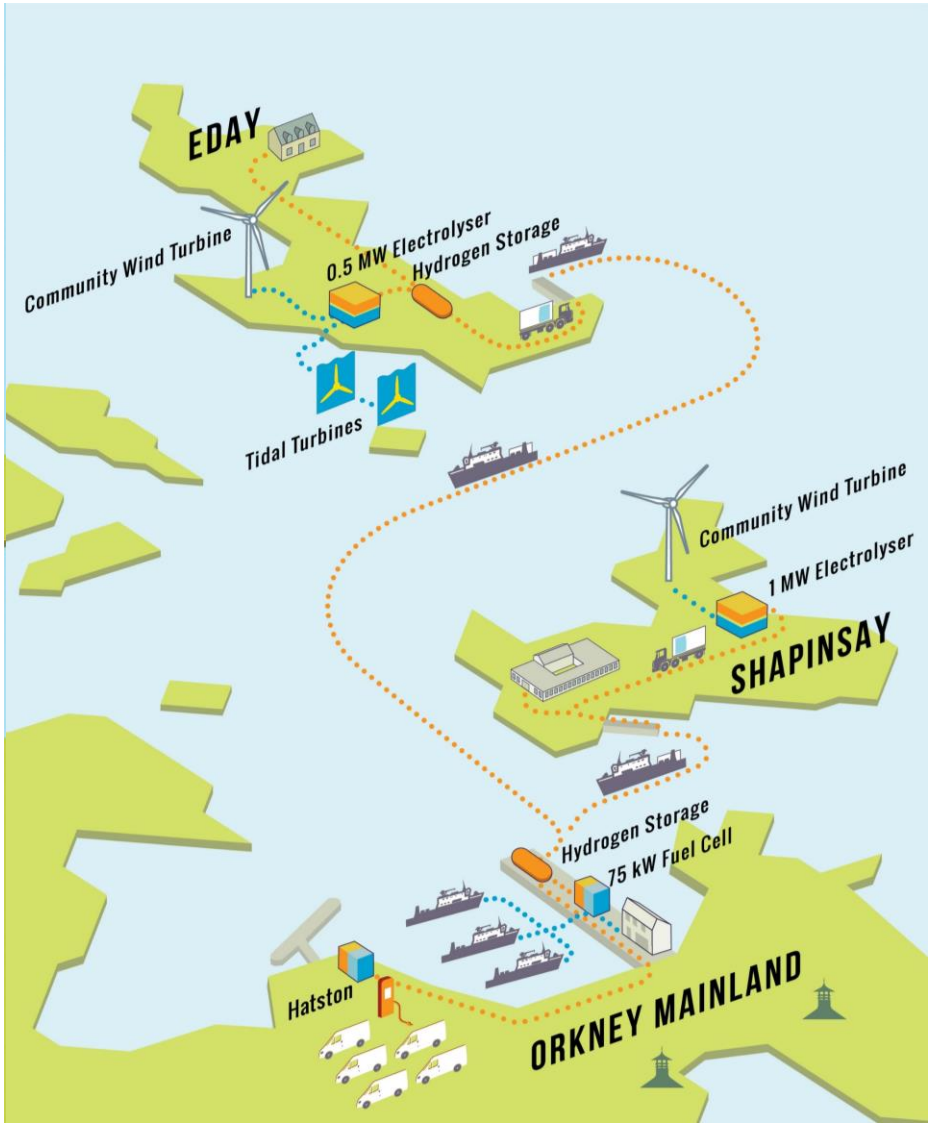

We are working to navigate and influence regulation

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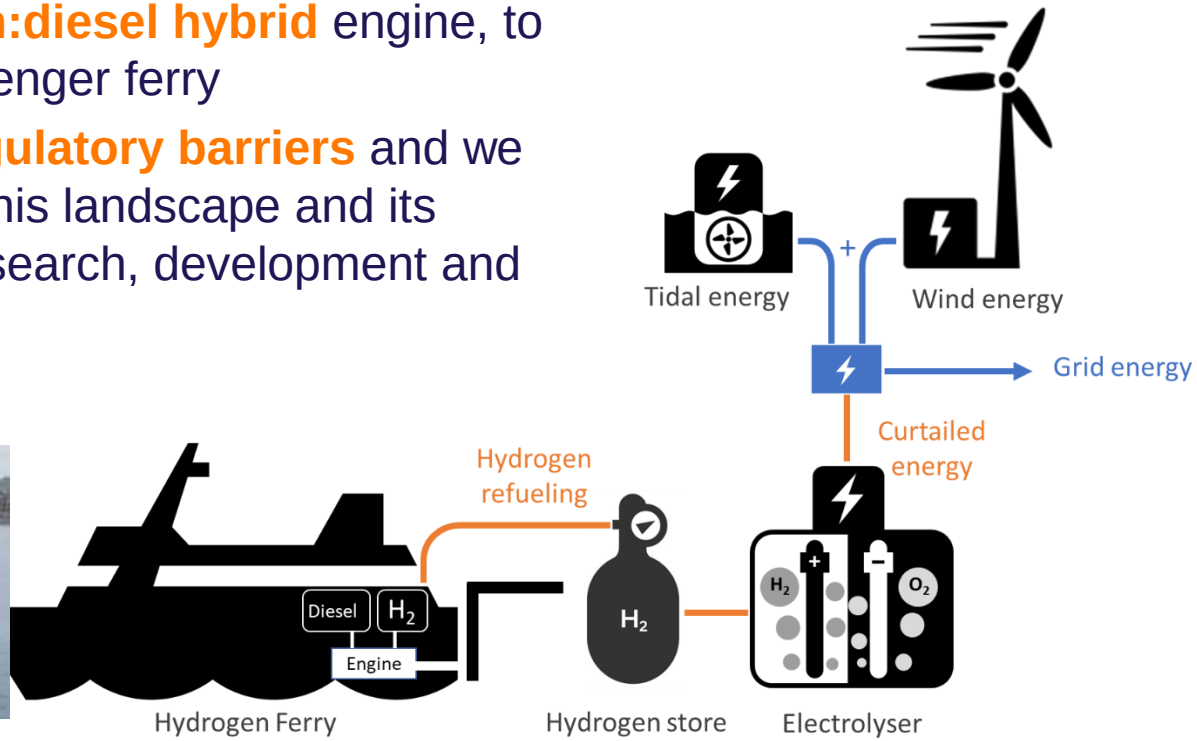
HyDIME: 'hydrogen diesel injection in the marine environment'

- This project has focussed on ystems 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

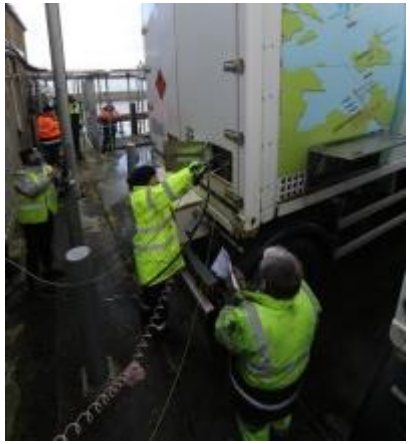


Orkney Islands Council · ULEMCo ultra low emission mileage company limited · Ferguson Marine · HSMI A Manufacturing Innovation Institute · Lloyd's Register · UKRI Innovate UK

Three main focus areas

Informing regulatory evolution

Equipment and technical solutions



Training and working practices

Regulation is vital in keeping maritime activities safe

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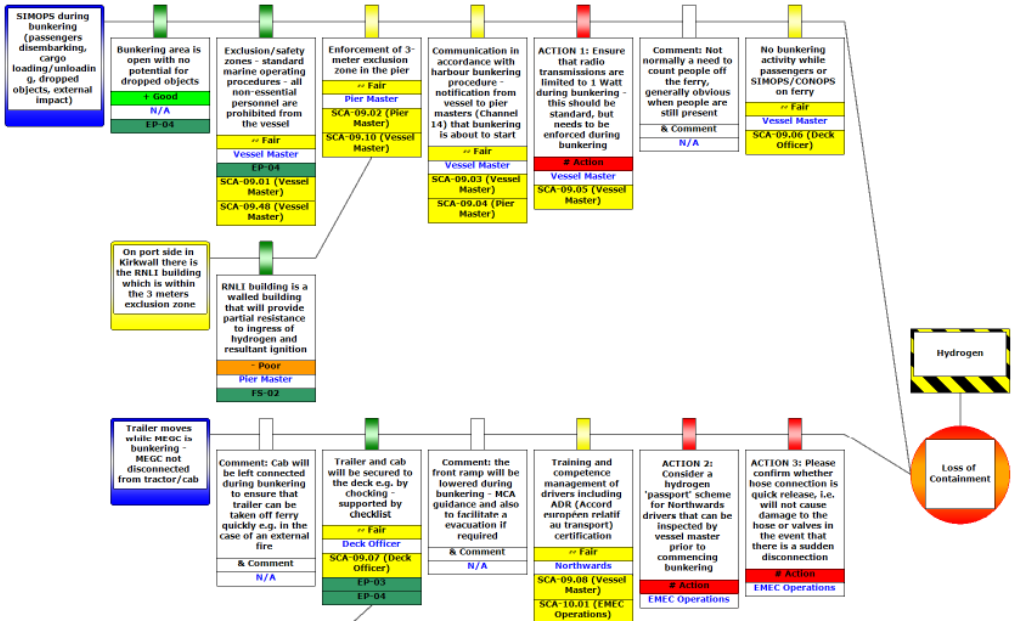
… but it can also make innovation difficult – and interesting!

5 day HAZID then 5 day HAZOP → MCA not engaged → Retrofit begins → MCA: "engine is not type approved" → Drama and problem solving → Bunker Bow Tie Risk assessment → 5 day task-based HAZOP → Trials document → Sea trial?



Technical solutions can be made inherently safer

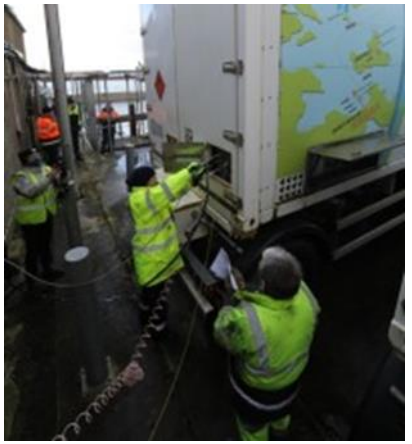
We have leveraged expert input in designing technical solutions to **handle hydrogen safely** onboard vessels

- We operate **bespoke multiple-element gas container trailers**, designed for island roads and shipping
- We use **WEH Quick Connectors** on trailers and all H_2 equipment in Orkney
- Innovative design for **storage below deck TCS** (tank containment space)

Training reduces operational risk

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**



ORKNEY ISLANDS COUNCIL Ferry Services

University of the Highlands and Islands Orkney College

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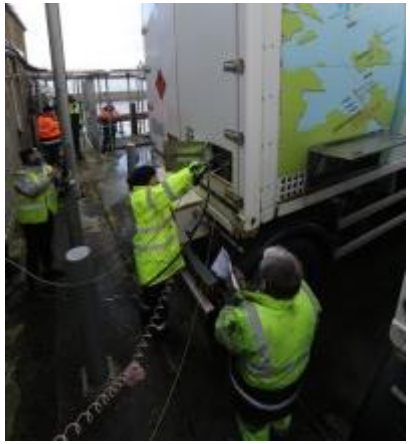
Conclusions

Three main focus areas

Informing regulatory evolution

Equipment and technical solutions



Training and working practices

Orkney is a great place to test future maritime technologies

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E4tech
Strategy | Energy | Sustainability

Clean Maritime Clusters Research Study

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)

Port	Low cost renewable electricity	Local demand for hydrogen for marine use	Proximity to an oxygen consumer	Proximity to adjacent hydrogen demand	Planned electrolyser projects	Potential hydrogen from renewable electricity cluster
Aberdeen						✓
Clyde						✓
Forth						✓
Holyhead						✓
Lerwick						✓
London						✓
North West						✓✓
Orkney						✓✓

Source: E4Tech and University Maritime Advisory Services, Clean Maritime Clusters Research Study, 2021.

... and we are realising that future together with various partners

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All of our work is rooted in partnership

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Thank you for your attention

Orkney Islands Council · Highlands & Islands Enterprise · Scottish Enterprise · The Scottish Government · UKRI Innovate UK · Department for Business, Energy & Industrial Strategy · FCH Fuel Cells and Hydrogen Joint Undertaking

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