Future Fuels

SCOTTISH MARITIME CLUSTER

November 2020

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CMAL
Caledonian Maritime Assets Ltd
Stòras Mara Cailleannach Eta

CMAL

BACKGROUND

- CMAL (Caledonian Maritime Assets Ltd.)
- Owned by the Scottish Government
- Scotland has declared a "Climate emergency"
- Own the ferries, ports and harbours and infrastructure necessary for vital ferry services across the west coast of Scotland, Clyde estuary and Northern isles

VESSELS

- 31 vessels are leased to CalMac on the West coast of Scotland
- 5 vessels are leased to Serco Northlink Ferries for Orkney and Shetland routes

PORTS AND HARBOURS

- 26 Harbours

Vessel replacement planning

Within the next decade, CMAL hope to replace;

CALMAC VESSELS

- 7 'Loch Class' vessels
- 3 'Sound route' vessels
- 6 Major Vessels + 2 under construction
- 3 Passenger vessels

NORTHLINK VESSELS

- 2 Freight vessels

Hybrid Diesel Electric Battery Ferries

- World's first Hybrid Diesel Electric Ro-Ro passenger Vessels
- 3 now in operation across West coast
- LBP 39.9m, 12.3m breadth, 17.3m draught
- 23 cars, 150 passengers

- Current reduction in CO_2 emissions of approx. 30% on the Hallaig
- 750 kWh's of installed batteries
- More suitable for smaller vessels

Next Generation

- Hallaig developed 2012
- 3 vessels based on battery technology at the time
- Battery technology has improved
- Energy density and weight improvements have been made
- Creating an opportunity for a longer working day
- Future ambitions for fully electric vessels, do we need to charge during working day or can we achieve with overnight charging?
- Dependent upon green energy (preferably) being available at overnight berths (mainland and island based)

Electrification; Challenges

- Vessel Route selection
- Shoreside power
- Shallow waters
- Vessel dimensions and shoreside infrastructure
- Battery technology still developing and will be improved further

Dual Fuel LNG Ferries

- Two currently under construction at FMPG
- Can run on MGO or LNG
- LNG is classed as a transition fuel

- CO_2 Emissions reduction in comparison with traditional MGO Vessel expected to be approx. 20%.
- Vessel route, dimensions, speed/power need to be considered

LNG Challenges

- LNG availability of supply
- HSE Approval
- Shoreside Infrastructure
- LNG Onboard Infrastructure
- LNG Hazards

HySeas III

- CMAL pioneered HySeas I & II projects
- HySeas III project underway
- Concept design stage

- Project assessing viability of;
  - H_2 as a fuel
  - Landside infrastructure
  - Refuelling
  - Creating hydrogen from renewable energy

HySeas III

- Massive long-term potential
- Currently no distinct regulations
- On a wider scale, source of Hydrogen, not clear where from at this point. Green/Blue Hydrogen?

SUMMARY

Electric

- Shoreside Grid and Vessel Constraints
- Shoreside Infrastructure
- Energy density improvements

LNG

- LNG hub in Scotland
- Clearer guidance on HSE approval route for shoreside infrastructure

Hydrogen

- Source of Hydrogen? Green/Blue?
- Guidelines for the design of Hydrogen fuelled vessels
- Shoreside Infrastructure & Refuelling for small scale
- Onboard Infrastructure

RESponsible Energy Islands – Leading by example

Neil Kermode
Managing Director

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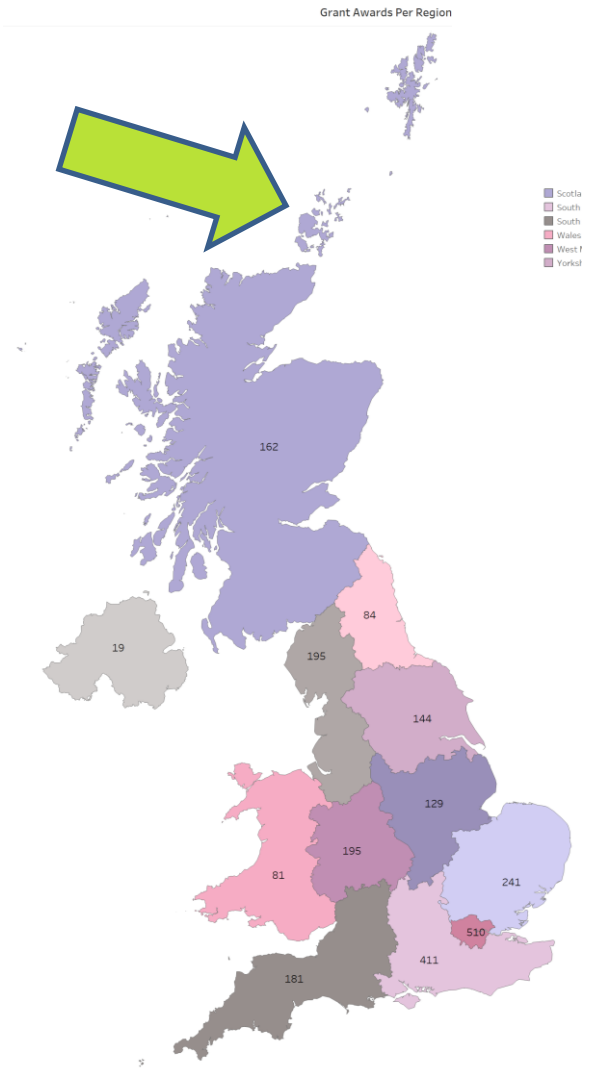
Orkney



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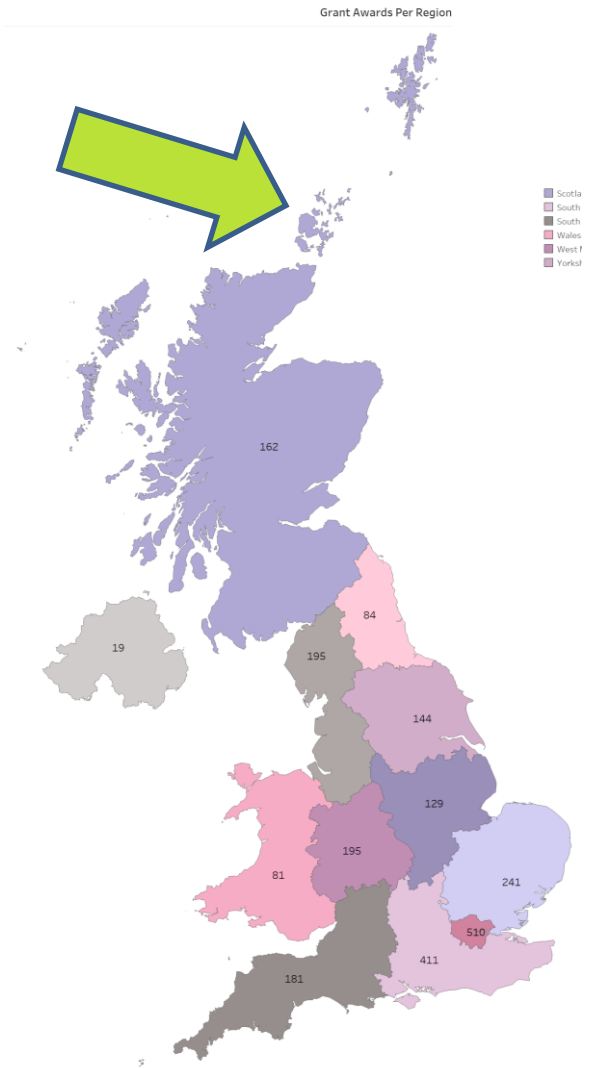
Orkney



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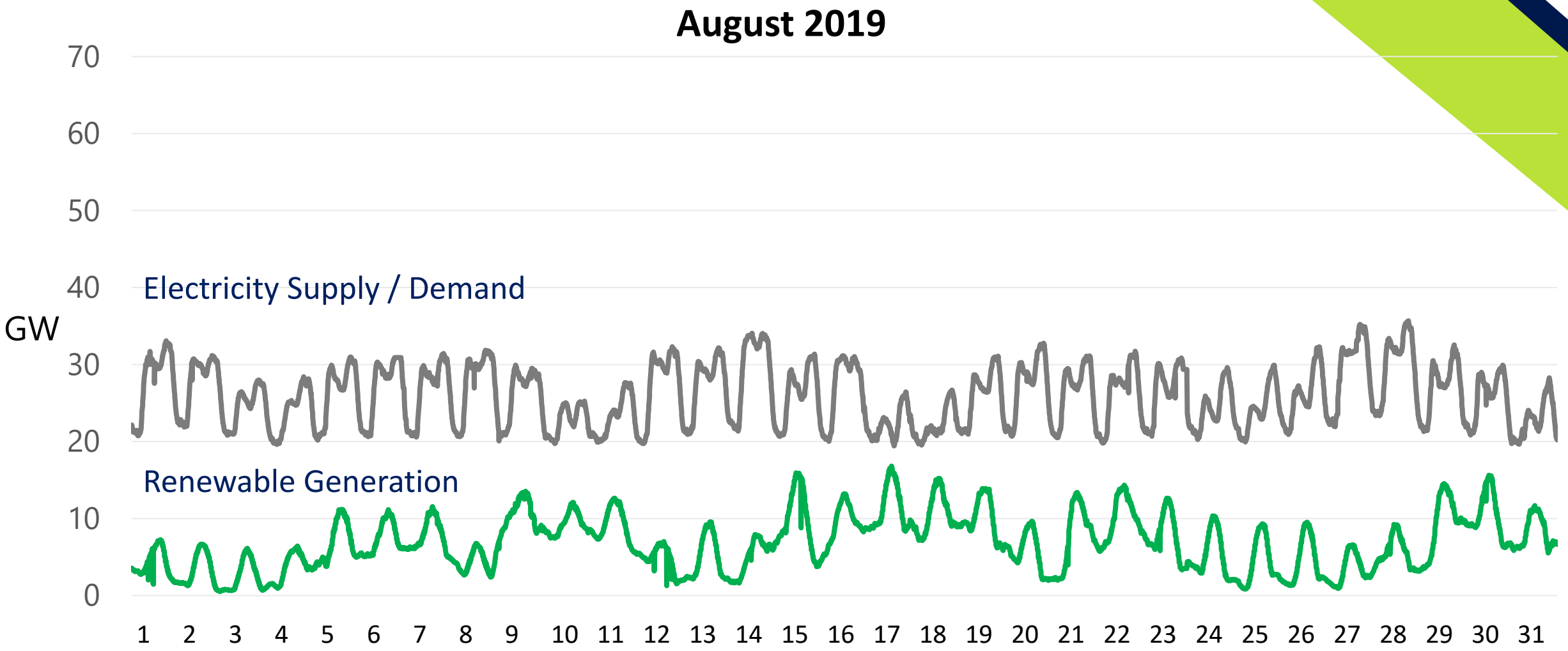
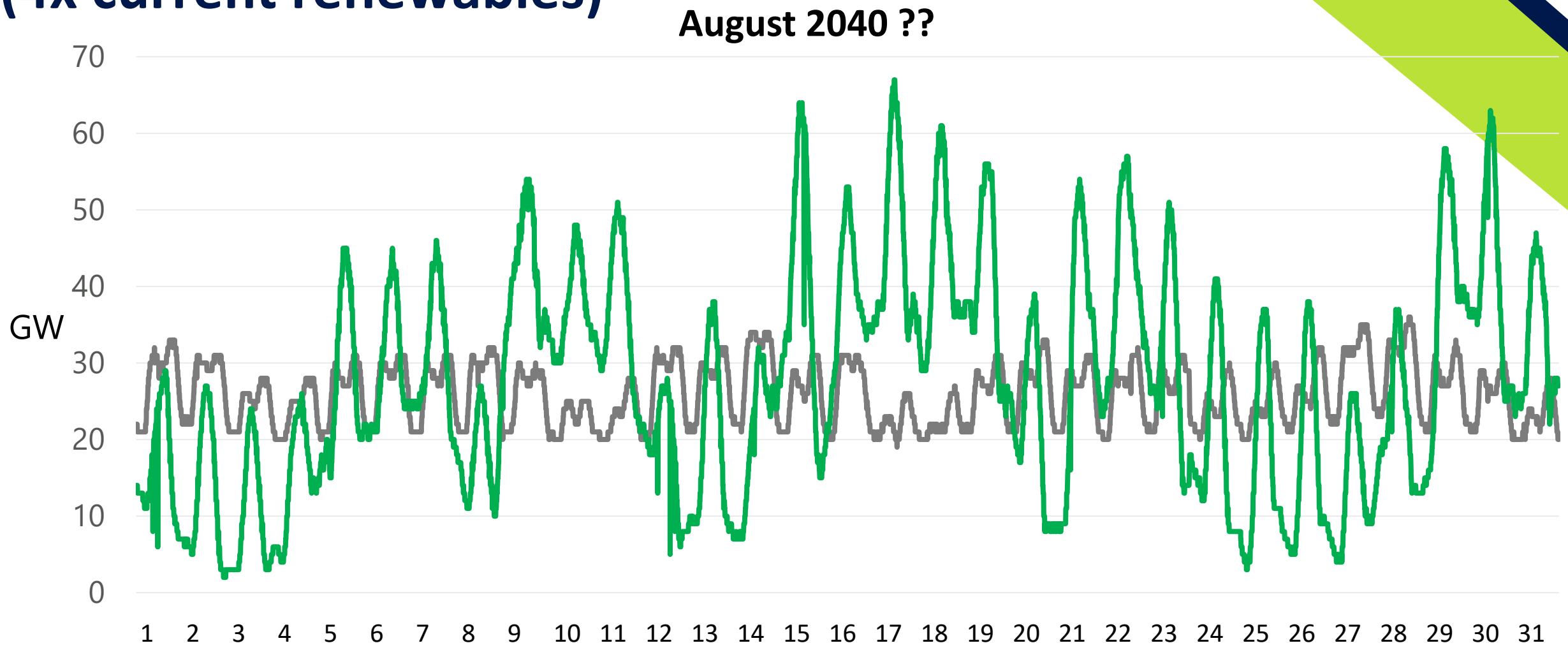
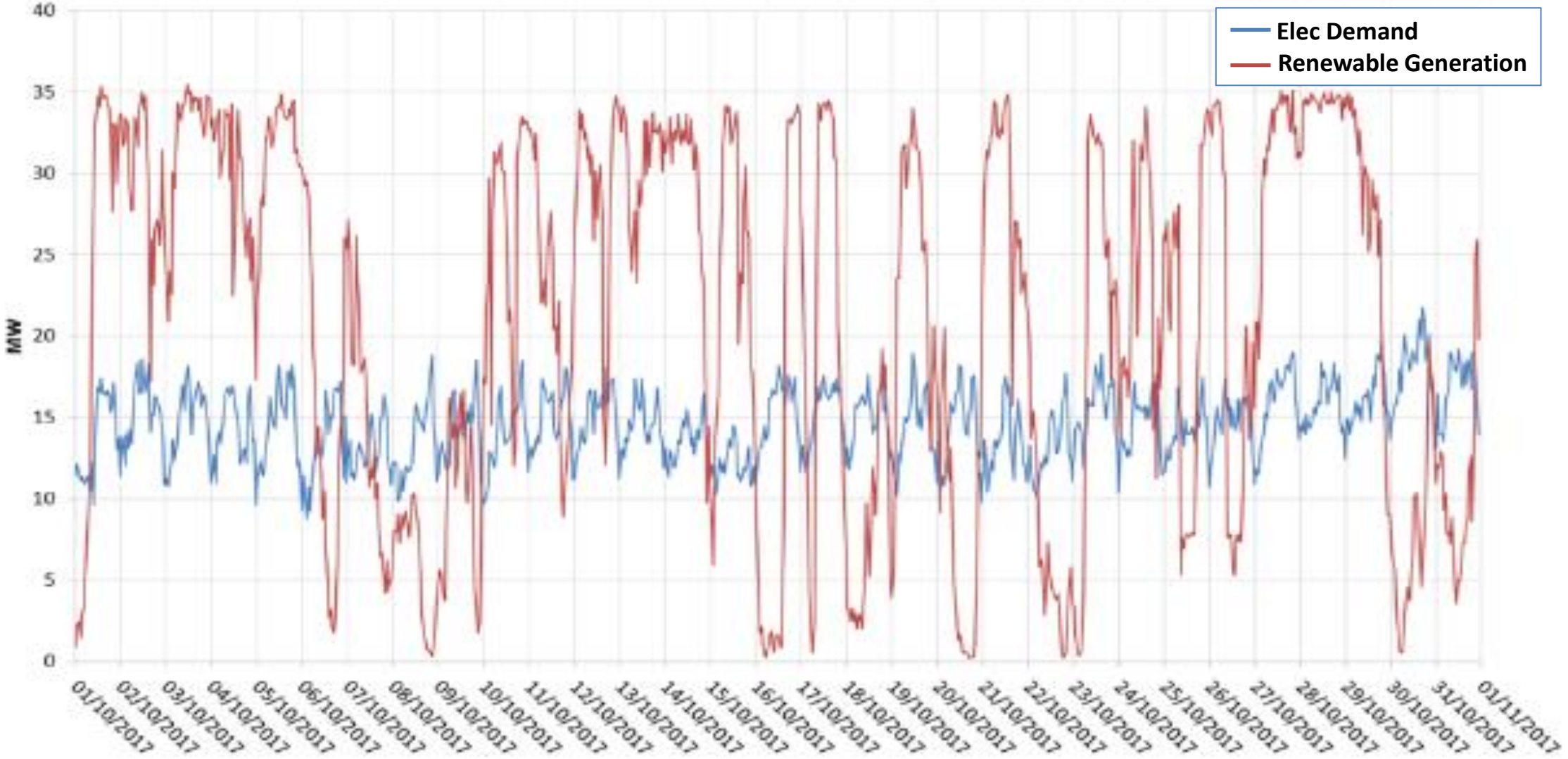
UK electricity system - today



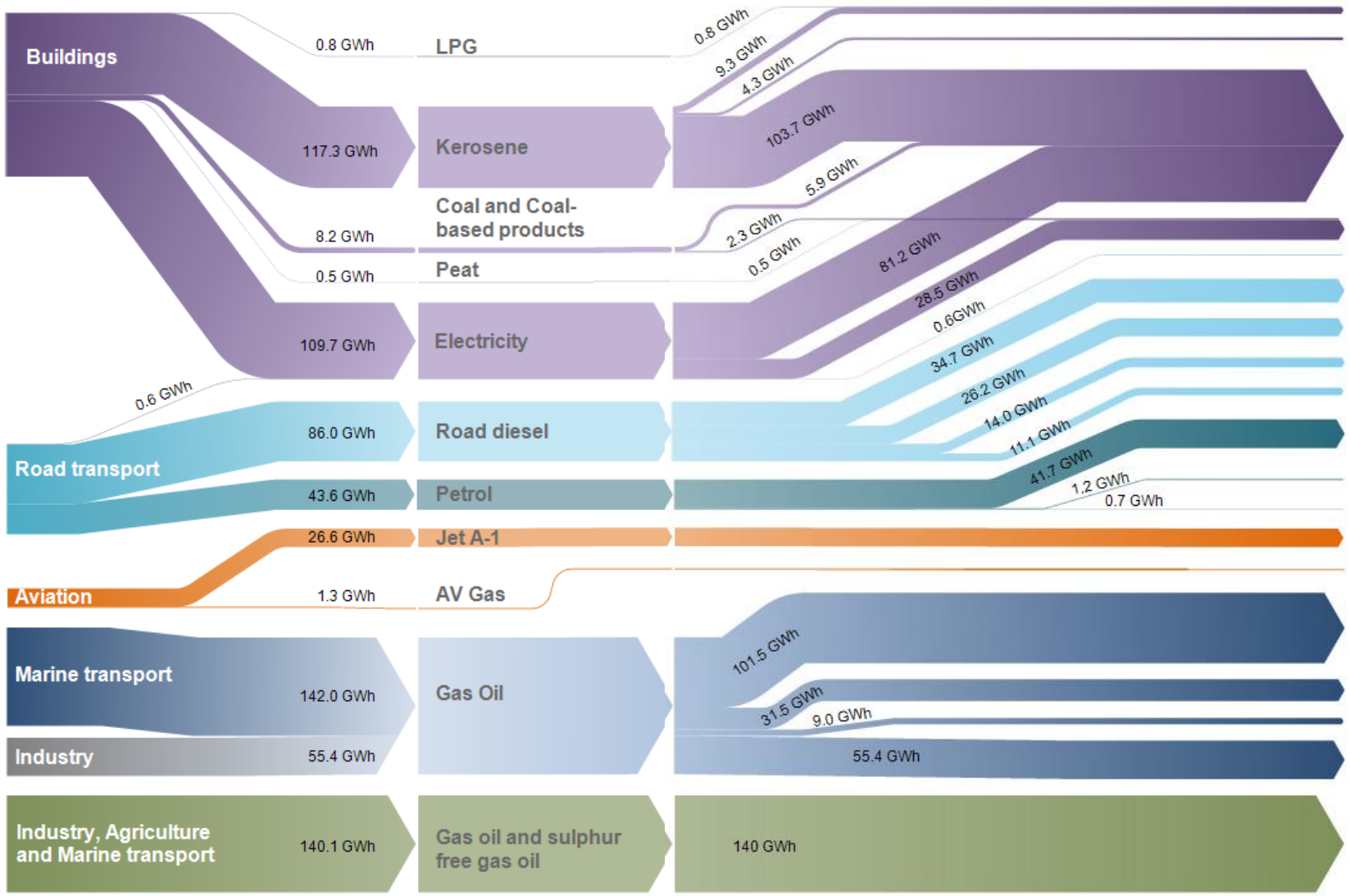
UK electricity system – 2040
(4x current renewables)



Orkney electricity system – today



Orkney Energy 2019



Public administration
Commercial
Domestic
Commercial and Industrial
Electric vehicles
Diesel cars
Diesel LGV
HGV
Buses
Petrol cars
Petrol LGV
Motorcycles
Off island flights
Inter island flights
Ferry services to the mainland
Inter island ferries
Towage and harbour craft
Crude oil processing
Industry, Agriculture and Marine transport

Heat & light

Transport (largely)

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1. Hydrogen from tides

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Orkney inter-island fleet

- 9 vessels = 2,800,000 litres of Gas Oil per year

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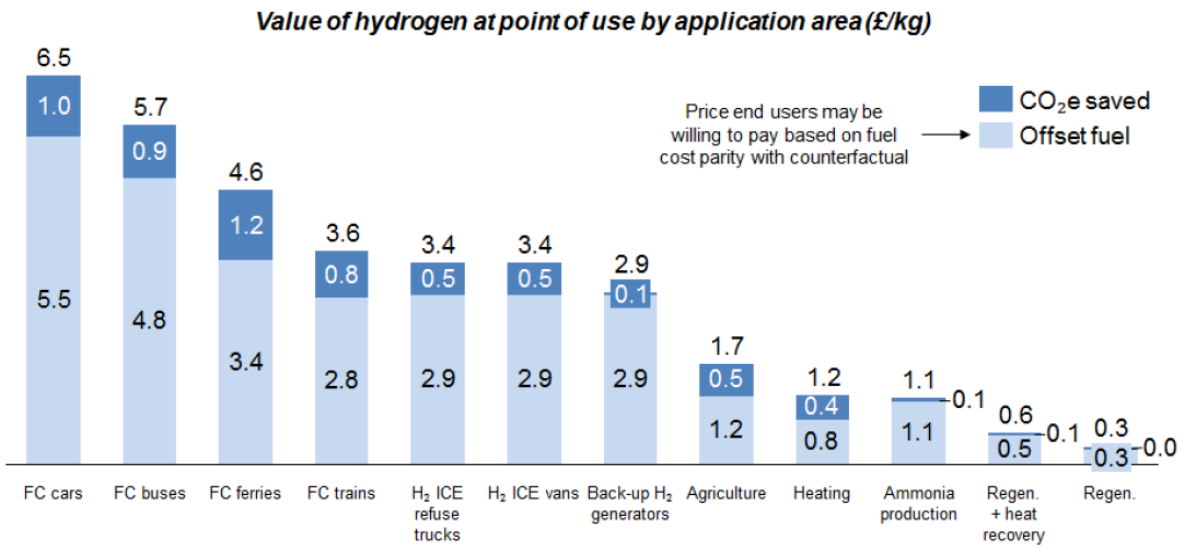
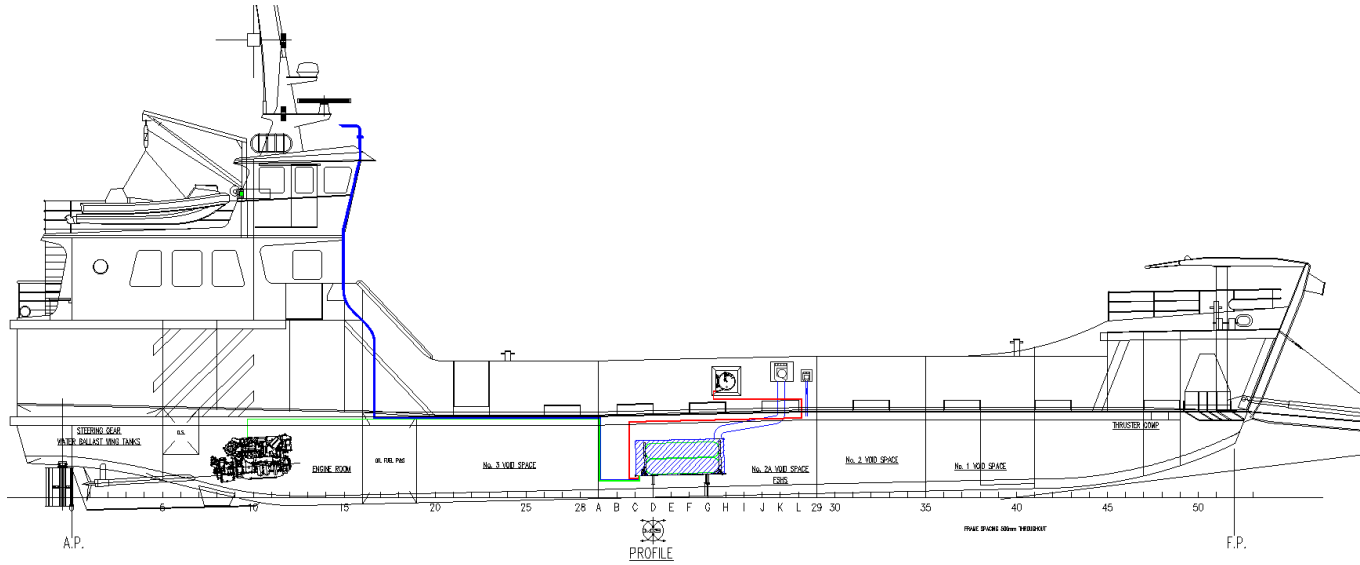
What have we been doing in shipping?

1. Make hydrogen
2. Transport it
3. Use it

- Surf n Turf – cold ironing - ashore
- Big Hit – (+vans and boilers)
- Hydyme – auxiliary power - afloat





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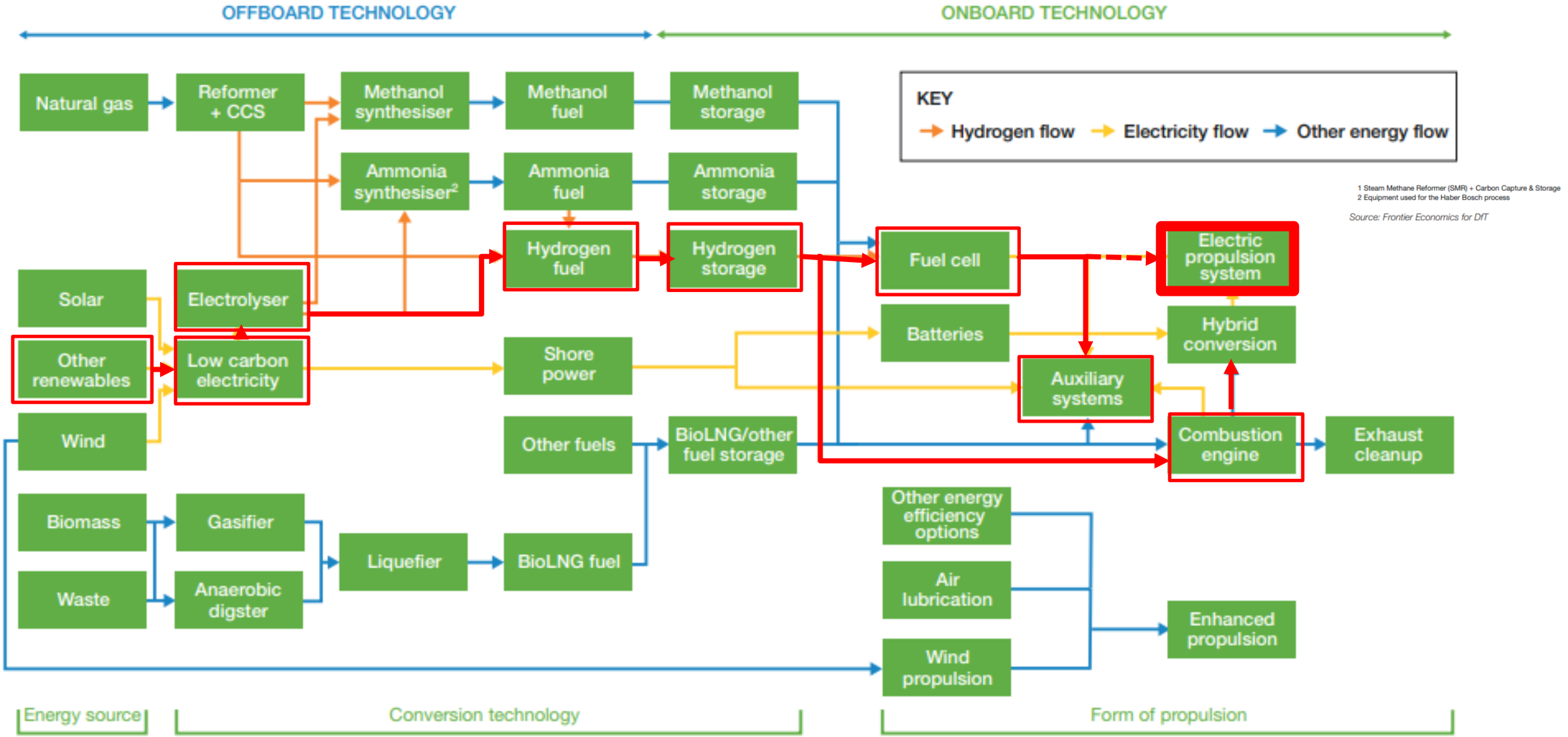
Fuel options



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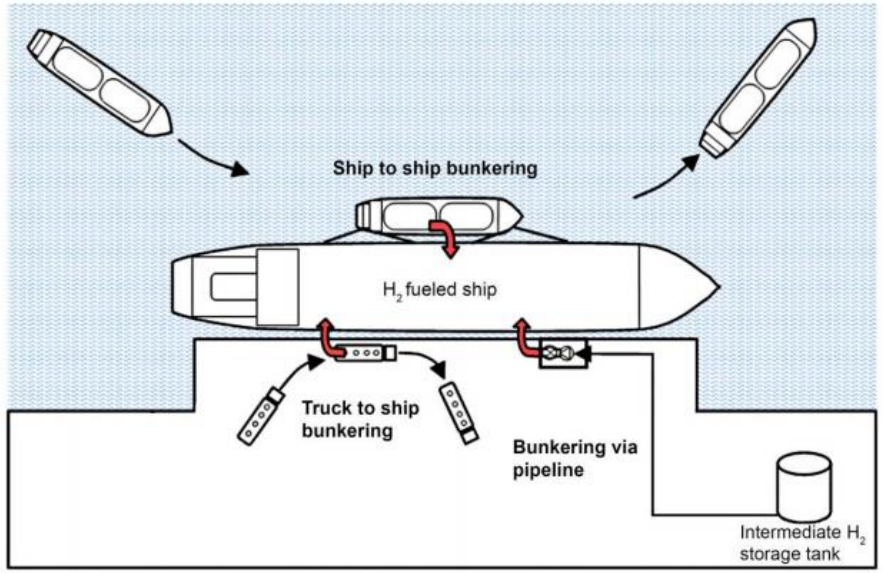
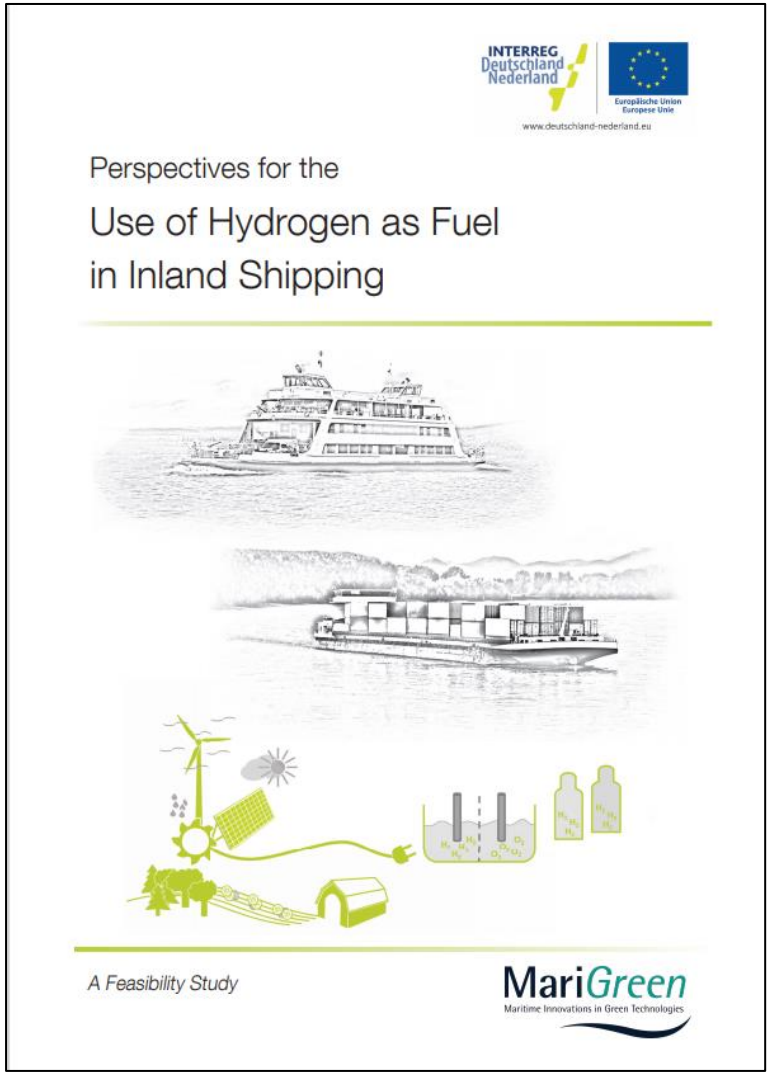
MariGreen



Operational Aspects	CH_2	LH_2	LOHC
Noise/vibration	++	+	+
Emissions (exceeding regulation)	n/a		
Range	-	+	+
Reliability	++	o	-
Easy bunkering	+	o	++
Cost per ton (or person) and km	+	o	-
Handling (crew competences)	+	o	-



http://marigreen.eu/wordpress_marigreen/wp-content/uploads/2018/11/Hydrogen-Feasibility-Study-MariGreen.pdf

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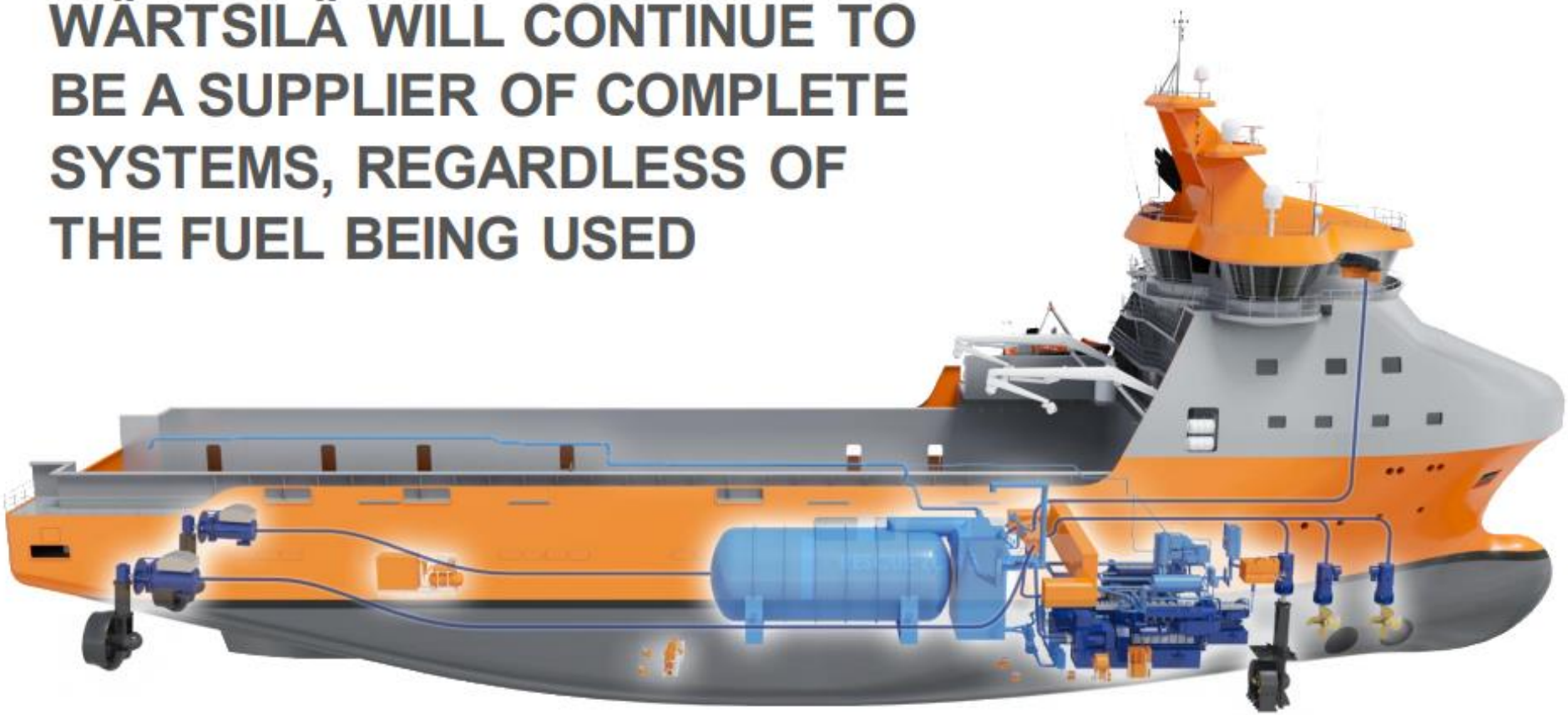
Industry

WÄRTSILÄ

WÄRTSILÄ WILL CONTINUE TO BE A SUPPLIER OF COMPLETE SYSTEMS, REGARDLESS OF THE FUEL BEING USED



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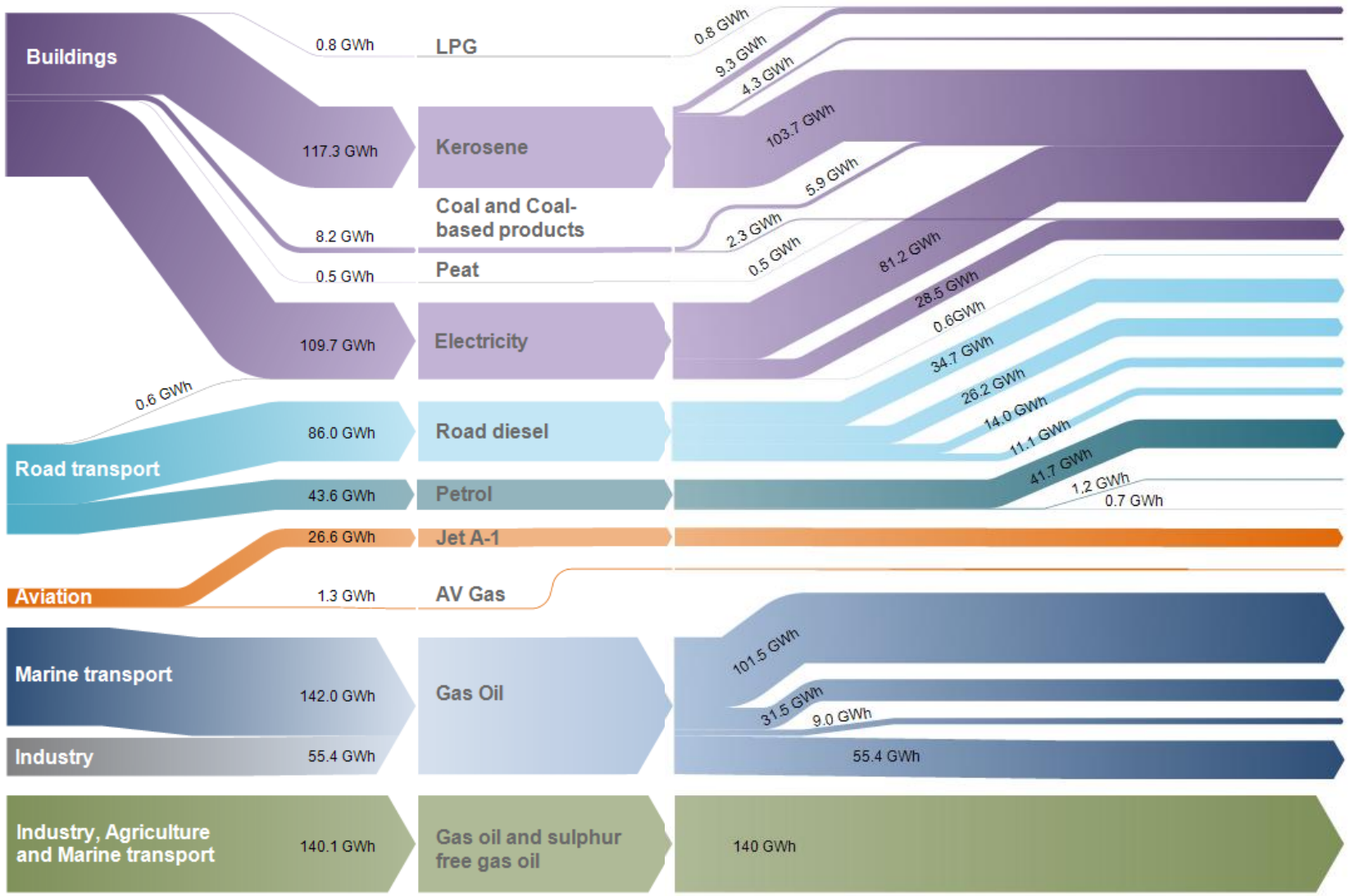

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Inter island ferries
Towage and harbour craft
Crude oil processing
Industry, Agriculture and Marine transport

Heat & light

Transport (largely)

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2. Aviation

Local statistics:

180,000 passengers

£2,100,000 fuel use
2,600,000 litres Jet A-1
140,000 litres AV Gas

6,842 Tonnes CO_2

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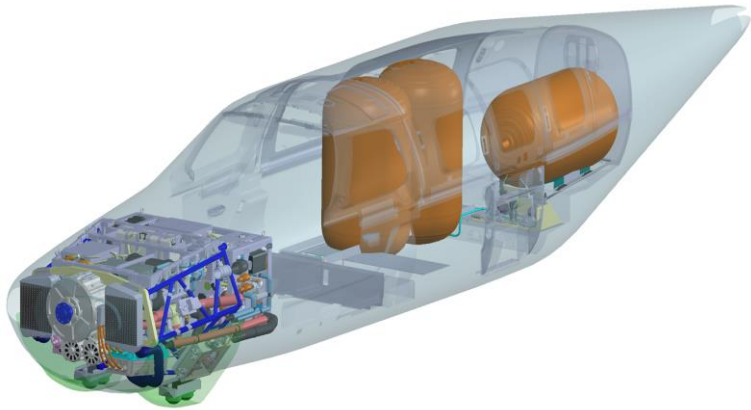
HyFLYER – Net Zero Aviation

EMEC HYDROGEN

- £5.3M project
- Hydrogen powertrain
- Battery to fuel cell phased tests
- 250-300 nautical mile range
- Orkney demo flight 2020



UKRI Innovate UK

AEROSPACE TECHNOLOGY INSTITUTE

HyFLYER

Intelligent Energy

ZEROAVIA

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Hydrogen Refuelling

Mobile truck and trailer unit

- 350 bar dispensing to J2601 non-communicative standard
- Compatible with multiple hydrogen sources
- Stepping stone for commercial aviation use
- H2 production in trailer - Enapter

FUEL CELL SYSTEMS®

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Results

- Learning by doing
- Creating pre commercial knowledge
- Practical demonstration
- Progress towards Net Zero

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