Developing a Systems Approach to reaching Net Zero

FST Seminar, June, 2021

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Recent Developments in Response to Net Zero Commitments

Prime Minister's 10-point plan for a Green Industrial Revolution

HM Government

- Offshore Wind – 40GW, 2030
- Hydrogen – 5GW production
- Nuclear – AMRs/ SMRs
- Electric Vehicles
- Public Transport, cycle/walk
- Jet Zero & Greener Maritime
- Homes / Public Buildings
- Carbon Capture
- Nature – 30k Hectares trees
- Innovation & Finance

PM's Council for Science and Technology

COUNCIL FOR SCIENCE AND TECHNOLOGY

Achieving Net Zero through a <u>whole systems approach:</u>

- Strengthened institutions, frameworks and leadership across Government
- Develop analytical capability, info & reporting to inform decisions
- Maximise use of technology, mobilise finance and international collaboration

Energy Systems Catapult – 2050 Scenario Analysis

CATAPULT Energy Systems

- ~2-3x Elect. Gen. Capacity
- Nuclear / BE-CCS
- Renewables & Decentralise
- -ve emissions (DAC etc)
- Transport revolution
- Industry electrification
- Demand-side behaviours

Royal Academy of Engineering

NATIONAL ENGINEERING POLICY CENTRE

Systems approaches to policymaking: national scale

Advice from the Prime Minister's Council on Science and Technology (CST):

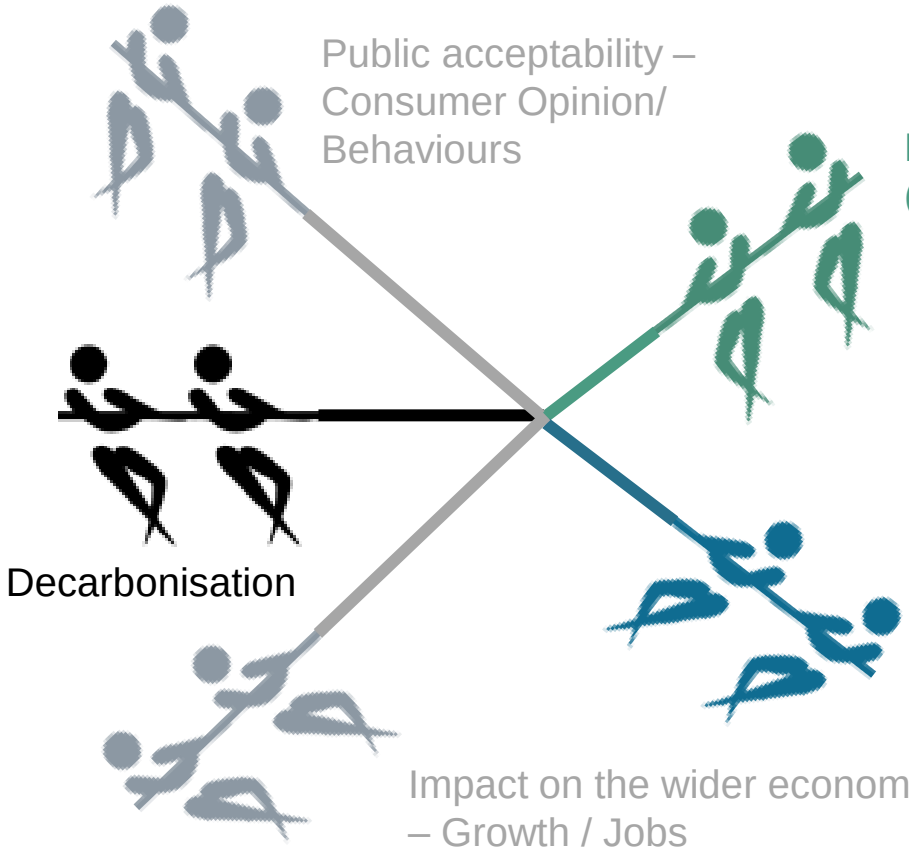
"Achieving net zero carbon emissions through a whole systems approach"

1. **Strengthen the institutions, governance frameworks and leadership structures needed across central government to galvanise action to achieve net zero.**
   i. Integrated multi-disciplinary analytical hub supporting all government decisions on climate
   ii. Translate the net zero target into all areas of policy
   iii. Stable leadership from the top of government

2. **Develop the analytical capability, flow of information, and reporting needed to inform decision.**
   i. Ensure that the all government bodies are collecting the right data and passing the information to the analytical hub.
   ii. Publish carbon emissions assessments for all public sector policies, including major infrastructure projects or investments.

3. **Maximise the contribution of technology, mobilise financial systems and galvanise international collaboration.**
   i. Mission-driven research and innovation
   ii. A National Infrastructure Investment Bank
   iii. International collaborations on trade, investment, finance, technology, capacity building and R&D.

Key Driver: The Energy Trilemma (and extensions….)



What are the options ?
What will they cost ?
Will they work ?

Aims for energy policy

Scotland's Draft Energy Strategy

'Whole-system' view

- Economic modelling, informing view of Scotland's future energy supply and demand
- **Integrated approach to heat, power and transport**
- New 50% 'all energy' 2030 renewables target
- Renewed focus on energy efficiency and energy demand reduction

2050 energy transition

- Long-term plan, consistent with requirements of the Climate Change Plan
- Flexible to future changes in technology and patterns of energy use
- Managed transition of energy supply, post-nuclear

A smarter model of local energy provision

- Encouragement for new localised models of energy supply and use
- Enhanced role for local planning and local ownership
- New economic opportunities of energy storage and 'smart' energy solutions

Clean Energy Project

Strategic Partners: Shetland Islands Council | OGTC | HIE | University of Strathclyde Glasgow

Steering Group: bp | EnQuest | equinor | Shell | Siccar Point Energy | SSE | Total

Industry Partners: babcock | Hitachi | ABB | Ricardo

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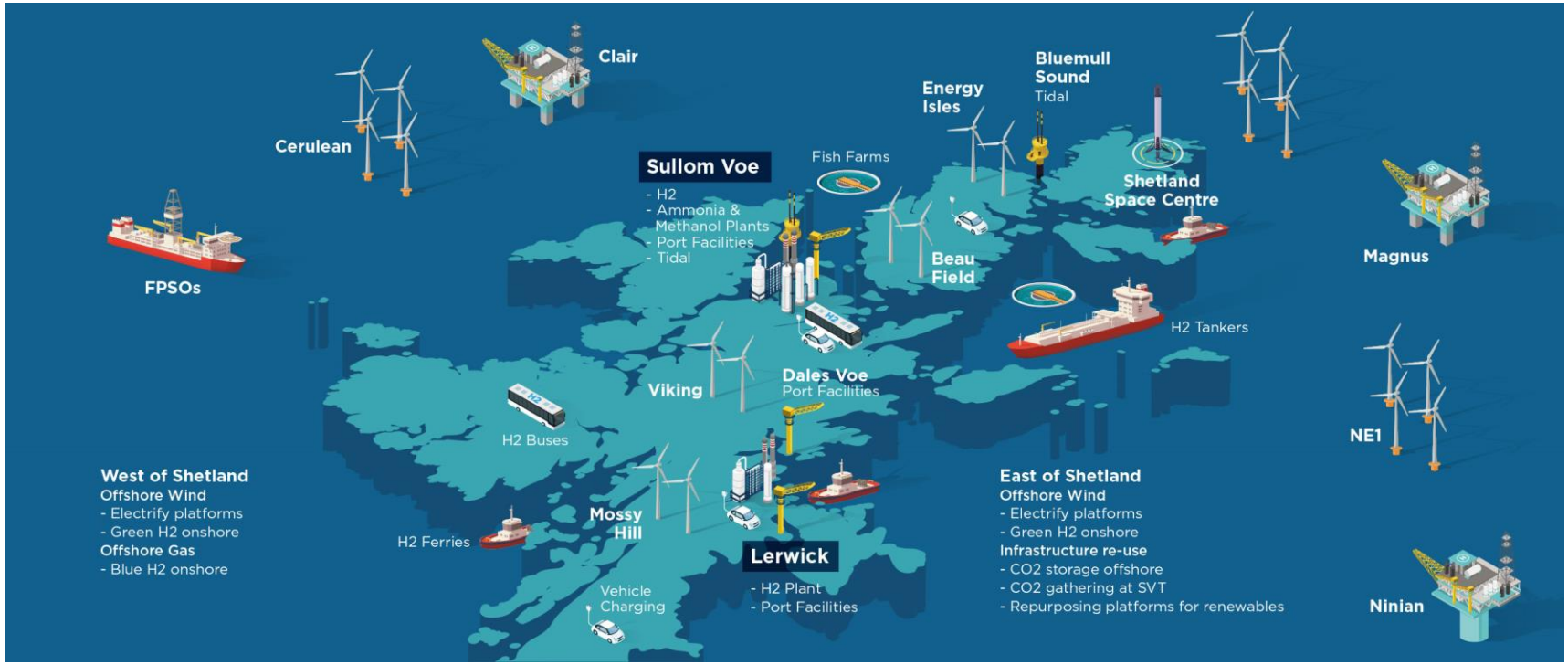
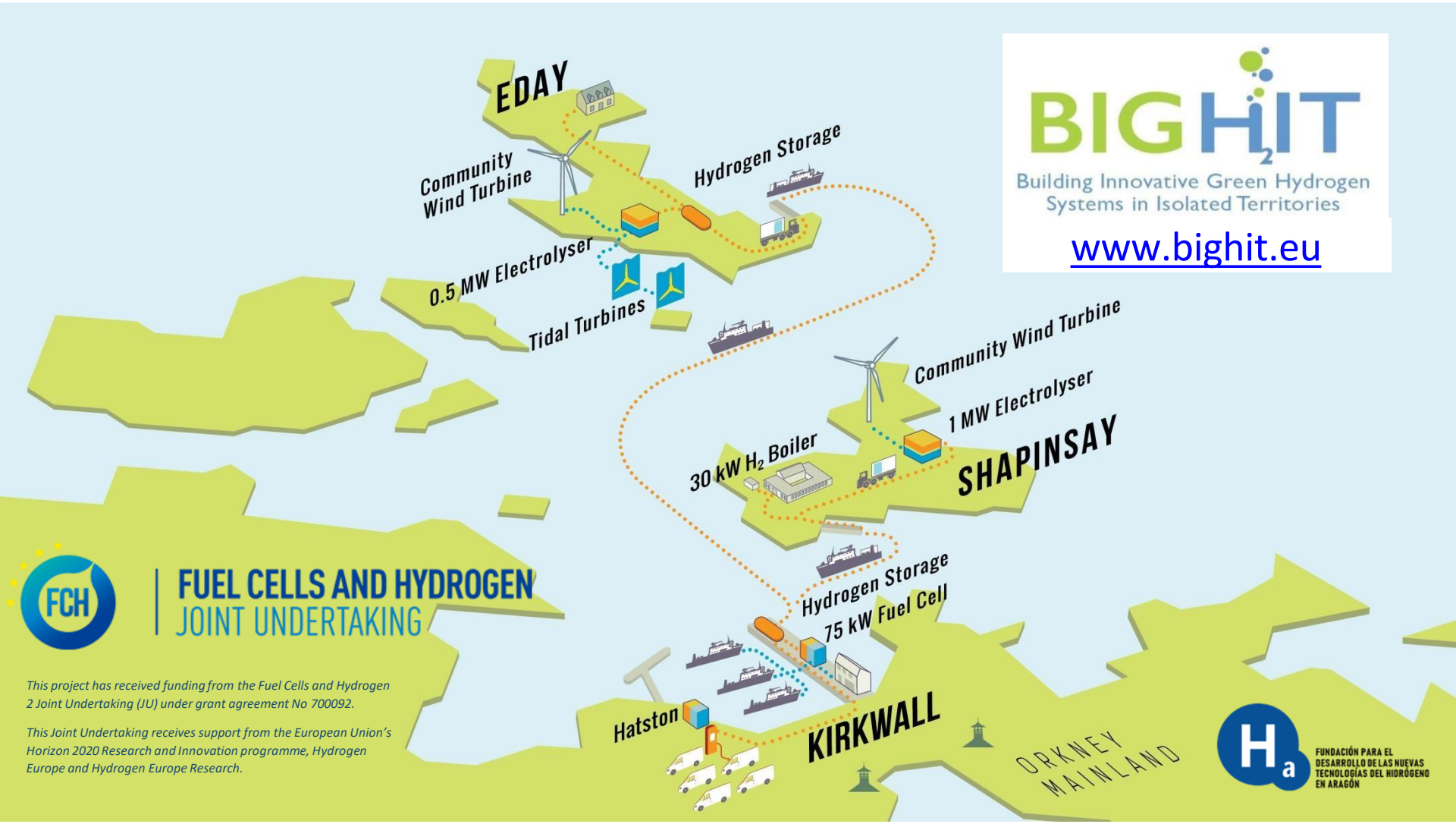

Clair
Cerulean
Bluemull Sound
Tidal
Energy Isles
Sullom Voe
- H2
- Ammonia & Methanol Plants
- Port Facilities
- Tidal
Fish Farms
Shetland Space Centre
Magnus
FPSOs
Beau Field
H2 Tankers
Viking
Dales Voe
Port Facilities
H2 Buses
NE1
West of Shetland
Offshore Wind
- Electrify platforms
- Green H2 onshore
Offshore Gas
- Blue H2 onshore
Mossy Hill
H2 Ferries
Lerwick
- H2 Plant
- Port Facilities
Vehicle Charging
East of Shetland
Offshore Wind
- Electrify platforms
- Green H2 onshore
Infrastructure re-use
- CO2 storage offshore
- CO2 gathering at SVT
- Repurposing platforms for renewables
Ninian



BIG H2IT

Building Innovative Green Hydrogen Systems in Isolated Territories

www.bighit.eu

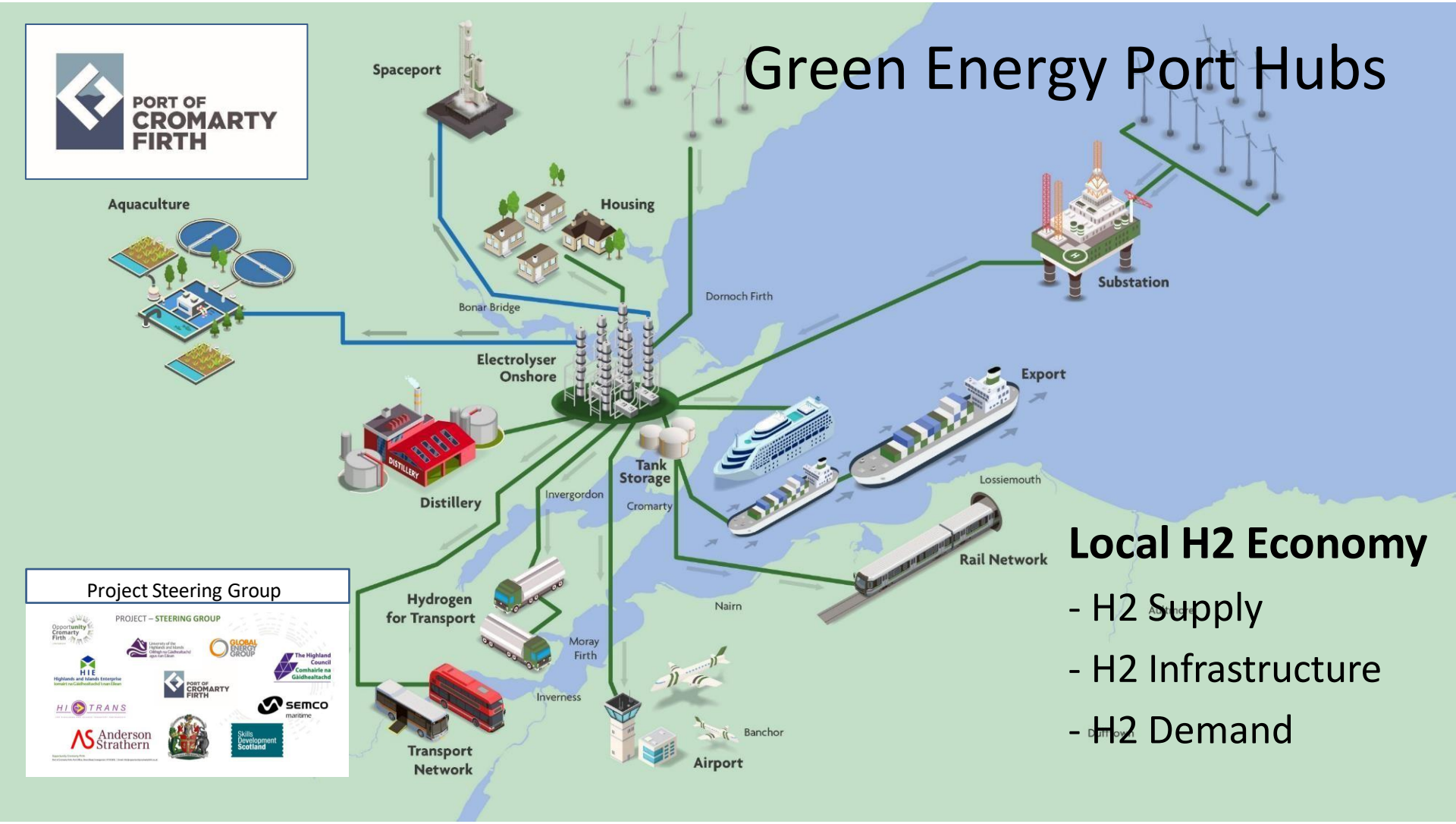
FUEL CELLS AND HYDROGEN JOINT UNDERTAKING

This project has received funding from the Fuel Cells and Hydrogen 2 Joint Undertaking (JU) under grant agreement No 700092.

This Joint Undertaking receives support from the European Union's Horizon 2020 Research and Innovation programme, Hydrogen Europe and Hydrogen Europe Research.

FUNDACIÓN PARA EL DESARROLLO DE LAS NUEVAS TECNOLOGÍAS DEL HIDRÓGENO EN ARAGÓN

Green Energy Port Hubs

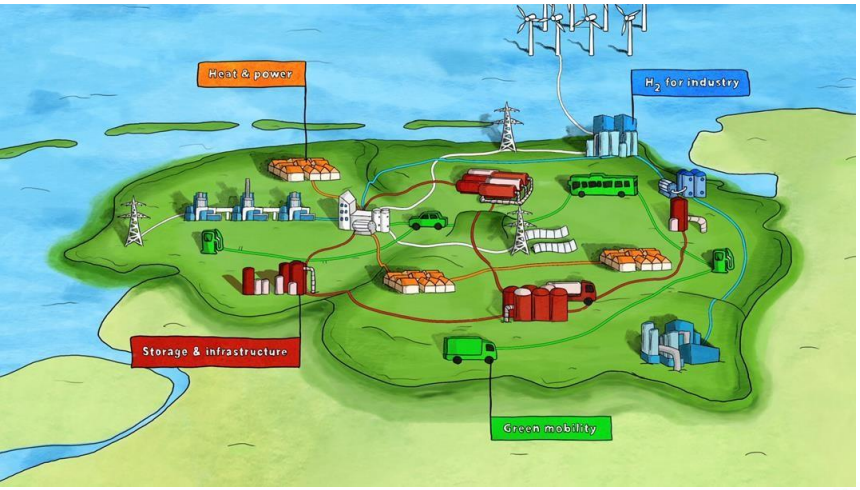


Local H2 Economy

- H2 Supply
- H2 Infrastructure
- H2 Demand

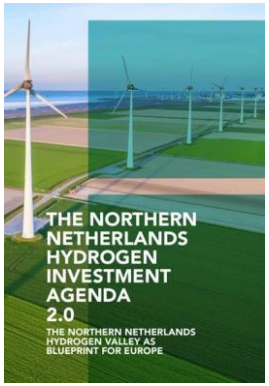
Project Steering Group

HEAVENN: H2 Valley in the North Netherlands



HEAVENN: 30 partners from 7 EU countries

- Total project investment over €98 million
- EU project contribution €20 million
- H2 Valleys represents the next development stage towards a local H2 economy - linking individual projects and developing local H2 infrastructure.

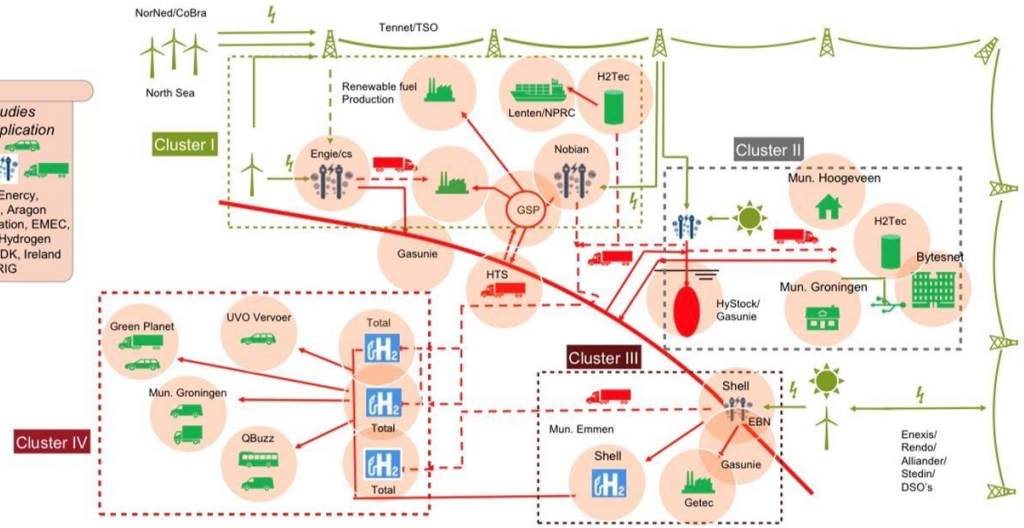


North Netherlands Economy

- Energy Transition
- Economic Growth

Studies & Replication

RUG, Enercy, Hinicio, Aragon Foundation, EMEC, EWE, Hydrogen Valley DK, Ireland HA, ERIG



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SUSTAINABLE GLASGOW

- City Council declared climate and ecological emergency for the city in May 2019
- Partnership between local government, academia, organisations and business.
- First ambition is for the city to **become carbon neutral by 2030,** there are significant challenges around decarbonising heat and transport in particular.
- Net zero strategy is under development with support of the Energy Systems Catapult and Connected Places Catapult
- Thematic hubs

Green Infrastructure and Transport

Greening the City

Private Sector and Green Recovery

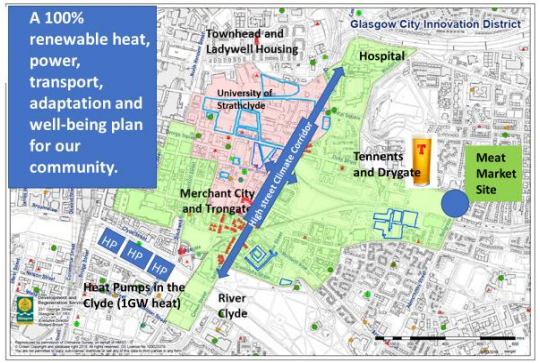
Housing and Heating

Strathclyde chairs the Green Infrastructure and Transport Hub

SUSTAINABLE GLASGOW

- Climate Emergency Implementation Plan approved June 2021 includes 52 Action Areas, with Sustainable Glasgow cited 31 times across multiple action areas
- Green Economy Hub launched Sustainable Glasgow Charter Pledge June 2021 with all major businesses and organisations signing to collaborate
- Future power infrastructure workshop held May 2021 with SPEN (utility) and other key organisations - focus on coordination and planning to accelerate electrification by anticipating new demand.
- Transport infrastructure focus across multiple authorities (city, regional and national) joining up and bridging across silos
- Exemplar infrastructure projects like Carbon Neutral Innovation District and climate adaptation with Climate Ready Clyde
- **Convening and coordination role: Accelerating plans and highlighting challenging trade offs – net zero and just transition**

Climate Neutral Innovation District



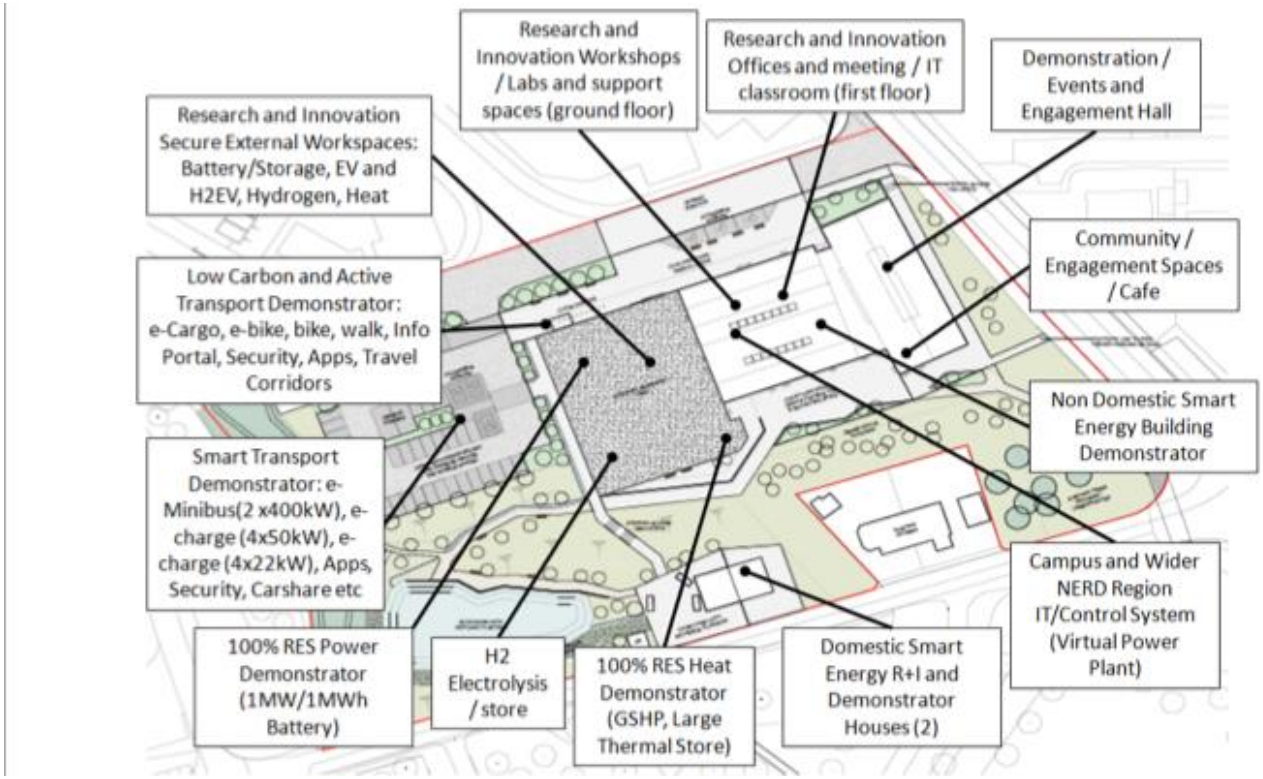
CORE (Community Renewable Energy)

CORE aims to accelerate transition to the future 100% renewable climate positive energy system for power, heat and transport within the Cumnock area and be an exemplar to Scotland and the UK in making the transition to a low carbon society. ***Funded by East Ayrshire Growth Deal (£17.5M UK Gov, £7.5M East Ayrshire Council) the partners (target >10x with leveraged spend***

Centre of Excellence in Energy Systems Integration	Regional Community "Living Lab"	Local integration of hydrogen, battery storage & heat pump	Smart Transport Hub: Refuel and Charge
Demonstrator Buildings & Projects	Two new build Research and Demonstrator houses on-site	Local Smart retrofit examples within easy access.	Support knowledge transfer to local industry
Knowledge Based Economy	Offer "hands-on" experience in STEM education for all ages.	UoS sponsored PhD research projects	Innovation & incubation for business & education support

CORE: Key Partners

CORE: Research, Innovation & Demonstration Centre



East Ayrshire Growth Deal: £24.5M National Energy Research Demonstrator

A Regional Community 'Living Lab' for Just Transition to Renewable Transport, Heat, Power

A Multi-Sector Integration Research and Innovation Project To Benefit Local Community and Economy

DSO Region
(SPEN Coylton GSP +)

Existing Loads
- 26,000 population, 11 towns (largest is Cumnock pop. 9,000)
- 40MW-10MW max and min load across 7 primary substations.

Existing and Planned Generation
- 72MW Connected, 110MW Consented* (*LTDS 2019 App 5)
- Community Benefit Payments. £12M constraint payments 2018.

£15M Cross-sector Integration Centre (Cumnock)

£9.5M Regional Transition Projects
- Leverage Growth Deal and Council spending, attract synergistic partners and funding for innovation, demonstration, research and implementation)

Research, Innovation and Demonstration Hubs

- VPP/ANM
- HP+Store
- EV - VTG
- 1MW bat
- H2 El+Sto
- Gnd Heat

- Community, Economy, Society, Health and Wellbeing
- Smart Power Networks and IT
- Smart Buildings and Heat
- Smart Transport
- Smart Hydrogen and Storage
- Smart Geology and Earth

Smart Non Domestic Demonstrator
with 2 Smart Homes on site for Demo / Test

Engagement Hubs

Community, Industry, Research, Public Engagement and Demonstration Space

Offices, Meeting Spaces, Events and Social Spaces.

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Smart Power Networks, Generation, Storage, and Flexibility
- Visibility, datasets and smart controls
- Integration of flexibility and storage with generation and loads.
- Heating, Cooling, Transport and Hydrogen integration.
- Generator, DSO/TSO and Customer value propositions (post ROC/FITS etc)

Smart Buildings, Heating and Cooling
- New Build and Retrofit to Smart Energy Standards (e.g. HP, Th store, PV, EV, Battery, Tariffs / Flex), private, public and social tenanted buildings.
- Mini-district energy systems, ground, water and mine sourced heat.

Smart Transport, EV and H2
- HGV (e.g. Emergency One), Bus, Train, Car share, Taxi, Delivery, Private..
- Smart Travel Hubs and Corridors, Refuel / Charge, Connections, IT, Apps

Rural and Urban Post Industrial Sites to be Repurposed
- 26 sites with potential for wind, PV, heat, storage, hydrogen etc.

Proposed Operational Models – Self Sustaining Research Innovation Infrastructure to 2030 and beyond.

- EAC / Strathclyde / SPEN collaboration.
- Innovation Model for Industry / Research / Funder / ESC / EAC collaboration. ETP and PNDC engagement models for Industry Journeys and routes to funding. Alignments with UOS Departments / EAC and SPEN for synergistic leveraged funding opportunities.
- SPEN network transition with visibility and flexibility key. WESA/PNDC integration: datasets, field trials, deployments, wider adoption and impact assessments.
- Now working on Governance, Financial , Operational, Contractual Arrangements and Technical Specifications for Approvals and OBC submission Aug 21.
- Project start Jan 22, Growth Deal spend complete by Jun 2030. (joint opportunities already being pursued)