



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

The BIG HIT Project

Jesús Simón, Valencia, 15-16 June 2017
H2 and Fuel Cells in maritime applications



CALVERA

Symbio FCell





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Grant Agreement no.: 700092

WHY HYDROGEN IN ARAGON?

- First Wind Farm in Spain installed near Zaragoza , Opel factory, and high expertise in hydrogen technologies of the University of Zaragoza
- Reasons to support new hydrogen technologies:
 1. To take advantage of the renewable energy potential
 2. To take advantage of the region's strategic situation
 3. A consolidated industry with sectors that could apply and develop new products
 4. Existence of a high level of involvement in research groups

WHO WE ARE?

The Foundation for the Development of New Hydrogen Technologies in Aragon is a private, not-for-profit entity, created to promote the use of hydrogen as an energy vector.

Key instrument for the promotion of strategic projects around the hydrogen, renewable energy, electric vehicles, energy efficiency.

Created on 23 december 2003





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Hydrogen Master Plans in Aragon

AIMS OF THE PLAN:

- **GENERALS**

- To have a tool for the identification of opportunities of the new hydrogen technologies
- To identify strategic lines for the region and to establish a time scale and actions plans

- **SPECIFICS**

- To review the state of technology and to define opportunities.
- To identify specific projects for Aragon's SMEs.
- To set across-the-board and general support actions
- To carry out a survey with longer temporary horizons 2020-2050,

1st Hydrogen
Aragon
Master Plan
2007 – 2010



2nd Hydrogen
Aragon Master
Plan
2011 – 2015



3rd Hydrogen
Aragon Master
Plan
2016 – 2020



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ADMINISTRACIONES PÚBLICAS / ADMINISTRATION



CORPORACIONES Y ASOCIACIONES / CORPORATIONS AND ASSOCIATIONS



ENERGIA / ENERGY



Class management



INMOBILIARIA - OBRA CIVIL REAL STATE - CIVIL WORK



AUTOMOCIÓN / AUTOMOTIVE



INDUSTRIA QUÍMICA CHEMICAL INDUSTRY



METAL MECÁNICO / METAL-MECHANIC



INVESTIGACIÓN, ENSEÑANZA E INNOVACIÓN / INVESTIGATION, TRAINING AND INNOVATION



INGENIERÍA Y CONSULTORÍA / ENGINEERING



SEGURIDAD Y HOMOLOGACIÓN / SAFETY & RCS



OCIO Y TURISMO TOURISME AND LEISURE



MIEMBRO ASOCIADO ASSOCIATE MEMBER



TRANSPORTE TRANSPORT



FINANZAS INVESTMENT



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Jeremy Rifkin
Victor Manuel Orera Clemente
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Building Innovative Green Hydrogen
Systems in Isolated Territories

‘BIG HIT offers an opportunity for Shapinsay to address the curtailment of its community owned turbine in a way that helps demonstrate an innovative energy option that will be available to island groups in the future.’

Nic Thake, Shapinsay Development Trust



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BIG HIT Project – 12 Partners from Europe



FOUNDATION FOR THE
DEVELOPMENT OF NEW
HYDROGEN TECHNOLOGIES
IN ARAGON



ITM POWER
Energy Storage | Clean Fuel



**SCOTTISH
Hydrogen
& Fuel Cell
ASSOCIATION**

EMEC ORKNEY
The European Marine Energy Centre Ltd

Symbio FCell



ORKNEY
ISLANDS COUNCIL



**Community
Energy
Scotland**



DTU Technical University of Denmark



MINISTRY FOR
TRANSPORT AND INFRASTRUCTURE



CALVERA



GIACOMINI
WATER E-MOTION

BIG HIT Project – Many Supporters



**The Scottish
Government**



Highlands and Islands Enterprise
Iomairt na Gàidhealtachd's nan Eilean



CRPM CPMR

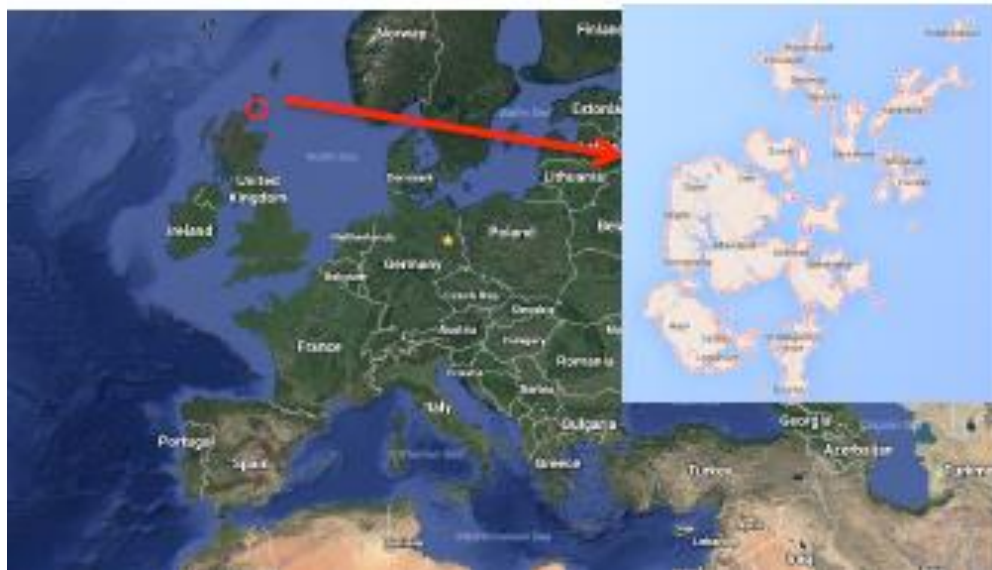




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Rationale

- Orkney Islands:
 - 20 inhabited islands. Population: 21 000
 - 56 MW of RES (11 MW wave/tidal + 45 MW wind)
 - Orkney-Scotland interconnector 30MW capacity



Electricity grid overloaded: **Curtailment** (In 2016 renewable electricity generation in the Orkney Islands produced the equivalent of 120% of their annual electricity demand)

Transition to hydrogen economy, meeting electricity, transport and heat needs



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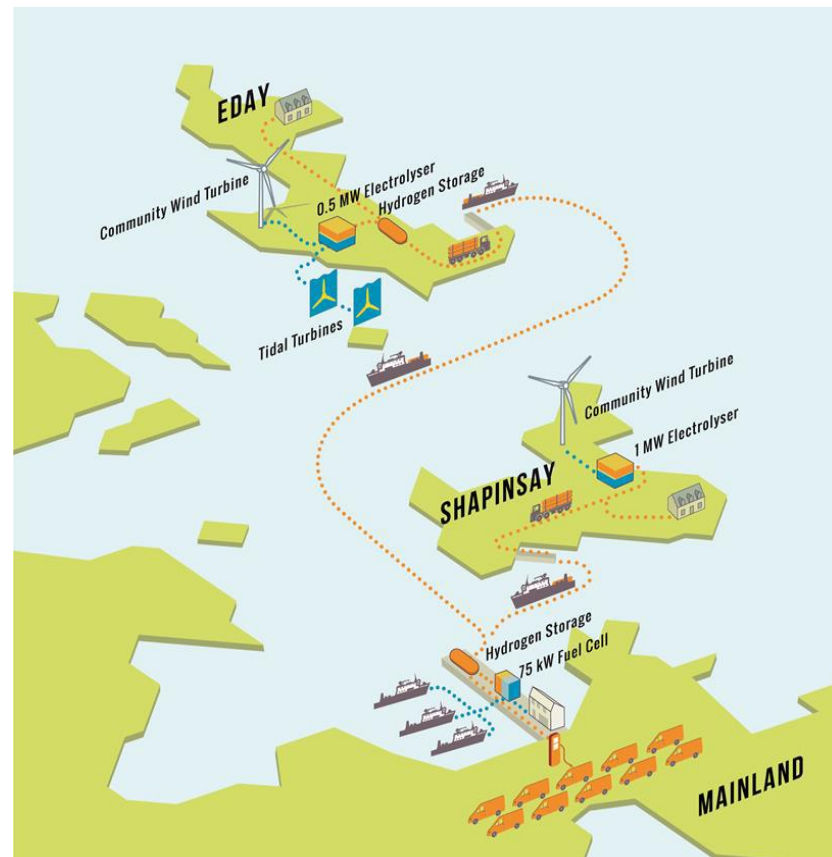
Objectives

1. *Delivering the Local Authority's Orkney Hydrogen Economic Strategy*
 - Conversion of 2.7 GWh/year of curtailed RE (wind & tidal) to H₂
 - Methodology to transport hydrogen
 - Storage of 970 kg of H₂
2. *Demonstrating replicable hydrogen economy solutions*
 - Possibility to export results to other isolated locations
3. *Environmental improvements*
 - Reduction of GHG emissions: 330 t pa CO₂ equivalent
4. *Bringing Economic Benefits to Island Communities (savings and new jobs)*
5. *Improve Local Public Acceptance of Hydrogen*
6. *The Demonstration of Orkney as a Hydrogen Territory*
7. *Contribution to FCH 2 JU MAWP (multi-annual work plan) targets*



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- Demonstration of Orkney as a replicable “Hydrogen Territory”
- To transform curtailed energy generated locally into a valuable energy vector – hydrogen:
 - Using hydrogen locally when possible
 - Transporting the remainder to mainland
- Demonstrating “real” end uses for hydrogen:
 - Heating for Council buildings
 - Auxiliary heating & power to ferries (cold – iron)
 - Transport: Refuelling a fleet of LDVs (Evs with FC range extender)



Funder	€ millions
Regional and National Funding	3.4
Partner funding	2.5
FCHJU	5.0
Total	10.9



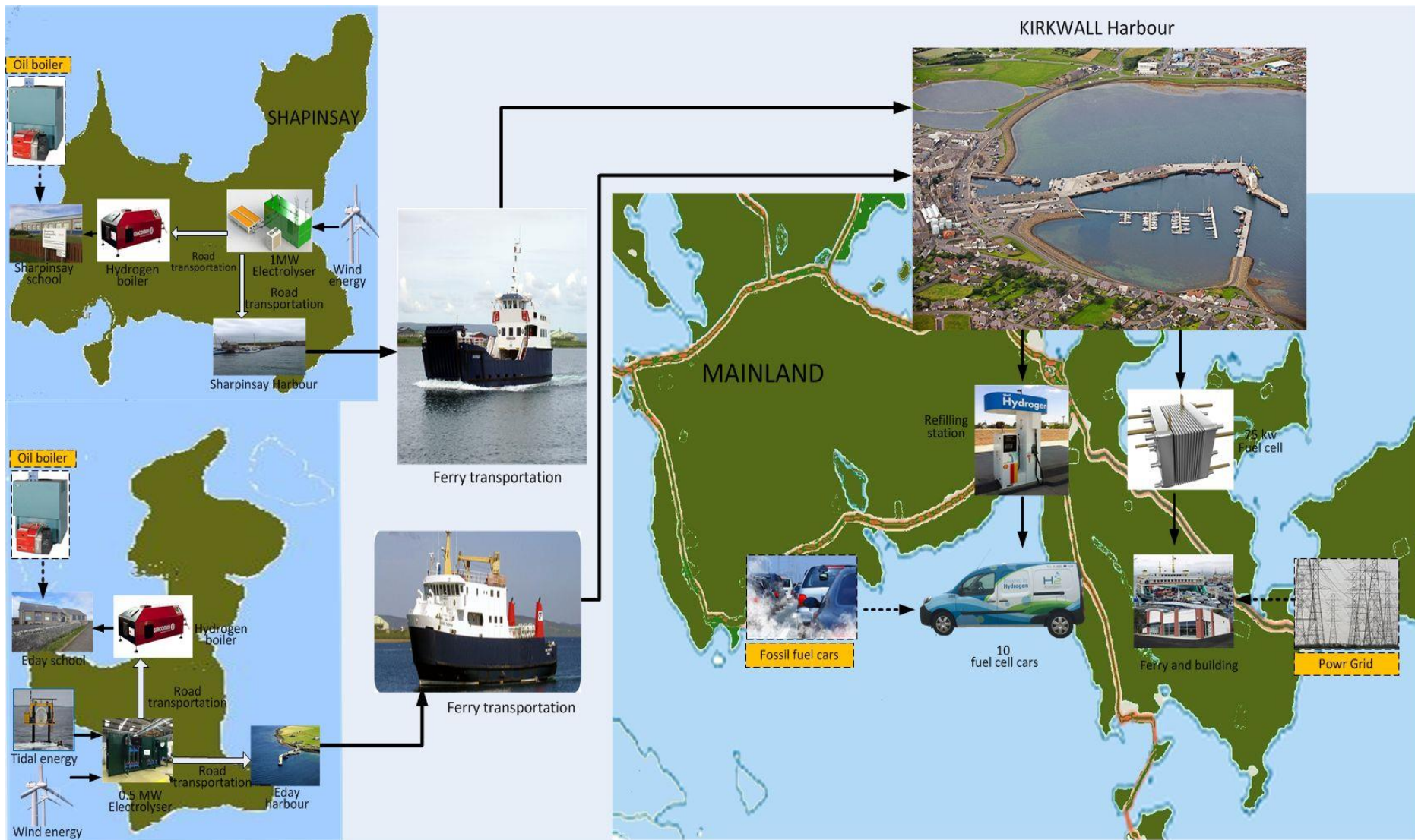
FCH solutions deployed

1. *Electrolysis: 1.5 MW*
 - 0.5 MW electrolyser in Eday
 - 1 MW electrolyser in Shapinsay
2. *HRS and 10 vans:*
 - 220 kg H₂ storage in the harbour with refueller (350 bar)
 - 10 Kangoo vans ZE-H₂ with FC range extender
3. *Stationary fuel cell: 75 kW*
 - CHP for buildings/ferries
4. *Tube trailers:*
 - 5 tube trailers: 25 t / 12 m
 - 270 kg of H₂/tube trailer
5. *Storage & compression:*
 - 220 kg H₂ storage and compression in the refueller
 - 500 kg H₂ storage and compression in the Eday electrolyser
 - 5 tube trailers used to store and transport hydrogen (270 kg H₂ per trailer)
6. *Catalytic boilers:*
 - 30 kW thermal



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Hydrogen will be transported in
MEGCs





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Workplan

- Duration: 5 years
(started May 2016)

1 year deployment
4 years of operation
- Six Work Packages
- Ongoing:
deployment phase,
commissioning by
the end of 2017





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LOCAL & WIDER BENEFITS – IMPACT

- Facilitates delivery of Orkney's Low Carbon Economic Strategy
- Pioneer pilot project – first in Europe as validated by EC (visibility & exposure)
- Overcomes grid constraints and harness local (otherwise curtailed) renewable resources (wind, tidal, wave)
- Reduces (grid) investments & improve grid load management
- Reduces imported fossil fuel consumption
- Boosts local economy including development of local skills & qualified jobs in emerging technologies
- Validates commercial/business models for integration of RES locally via hydrogen (near-to-market solutions)



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HYDROGEN TERRITORIES PLATFORM

The Hydrogen Territories Platform will be a platform that serves **two purposes**:

- **The dissemination of BIG HIT project information.** This will include project description, partner description, calendar of upcoming events, technical reports, etc.
- **The dissemination of information which facilitates the project being replicated widely in follower and other territories**, all of the key information on how to replicate the project will be held on the Hydrogen Territories Platform. This will include detailed descriptions of the equipment, and equipment selection process, the methodology and practical considerations regarding the logistics of hydrogen between islands, business models and key technical reports.

First meeting of the Hydrogen Territories Platform will be during the spring of 2018 in Orkney

Do you want to join us?

Supported by:



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