



Making Hydrogen Transport Work

Scotland's Experience and Ambitions

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Presentation Outline



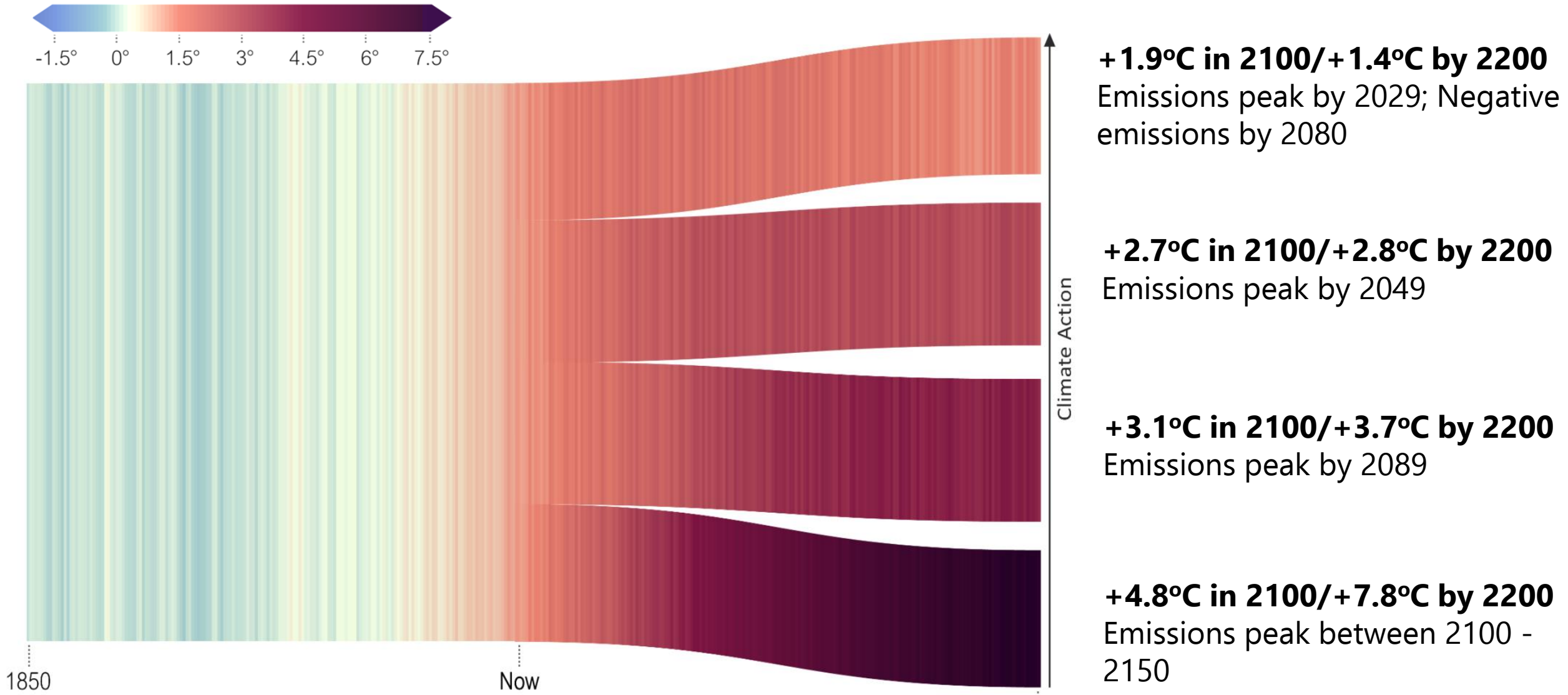
- Meet our Scottish Hydrogen & Fuel Cell Association members
- Global Climate Change & the UK CCC led Net Zero response
- Hydrogen's Role in Delivering Net Zero: 'Reaches the Parts...'
- Learning by Doing with Hydrogen Transport Activities in Scotland
- Partnership working examples in Fife, Orkney, and Aberdeen
- Making Hydrogen Transport Work with hydrogen hubs
- Building local skills & expertise with international partnerships

SHFCA Members: Building a Hydrogen Economy



SHFCA members include Micro, SMEs, Corporates, Local Authorities, Academics, & Partners

Climate Choices: the need for rapid action



Source: Projections based on CMIP5 RCP scenarios, graphic from warningstripes.com

Scotland's Contribution to Stopping Global Warming

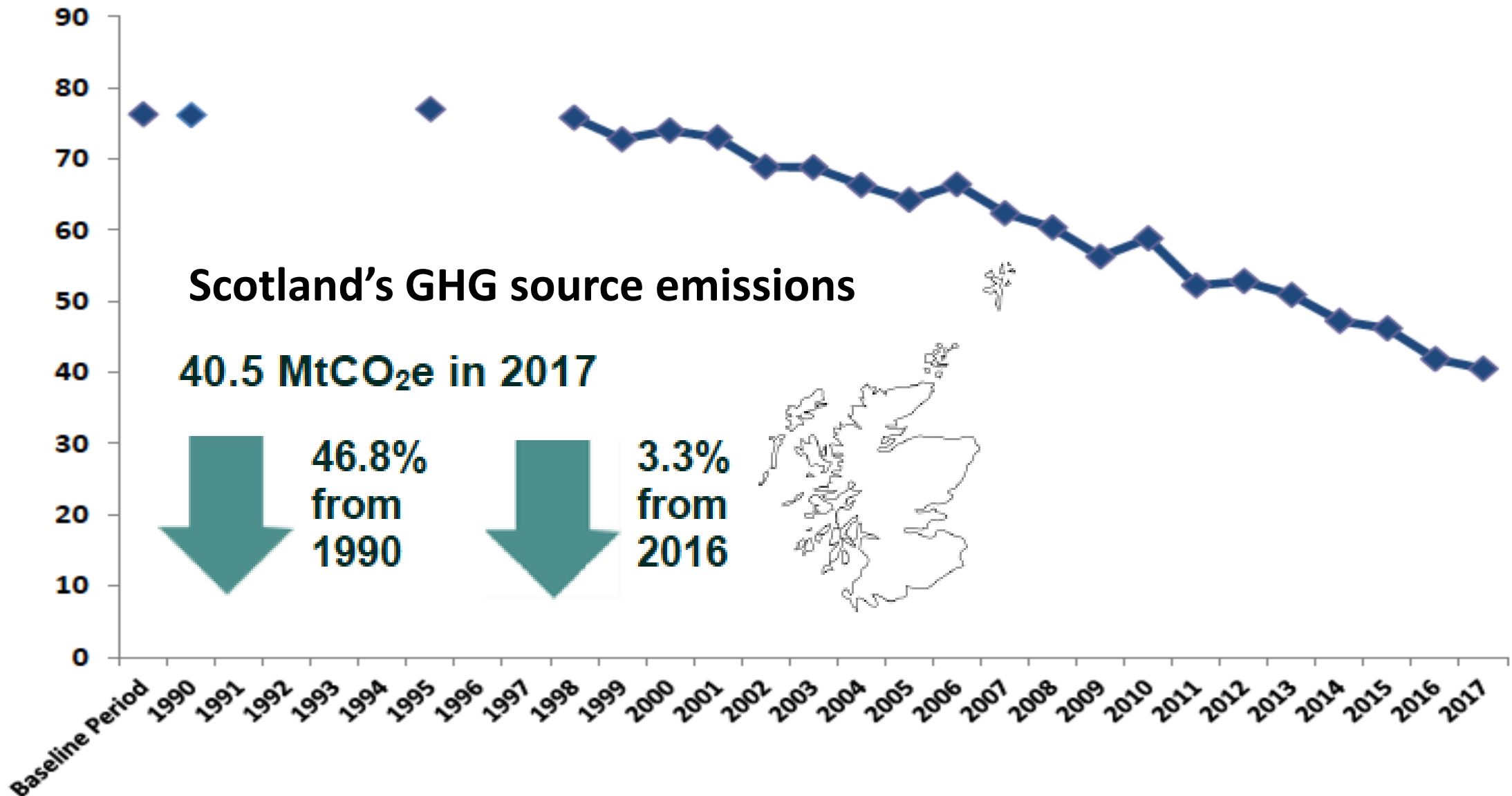
Scotland's target: Net Zero by 2045

Year	Scottish CO ₂ Reduction
2030	75%
2035	80%
2040	90%
2045	100%

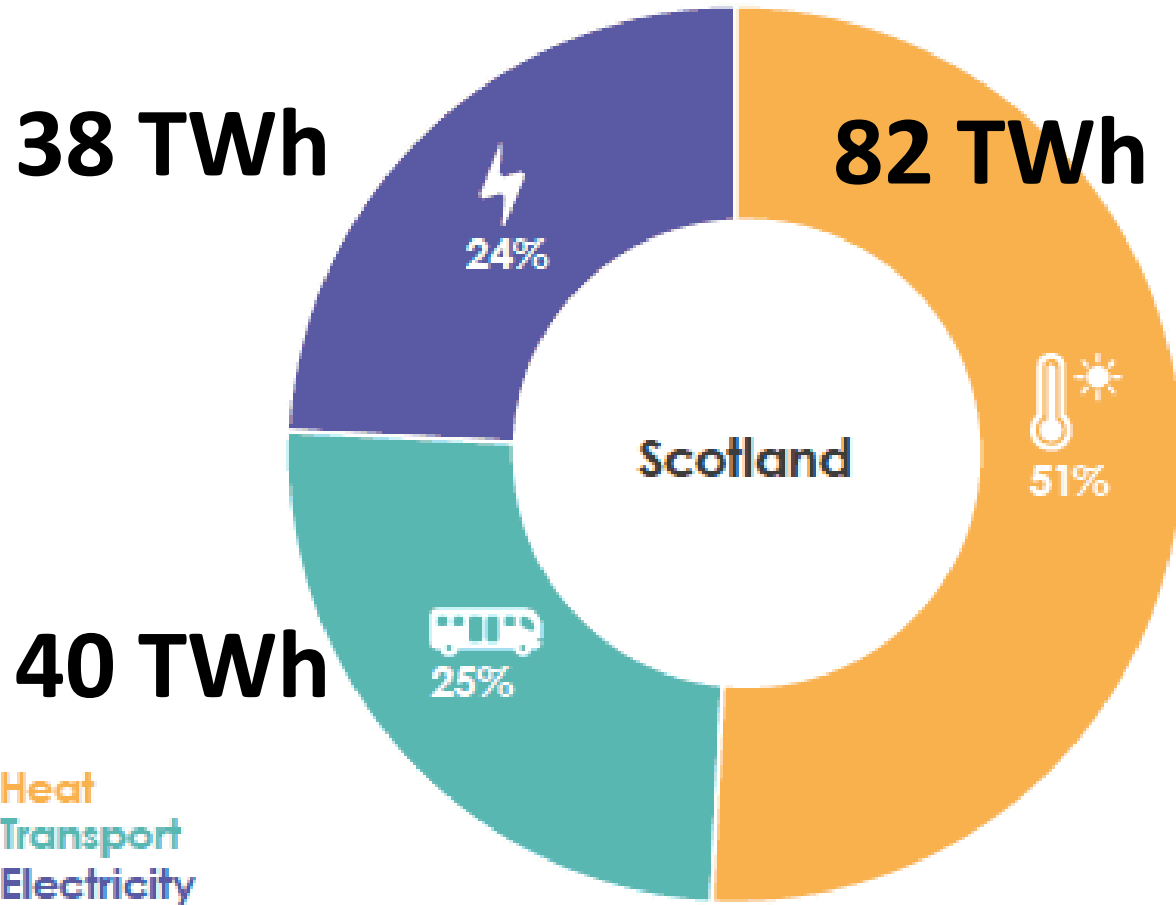
The [CCC advises](#) combined use of renewables and CCS for rapid and effective carbon reduction



Reducing Greenhouse Gas Emissions

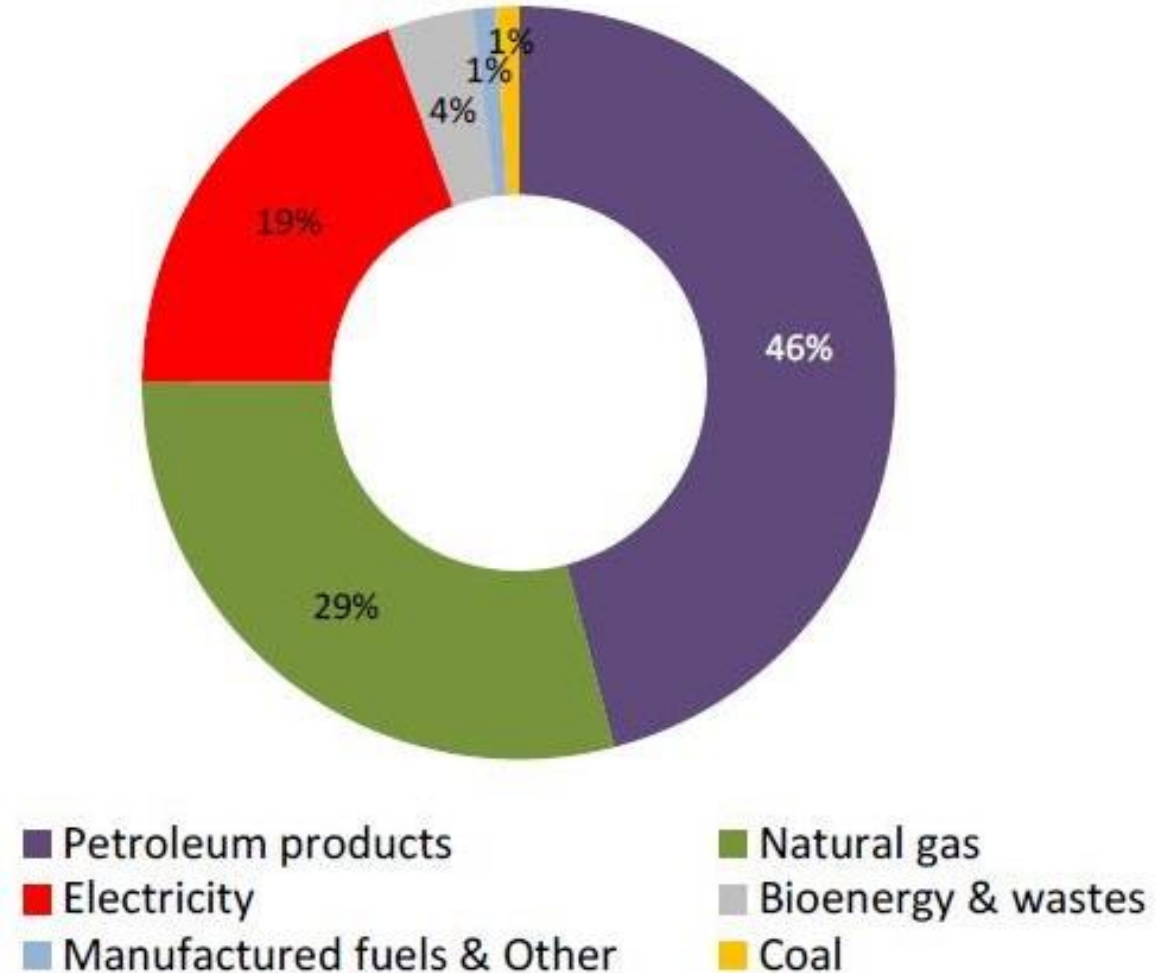


Current Scottish Final Energy Demand



Heat
Transport
Electricity

Final Consumption **160 TWh**



[Future of Energy in Scotland](#): (Dec 2017)

Future of Energy in Scotland – Transition to Net Zero

A rapid transition from coal/oil/gas to Renewables:

- From centralised to localised Energy Systems
- Whole energy system approach
- H₂ for 'hard to treat' heat, transport, and industry



A
WHOLE-SYSTEM
VIEW



A STABLE,
MANAGED
ENERGY
TRANSITION



A SMARTER
MODEL OF
LOCAL ENERGY
PROVISION



Longannet, Scotland's last coal fired power station, closed in March 2016

Scotland's Renewable Energy Growth

Diagram 4: Electricity generated (GWh) from renewable sources, Scotland, 2000-2015



68.1% of Scotland's gross electricity demand was met from renewables in 2017 (**25 TWh**)



**AN INCLUSIVE ENERGY
TRANSITION**



BIG HIT Grant
no.: 700092



THE
CHALLENGE
FUND



THE
CHALLENGE
FUND



Net Zero The UK's contribution to stopping global warming

Committee on Climate Change
May 2019

The Hydrogen Office at Methil in Fife



2011: The Hydrogen Office at Methil, Fife

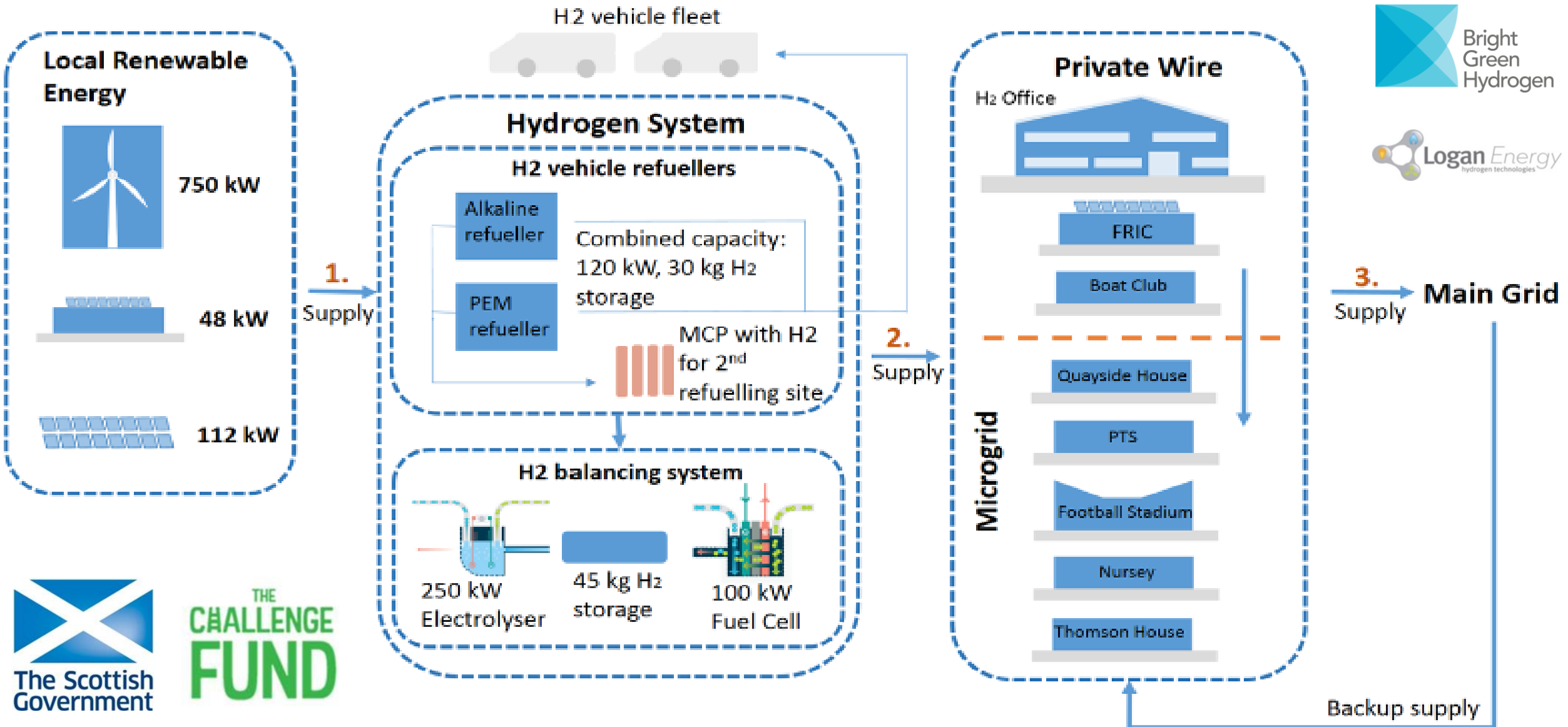


Levenmouth Energy System

TOSHIBA
Leading Innovation >>>

 Bright
Green
Hydrogen

 Logan Energy
hydrogen technologies



Levenmouth Fleet – with 2 RCVs

- 17 hydrogen vehicles: 10 5FC-RE, 5 H2-ICE vans
- 2 x world first H2-ICE Refuse Collection Vehicles
- Diesel-hydrogen conversions by





Net Zero
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Orkney: >100% Green Electricity

Renewables generate > 100% of Orkney's electricity

Over 50MW of installed renewable capacity

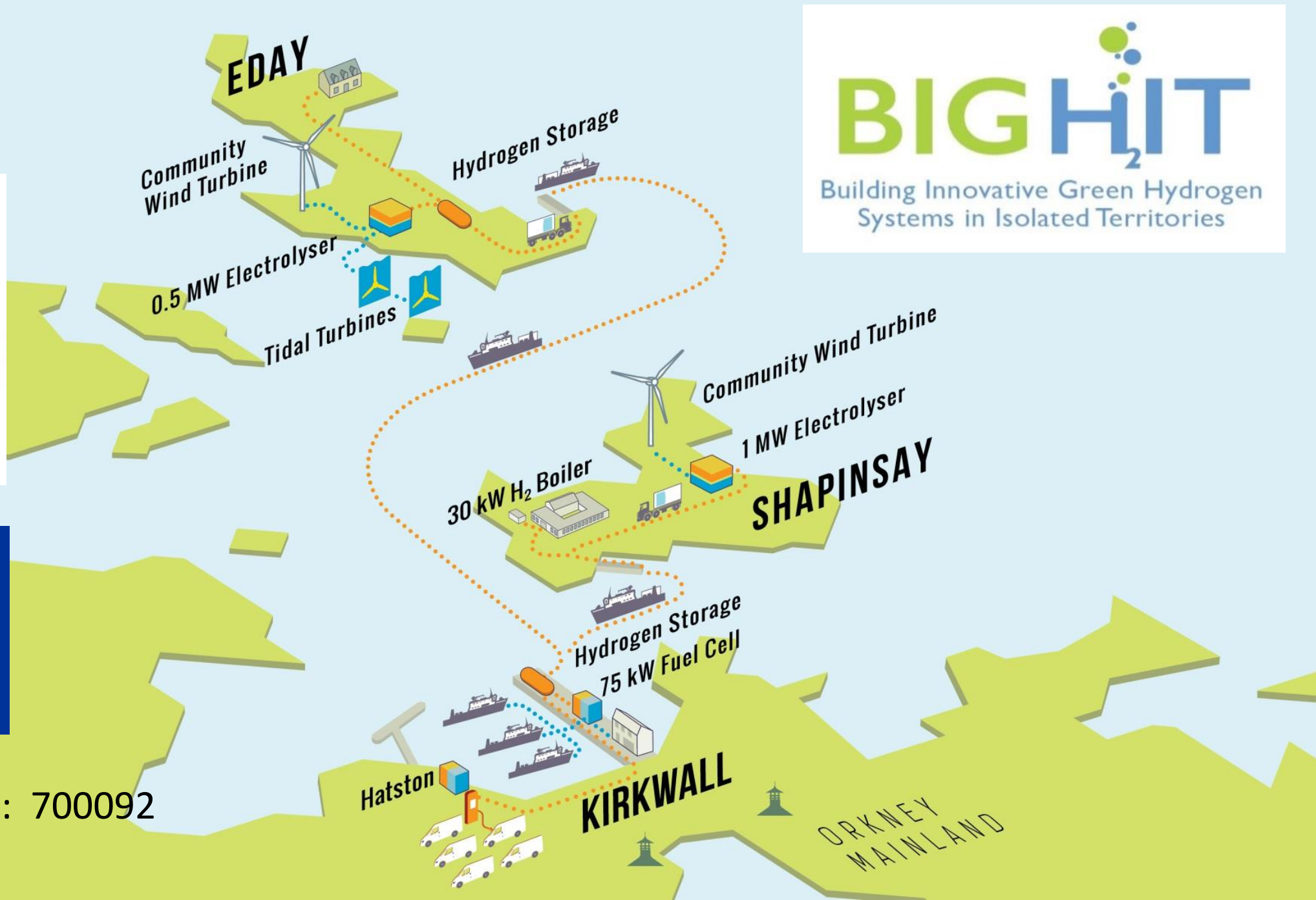
>1000 renewable installations for 10,000 households



By 2014 Orkney was generating 120% of its
annual electrical demand from Renewables



BIG HIT Grant no.: 700092





Hydrogen into Heat, Power, Transport



Hydrogen refuelling station by ITM Power in Kirkwall, opened May 2018. Refuels the Symbio vans used by Orkney Islands Council.



Hydrogen vans from Symbio used by Orkney Islands Council together with one of the five Calvera hydrogen trailers

Growing the Orkney H₂ project portfolio



[HySeas III – H2020 €21m EU funded project](#) World first fuel cell ferry now scheduled for construction and destined for operation in Orkney



[HyDime – Innovate UK project](#) UK's first H₂ injection system for hydrogen/diesel APU for Shapinsay ferry. Led by Ferguson Marine with Orkney Islands Council & EMEC as partners.

€11m EU INTERREG [\(ITEG\)](#) £28.5m BEIS [ReFLEX project for Orkney Virtual Energy System](#)
Orkney projects with Hydrogen now approximately £65M in total.

HyFlyer – H2 Fuel Cell Plane

- 6 seater plane with H2 fuel cell electric power train
- 300 mile range
- Trials being carried out at Cranfield
- 250 mile flight from Orkney planned in late 2020
- SHFCA members involved:

EMEC
THE EUROPEAN MARINE ENERGY CENTRE LTD

**FUEL CELL
SYSTEMS**



HyFlyer ZeroAvia 6-seater zero-emissions aircraft



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Aberdeen: Energy Transition Zone



2014 Ambition: Be the Energy Capital of Europe



Kittybrewster: Green Hydrogen produced on Site

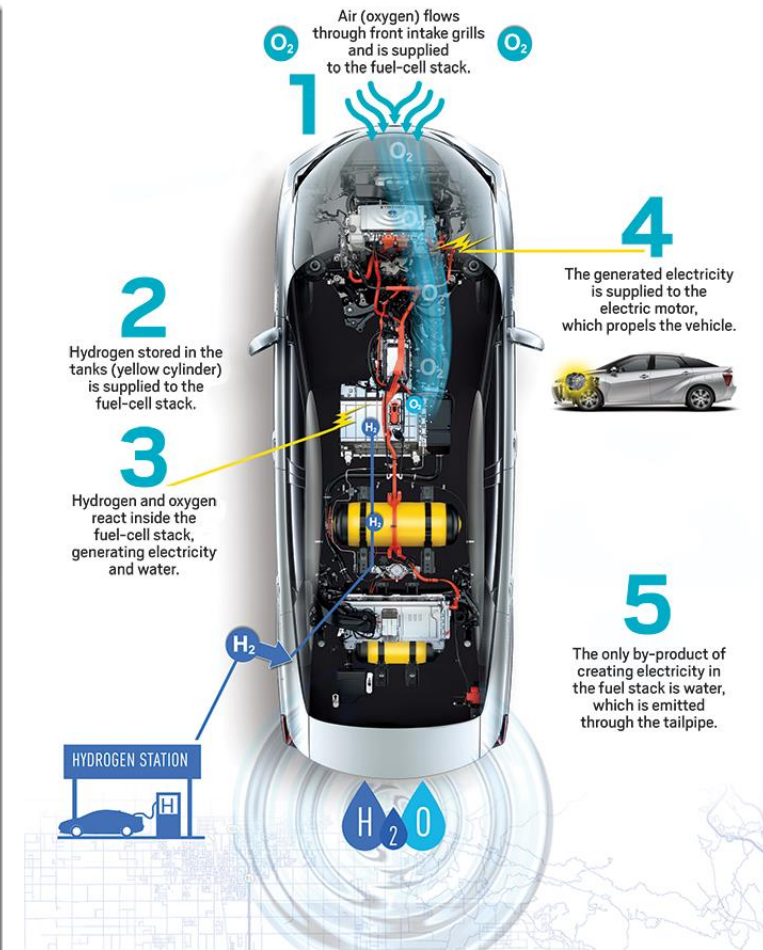
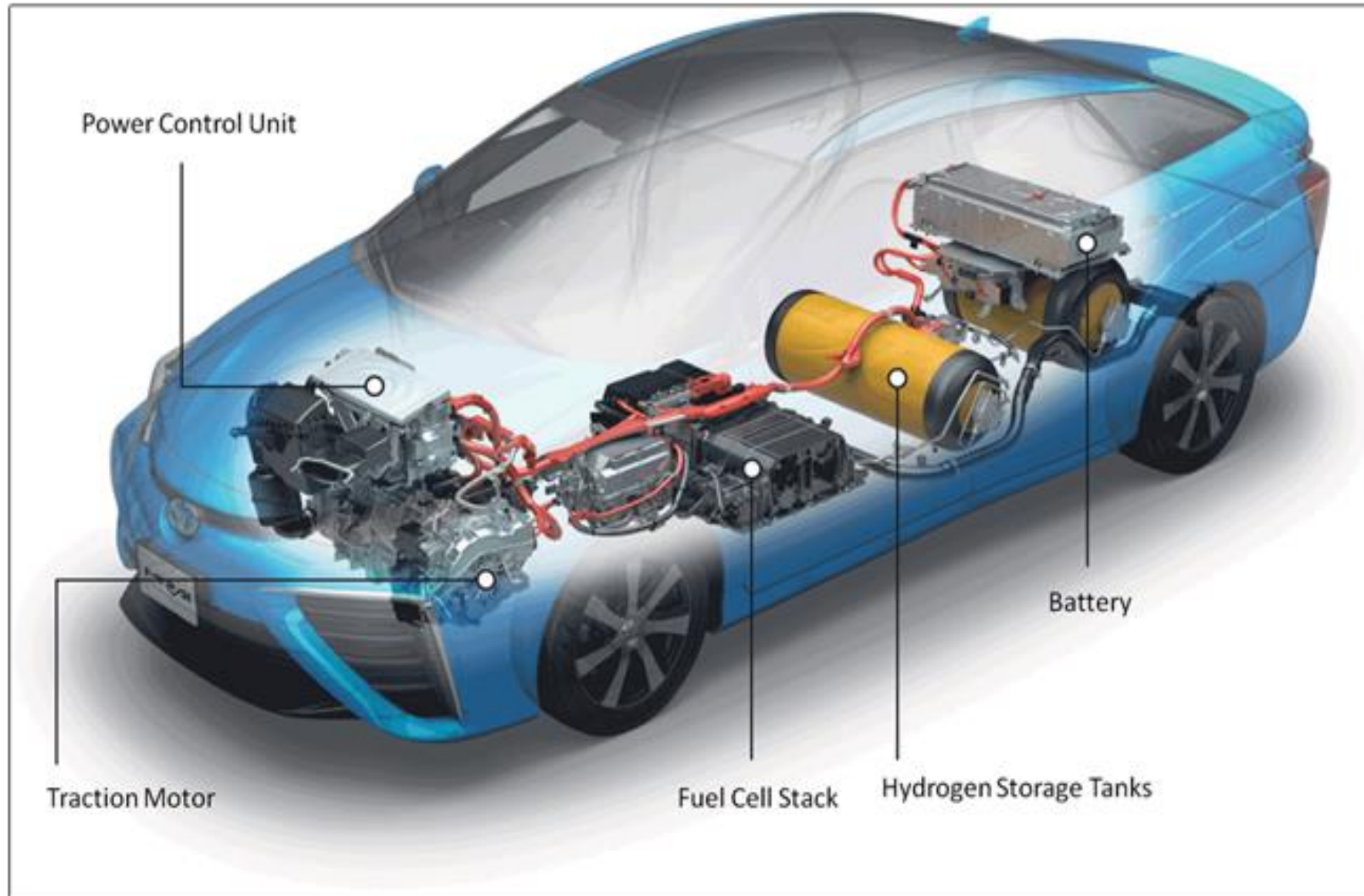


A €22m
project

Hydrogen is produced at Kittybrewster site
Using **HYDROGENICS** electrolyzers
Advanced Hydrogen Solutions



CoWheels & NHS: Toyota Mirai H₂ FCEV



Toyota Mirai



2019: some of Aberdeen's 50+ Hydrogen Vehicle Fleet on display in Union Square




Innovate UK

Aberdeen's new fleet of 15 double-deckers



2020 Ambition: Leading the Energy Transition





An aerial rendering of a proposed new harbour facility in Aberdeen. The harbour is a large, rectangular basin enclosed by a grey stone breakwater. Inside the basin, several ships are docked or moving, including a large cruise ship, a red and white tugboat, a green and white tugboat, and a yellow tugboat. On the right side of the basin, there are several stacks of colorful shipping containers (red, green, blue, and yellow) and a large white storage tank. The harbour is situated on a rocky coastline with a green hillside in the background. A road and some buildings are visible on the right side of the image.

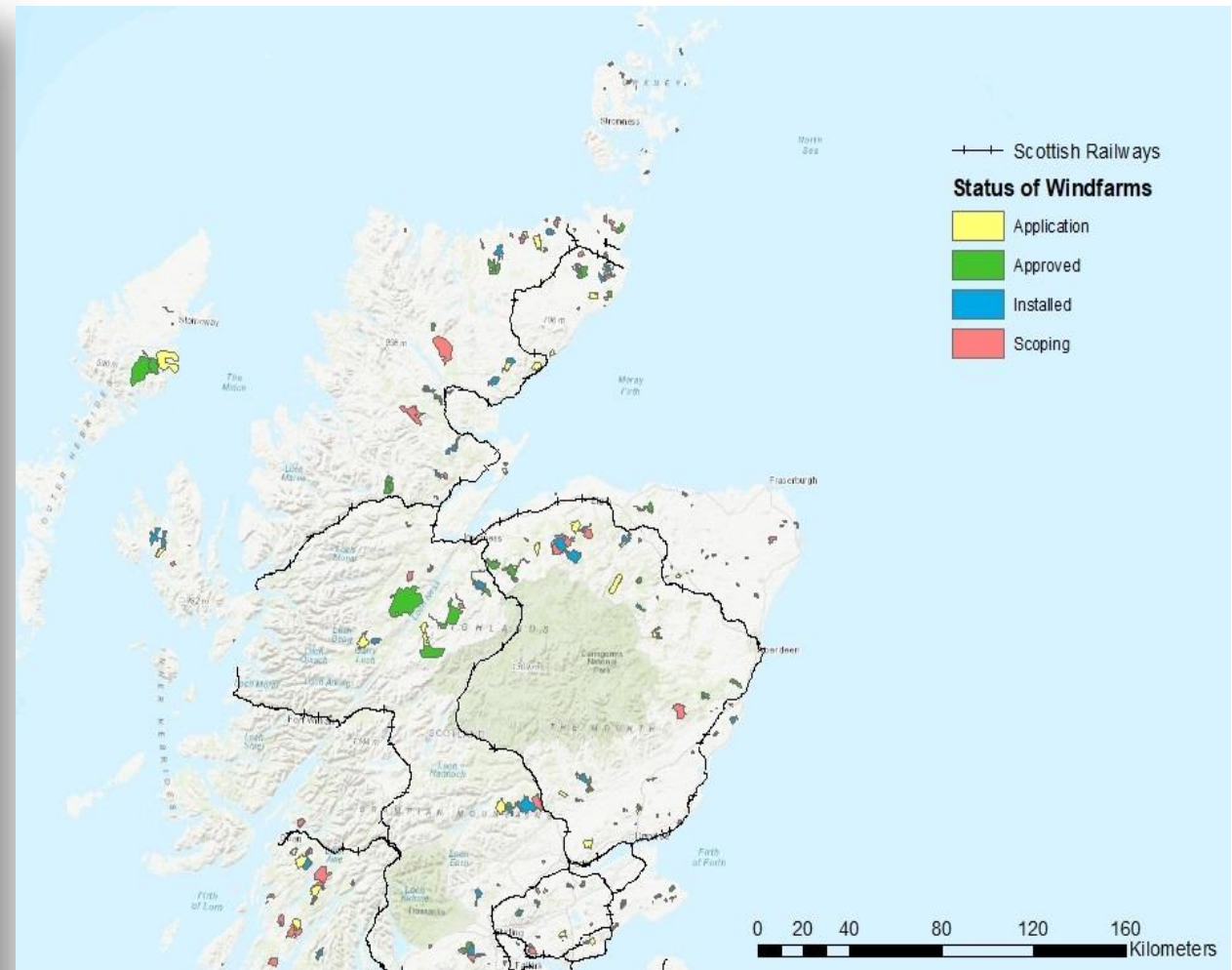
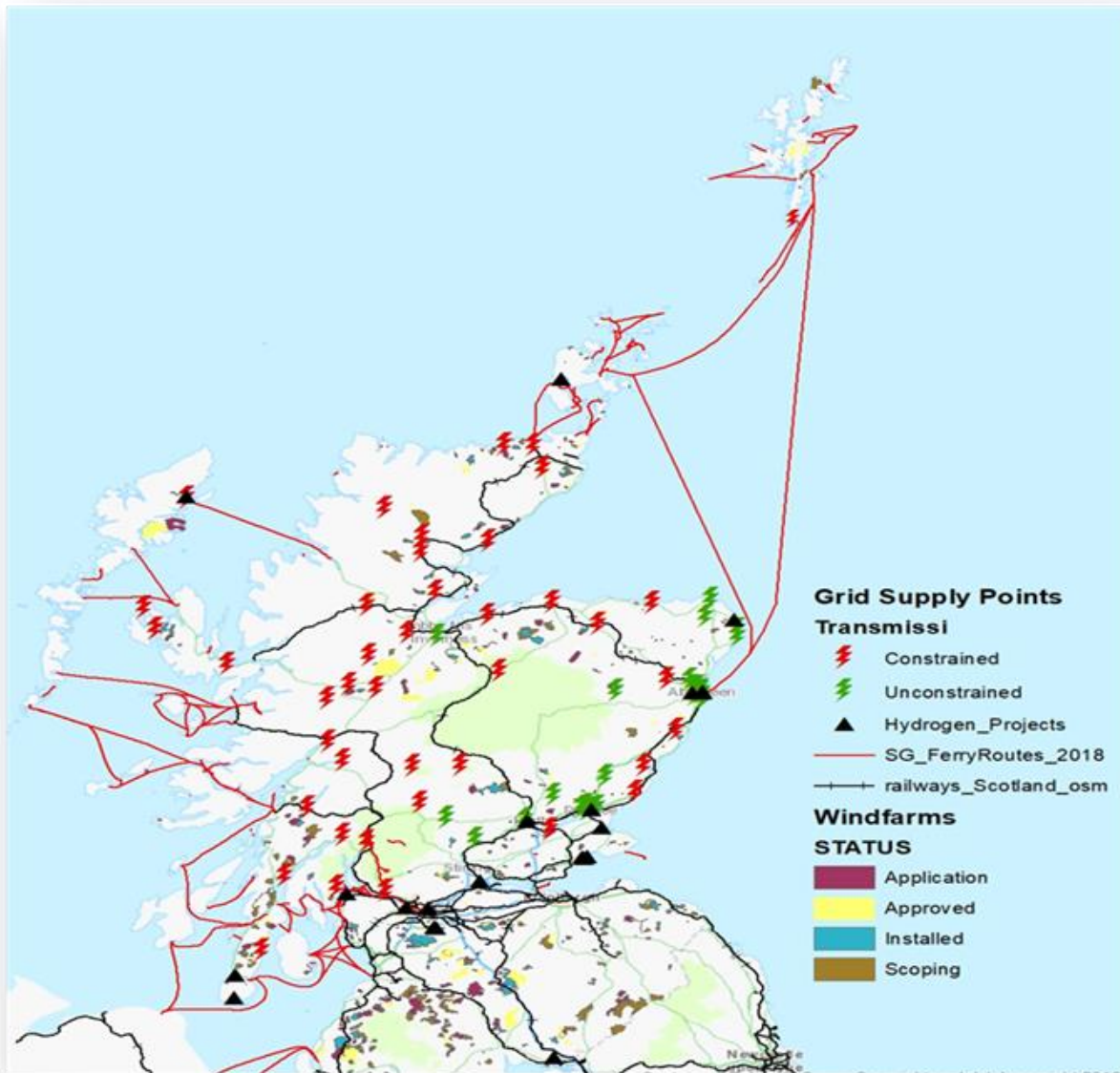
Aberdeen's new South Harbour
£350M infrastructure investment
Logistics for offshore renewables
Hub site for green hydrogen

Aberdeen hub for a Hydrogen Highlands Highway



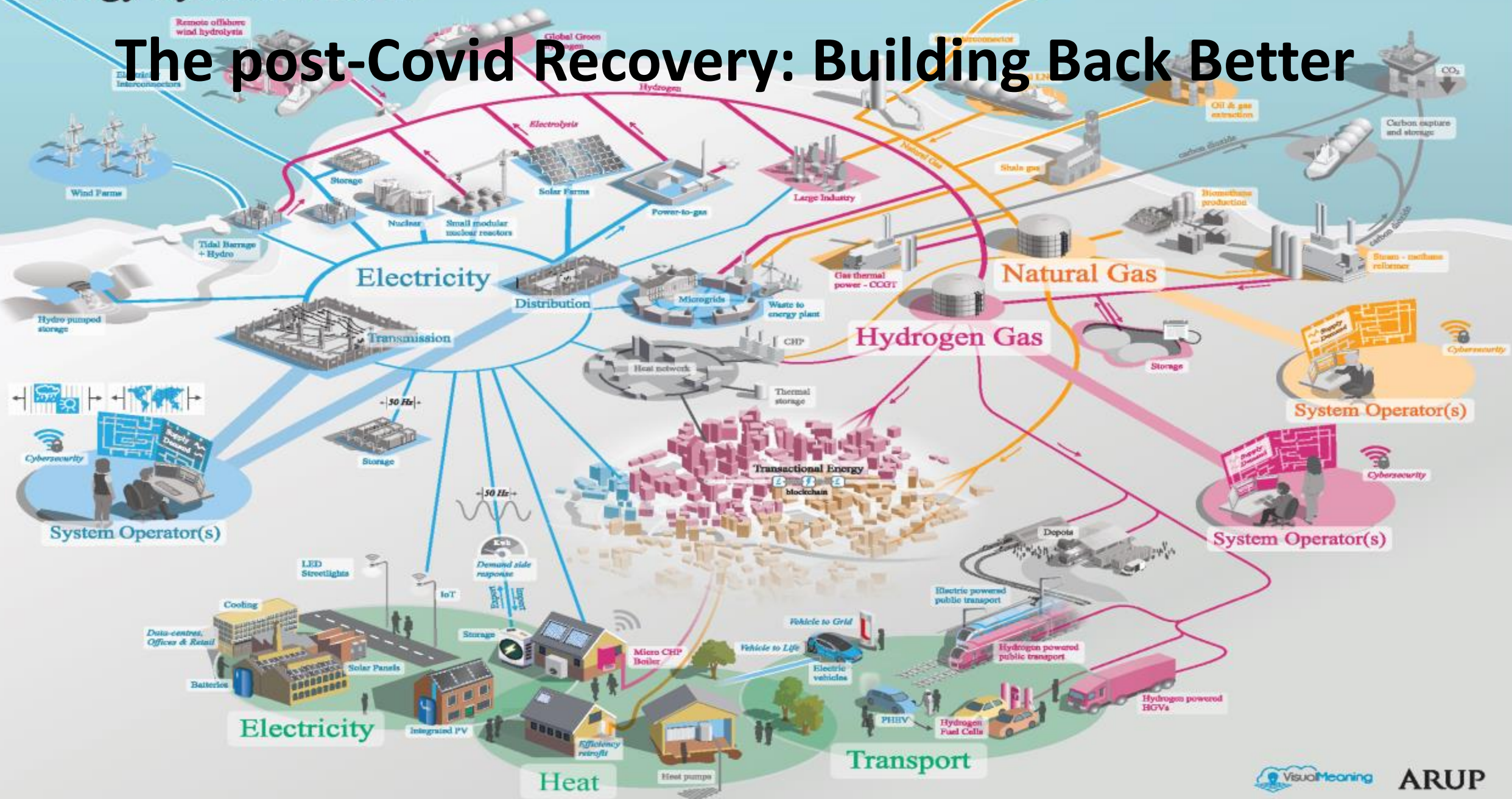
Toyota-Kenworth Trucks at the Port of Los Angeles, USA

Hydrogen Transport Hubs – Opportunity Mapping



Grid, Windfarms, Ferries & Rail Integration

The post-Covid Recovery: Building Back Better



Key Take-Aways



- Breadth of our Scottish Hydrogen & Fuel Cell Association membership
- Global Climate Change & the UK CCC led Net Zero response
- Hydrogen's Role in Delivering Net Zero: 'Reaches the Parts...'
- Learning by Doing with Hydrogen Transport Activities in Scotland
- Partnership working examples in Fife, Orkney, and Aberdeen
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Next year in Glasgow...





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Thanks for Listening
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