SURF 'N' TURF

Tide | Wind | Hydrogen

Orkney's already on the way to a clean fuel future

The Surf 'n' Turf Project

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Community Energy Scotland
Empowering Communities

EDAY RENEWABLE ENERGY

ORKNEY ISLANDS COUNCIL

EMEC ORKNEY
The European Marine Energy Centre Ltd

ITM POWER
Energy Storage | Clean Fuel

Background to Orkney

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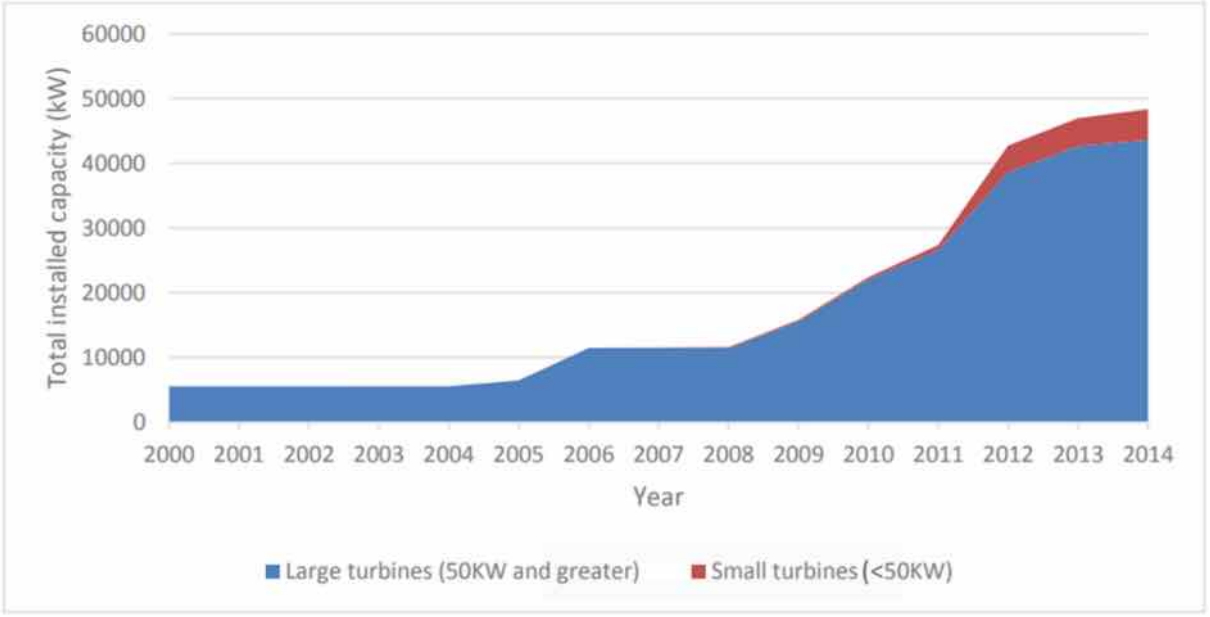
- Archipelago of 70 or so islands and skerries
- High level of natural history, scenic, and heritage
- Farming > Fishing/Shipping > Tourism (Cruise)
- 21 inhabited islands
- Pop. c.20,000, 80% on main island, “Mainland”
- Total population increased slightly over last 40 years
- Dropped by nearly 40% outside of Mainland
- Other Isles split into North and South Isles
- South Isles include Flotta Oil Terminal and Scapa Flow
- North Isles divided into inner and outer
- All have internal ferry, outer North have air services

Renewables in Orkney

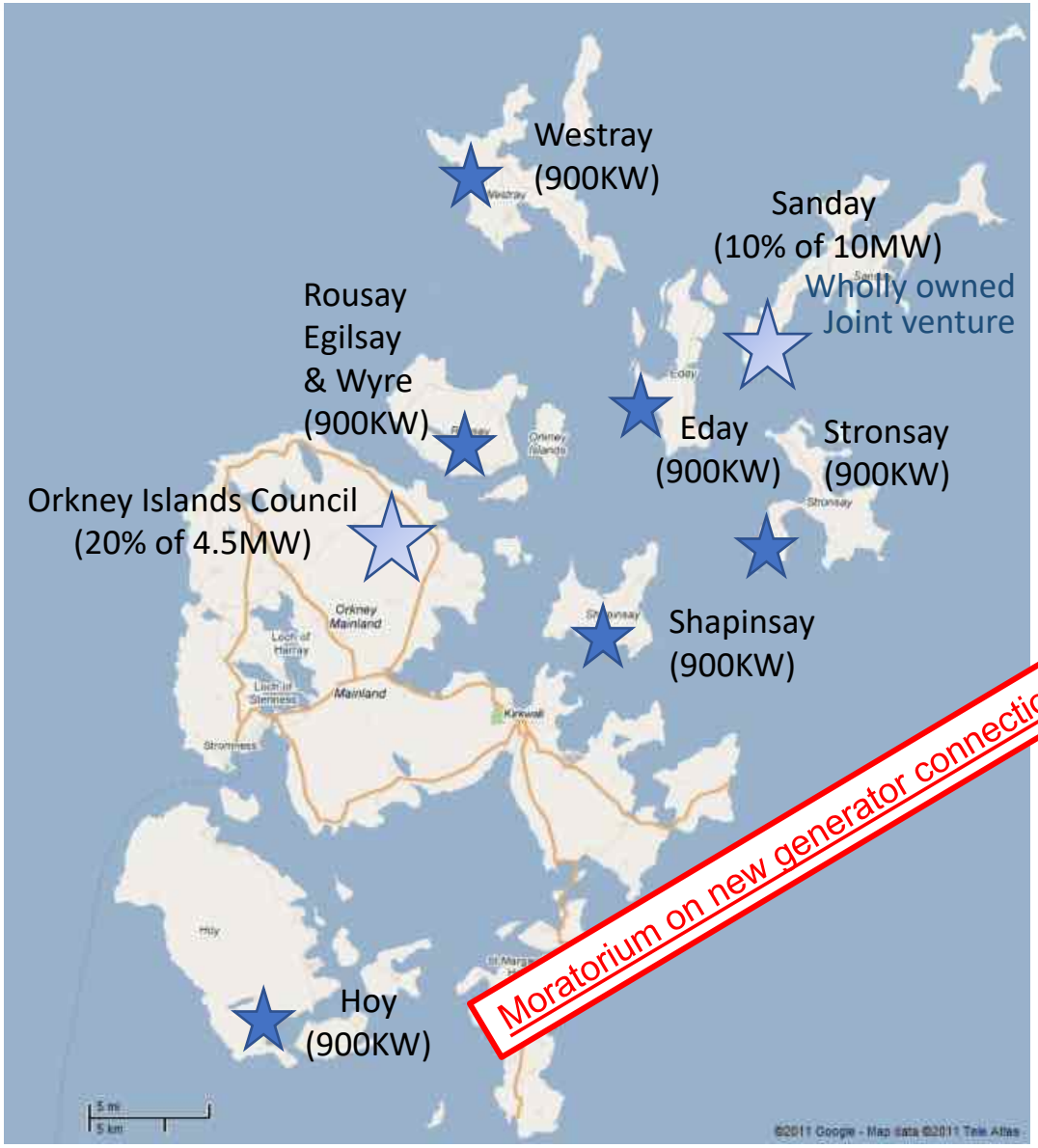
- Over 100% of Orkney's electricity from Renewables
- More than 50MW of installed renewable capacity
- 1000 renewable installations for 10,000 households
- Hosts the European Marine Energy Centre
- Potential for 1GW marine renewable energy
- But currently has significant grid constraints



By 2014 Orkney was generating over 100% of its annual electrical demand from Renewables

Orkney Large-scale Community Owned Wind Turbines

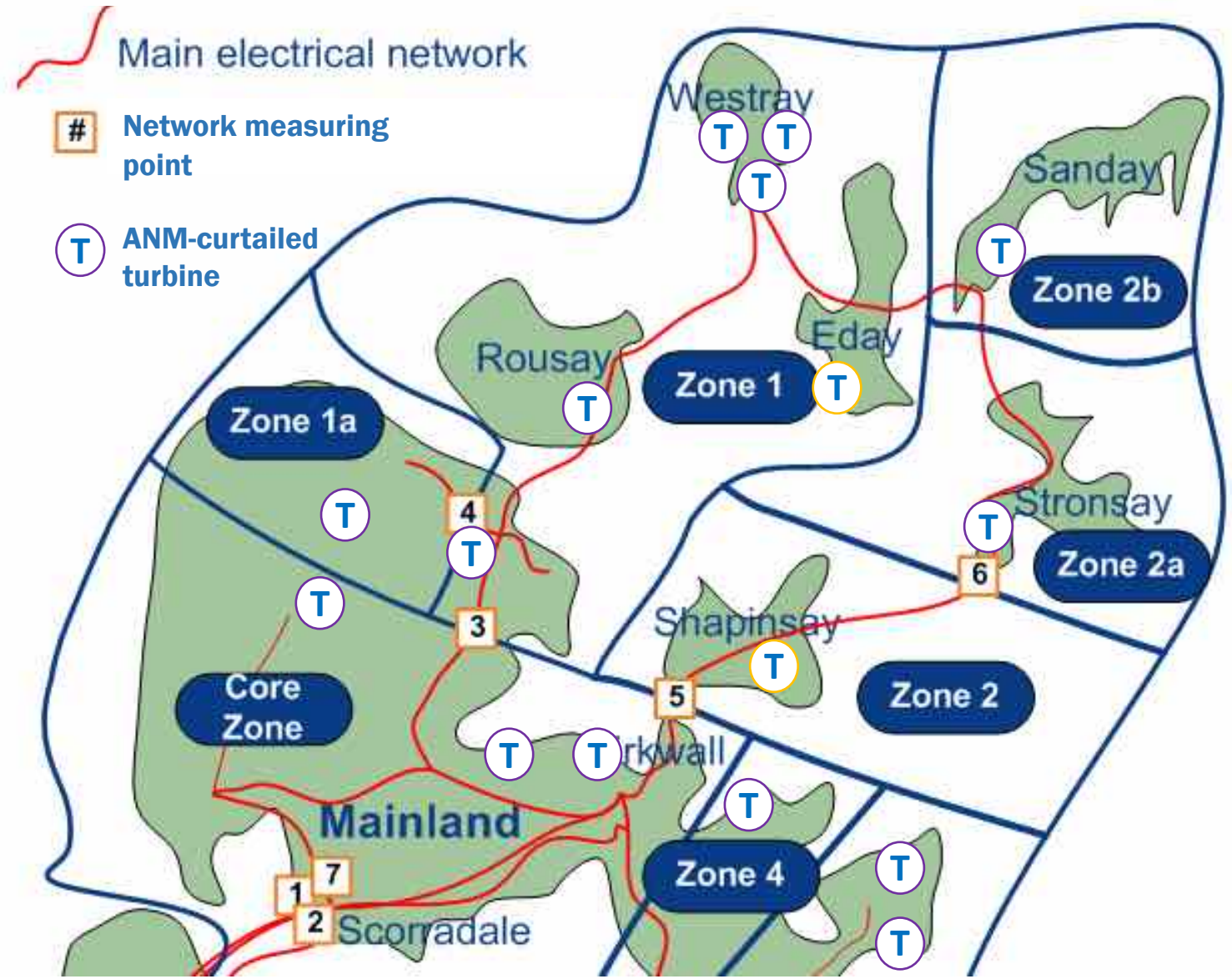
Community Energy Scotland
Empowering Communities



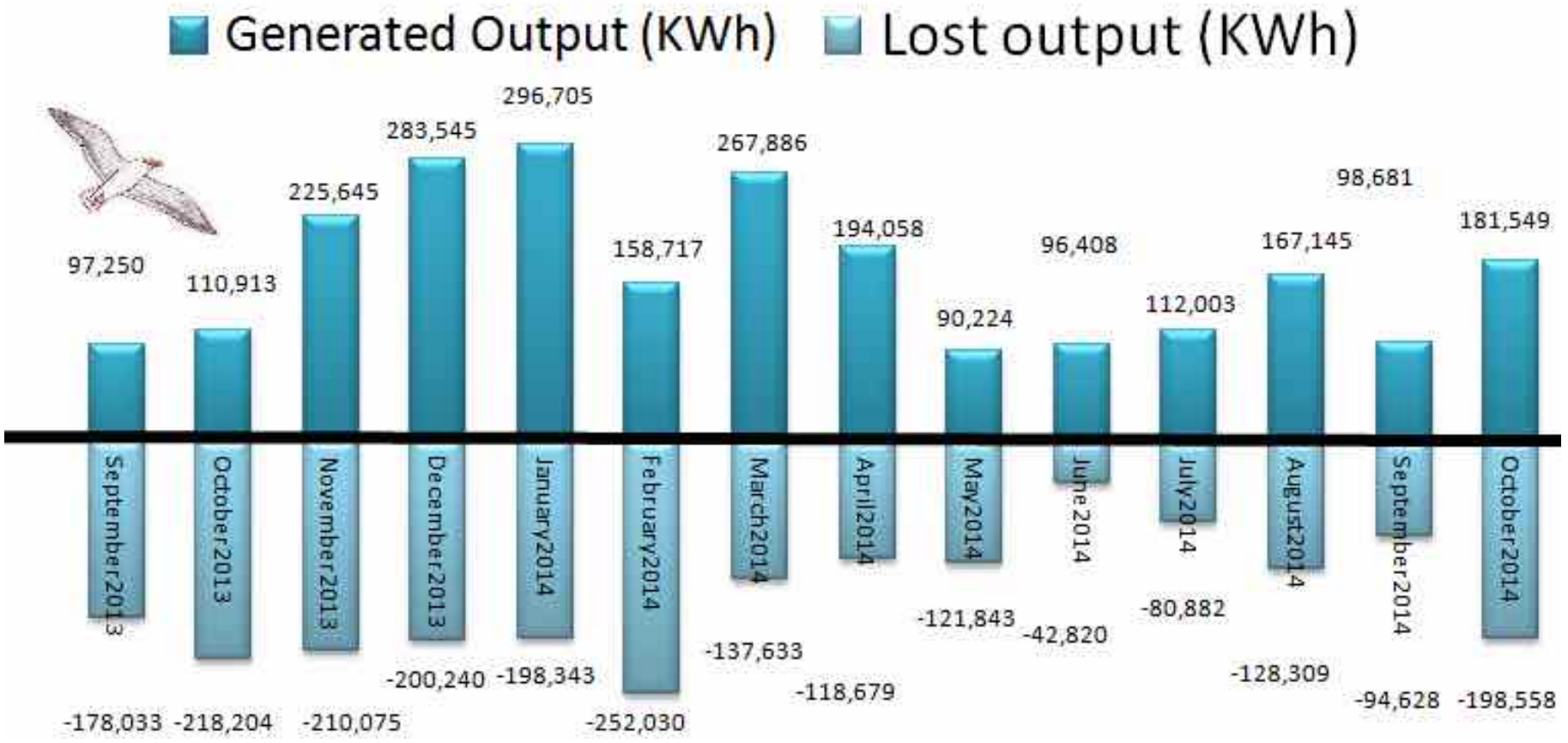
Total Installed: c. 7.3MW

All but Westray –
ANM/New Non-firm Connections

Orkney Smart Grid Zones



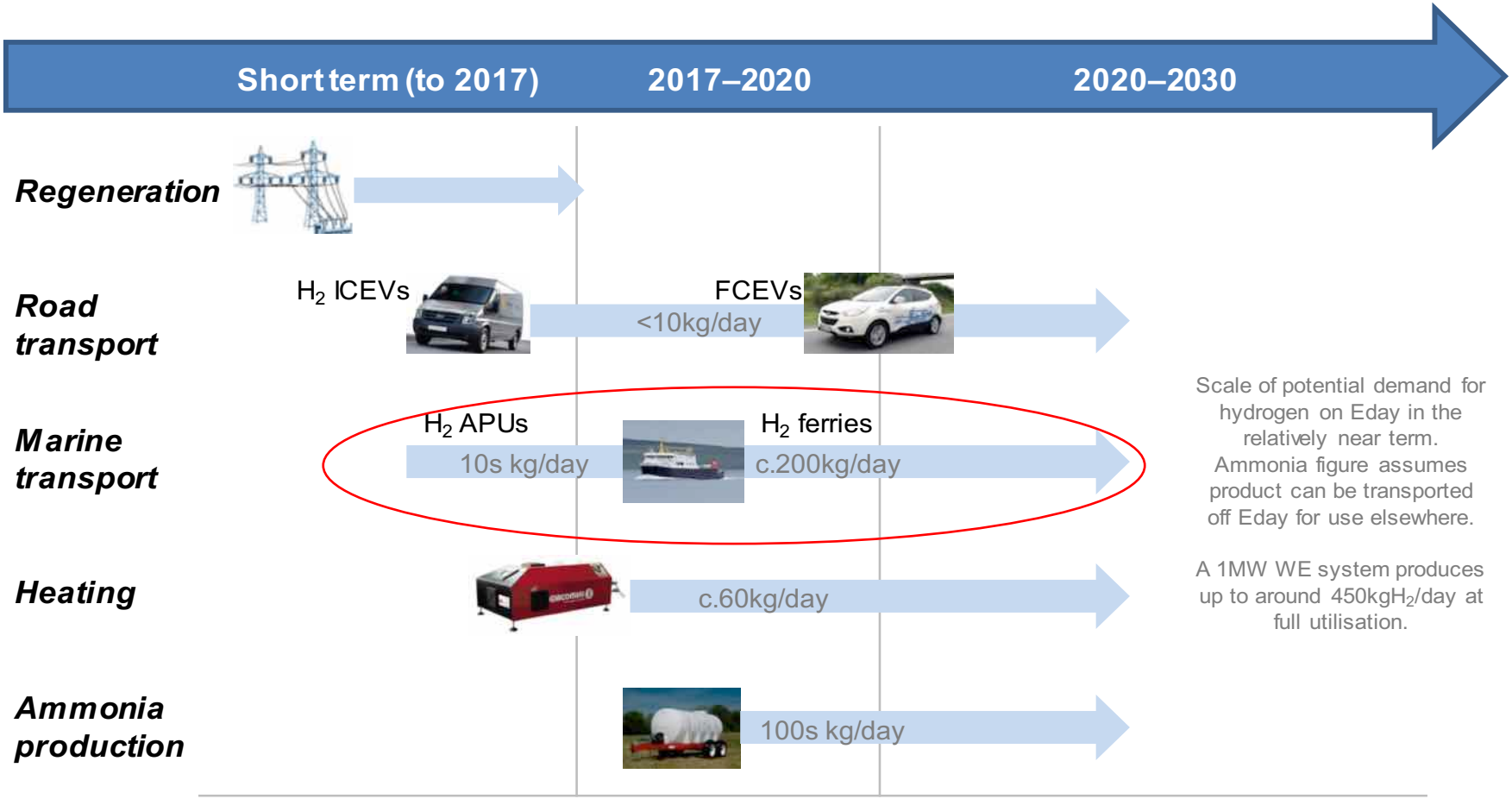
Eday's Iceberg Graph: Generation vs. lost generation



> £250,000 prevented

Courtesy Andrew Stennett, ERE

Element Energy H_2 Supply Options studies



Scale of potential demand for hydrogen on Eday in the relatively near term. Ammonia figure assumes product can be transported off Eday for use elsewhere.

A 1MW WE system produces up to around 450kgH_2/day at full utilisation.

ICEV = internal combustion engine vehicle, FCEV = fuel cell electric vehicle, APU = auxiliary power unit

Ferries energy use

- Orkney Islands Council reviewing energy use for ferries
- 9 vessels across Outer and Inner Isles routes

- 10s of MWh of diesel a day ‘each’
- Lack of mature low-carbon propulsion technology
- 50kW Auxiliary Power Units & cold iron overnight

Surf ‘n’ Turf : Moving Clean Energy as H2

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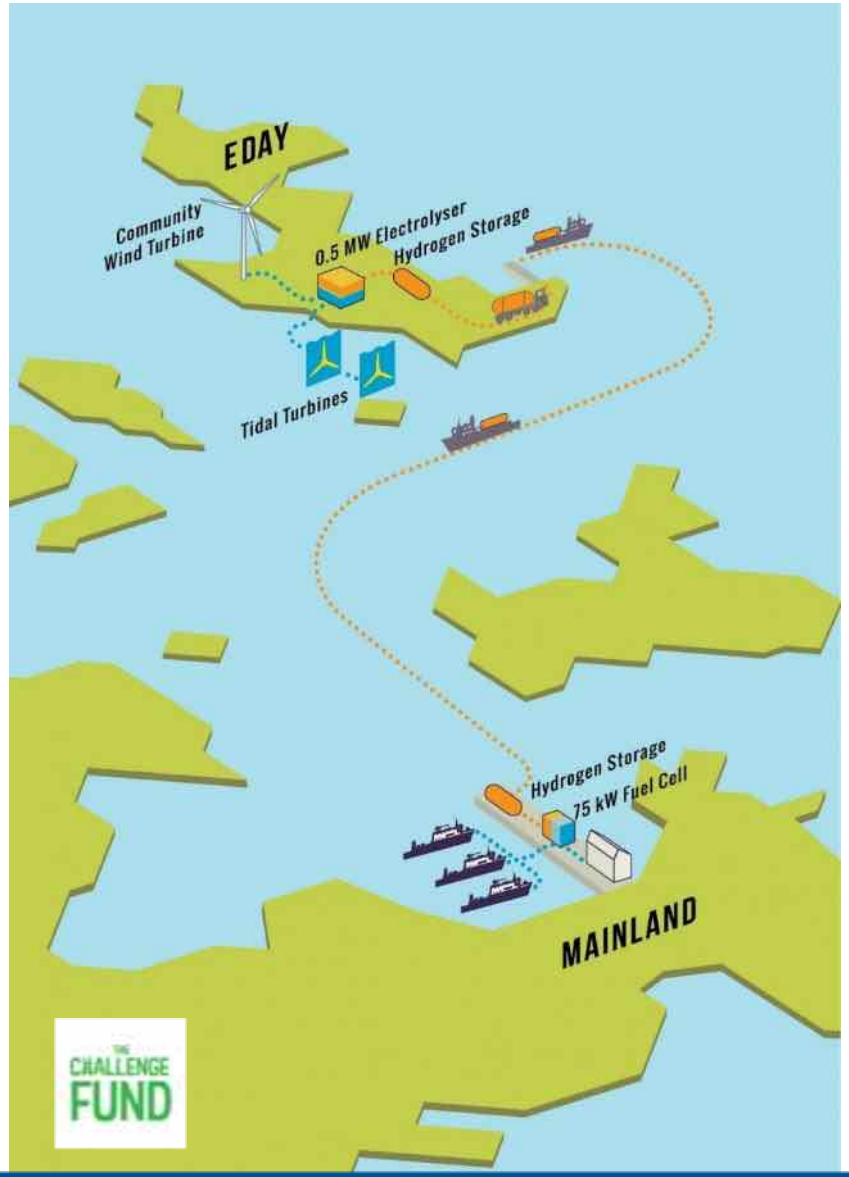
- Integrate the ERE wind to the EMEC electrolyser system
- Use mobile stores to transport the H2 between EMEC and Kirkwall Pier
- Run a fuel cell on the Pier making electricity to cold iron the ferries and supply the local harbour.
- Adapt the FC so it is like one on a ship, then equip and run it as a H2 training unit



EMEC Eday electrolyser

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Generation – tide and wind

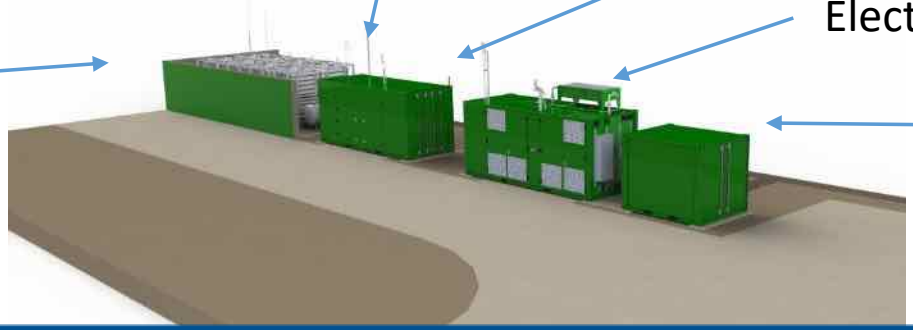
Local demand - electrolyser

Buffer Store

Compressor

Electrolyser

High pressure store



Transformer

Hydrogen moved by mobile storage units

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Fuel Cell and compound

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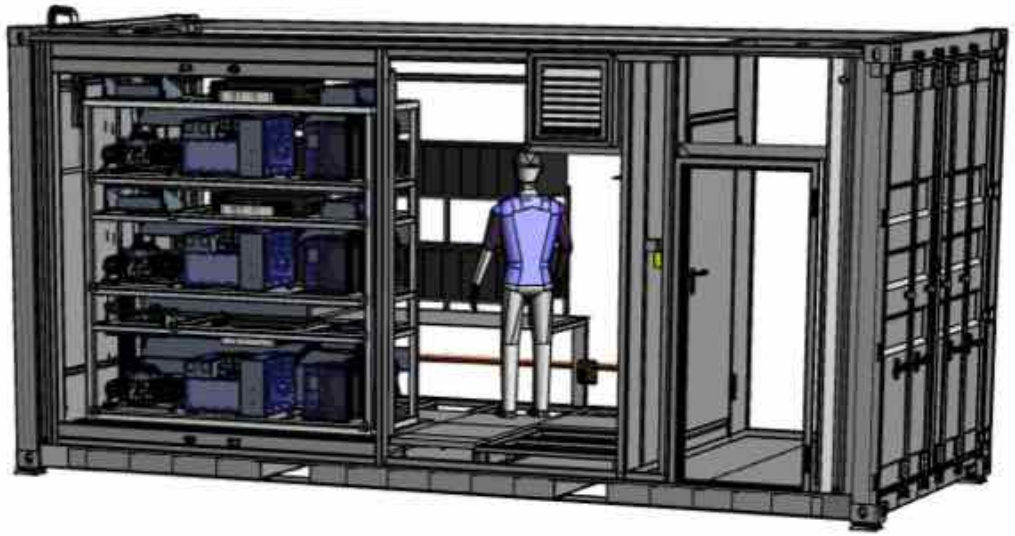

CHP with waste heat

Surf ‘n’ Turf Launch 27th Sept 2017

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Building Innovative Green Hydrogen systems in an Isolated Territory: a pilot for Europe

The BIG HIT Project

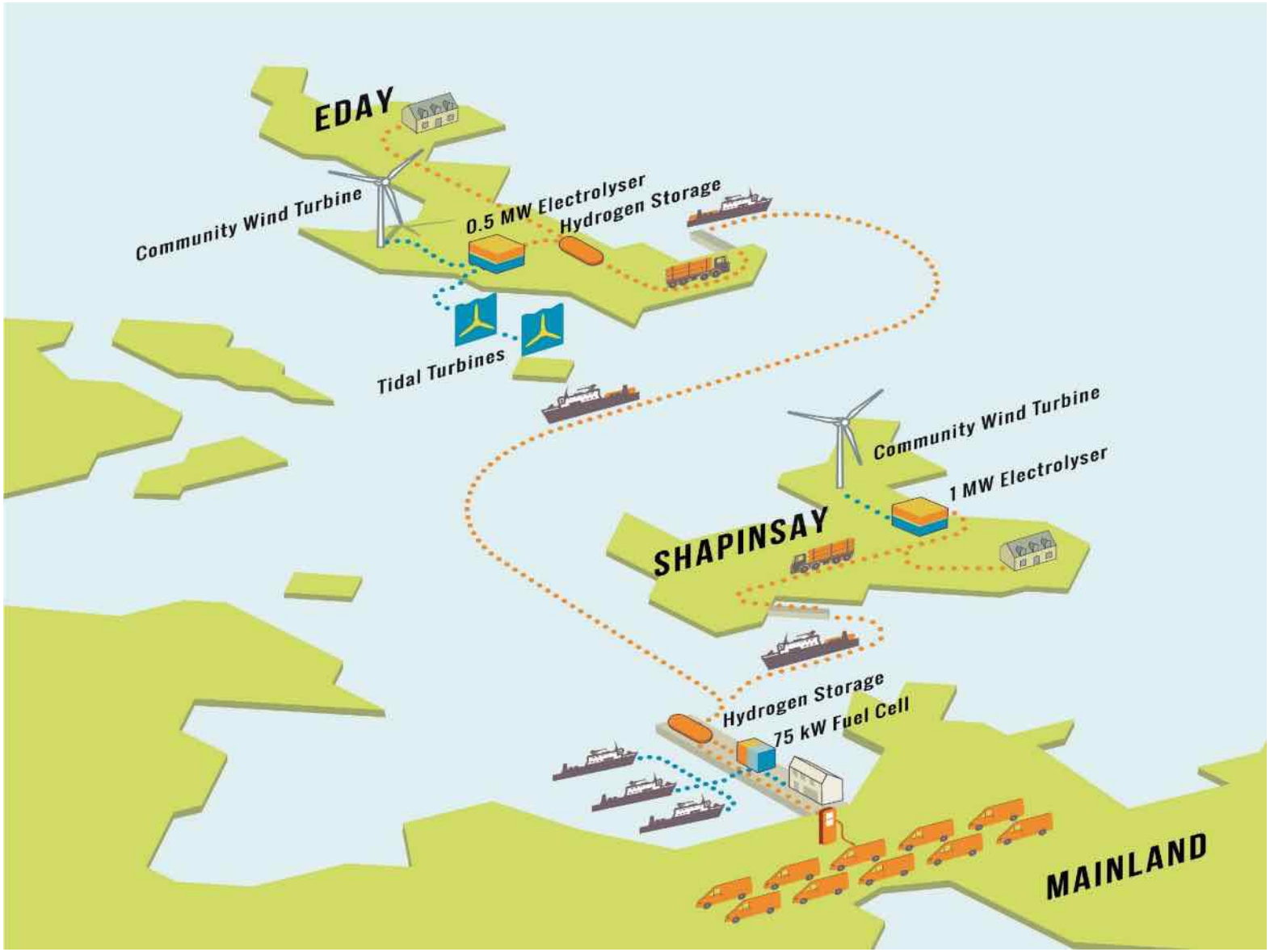
Surf ‘n’ Turf to BIG HIT

Shapinsay’s 0.9MW local wind turbine

Green H2 for Van Fleet

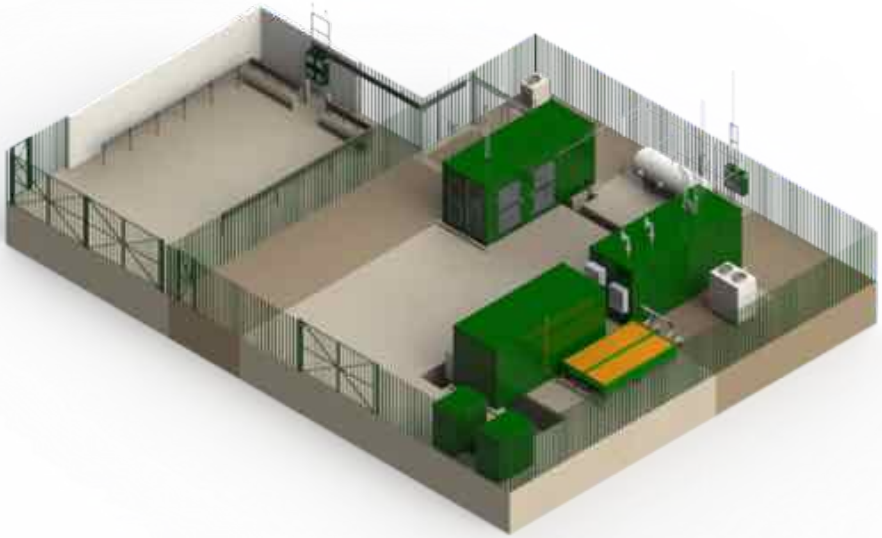
- BIG HIT adds a 1MW electrolyser on Shapinsay to produce green hydrogen from constrained community turbine.
- Supply hydrogen for fleet of hydrogen range extended EV vans in Kirkwall, also into heating for school on Shapinsay.
- Help overcome local grid constraints, add local value.
- €5m EU grant support from FCH 2 JU.

Solutions deployed

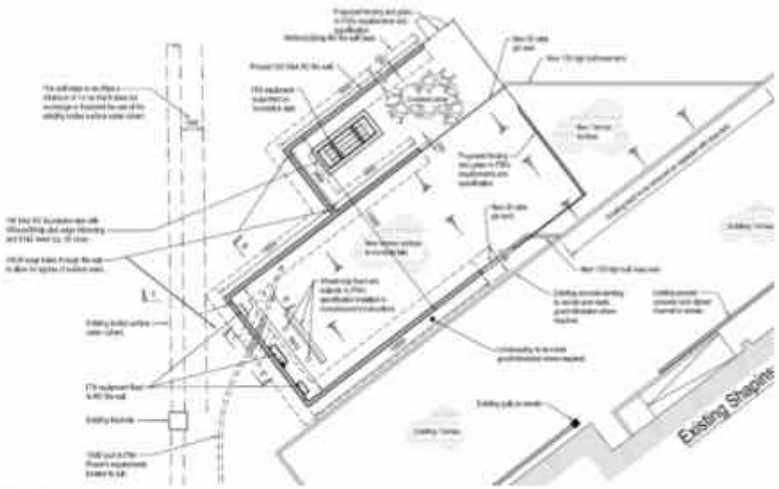


Present situation

Shapinsay electrolyser site



Shapinsay school

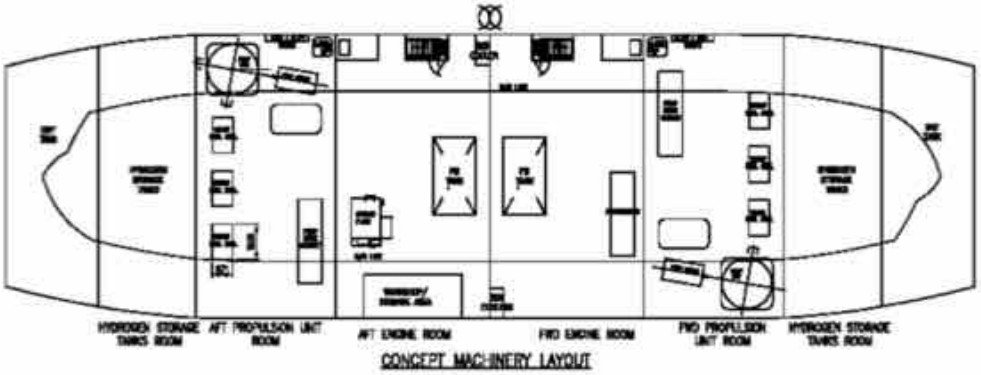


Kirkwall hydrogen refuelling station

What next in Orkney? H2 Ferry…

CMAL's MV Hallaig diesel-electric hybrid ferry undergoing sea trials in August 2013

- CMAL's diesel-electric hybrid ferry – built in Port Glasgow, Scotland
- Capable of carrying 22 cars or 2 large lorries
- Hydrogen evolution design undertaken



HySeas H2 Ferry design supported by Scottish Enterprise