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Prospering from the Energy Revolution

Milford Haven: Energy Kingdom (MH:EK)

Project fact sheet

The MH:EK detailed design project is about exploring the role of hydrogen in a whole energy system approach to the development of smart local energy.

The Prospering from the Energy Revolution challenge programme ran from 2018 to 2023.
For more in-depth information on the programme and the projects see:
https://www.ukri.org/what-we-offer/browse-our-areas-of-investment-and-support/prospering-from-the-energy-revolution/

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Milford Haven: Energy Kingdom (MH:EK)

Dates:
1 March 2020 – 30 September 2022

UKRI funding:
£2.0m

Link:
https://milford-haven-energy-kingdom.virtual-engage.com/

Project partners:
Pembrokeshire County Council (lead)
Offshore Renewable Energy Catapult
Port of Milford Haven
Wales and West Utilities
Riversimple
Arup
Energy Systems Catapult

SLES components:
Hydrogen
Electricity
Mobility
Heat
Trading platform

What is the project?

The MH:EK detailed design project is about exploring a whole energy system approach and the potential for hydrogen alongside renewable electricity in supporting the decarbonisation of transport, heat, and electricity demand. It has developed a series of smart local energy system (SLES) propositions suitable for early investment aimed at kickstarting local decarbonisation across the energy system, and a long-term route map for the decarbonisation of Pembrokeshire. It has explored the synergies between regional SLES opportunities and decarbonisation of the large-scale national energy infrastructure including the UK's largest energy port and opportunities for offshore wind in the Celtic Sea.

What has been delivered? What has been successful?

- ✓ An investment brochure detailing three propositions for short-term SLES developments of which two have been identified as immediately investable.
- ✓ Development of MH:EK long term pathways focused on decarbonising Pembrokeshire's energy system by 2050 including wider renewable plans for the region and integration with plans for a GB-wide hydrogen transmission backbone.
- ✓ Hydrogen infrastructure trials of two hydrogen fuel cell vehicles, a public hydrogen refueller and electrolysers, and the world's first smart hybrid heating system (air-source heat pump and a hydrogen boiler) retrofitted in a commercial setting.
- ✓ Exploration and development of hydrogen focused system-architectures, trading platforms and a SLES data ecosystem.

Barriers encountered and outcomes

Barrier	Local hydrogen use in the three SLES propositions is limited by the current economic and physical constraints related to the interaction between electricity and hydrogen vectors.
Outcome	Techno-economic modelling identified only a relatively small role for local green hydrogen use within the propositions. This is limited by the opportunity cost for local renewable generators of producing hydrogen rather than electricity, and the fact that electrolyser capacity may be unused when excess renewable generation is not available.
Barrier	The third SLES proposition, based around Pembroke town, is not sufficiently strong to take forward in the near term. This is driven by the lack of district-level integration between the buildings' heating systems and very limited existing interaction between energy vectors.
Outcome	Although not recommended for investment, the proposition demonstrates the opportunity to increase local renewables if wider constraints can be overcome. It also promotes the potential to integrate existing hydrocarbon-based industries into a wider SLES in the longer term.
Barrier	Although MH:EK aimed to follow emerging best practice for data management, the ability to maximise this was limited by existing data practices beyond the control of the project.
Outcome	The project undertook a review of data challenges as a case study against recent Energy Data Taskforce recommendations. This review proposed establishing a robust data ecosystem at local level and put plans in place to prepare for initiatives such as open data and data standards.

Impacts

Forecast GHG savings in 2032:	81.6% (Range: 80.4% to 82.6%)
Forecast energy and network savings in 2032:	£1.24m (Range: £1.08m to £1.37m)
Match funding:	£2.5m

Top lessons learnt

1. Smart local energy systems have significant benefits in terms of costs and carbon emissions particularly where there is strong interplay between vectors. However, where close integration of electricity and heat networks is not feasible, hydrogen can play an important bridging role.
2. The importance of standardisation and the development of interoperable infrastructure and technology cannot be overstated.

What's next?

- Take forward no-regrets decisions identified including two of the SLES propositions developed for Milford Haven Marina and Pembrokeshire Food Park.
- Develop the proposed MH2K consortium to develop green hydrogen production at sea.

Heat, power and mobility evaluated. Cost and carbon values are based on impact of two case studies and against a counterfactual of no intervention. For more information on the methodology used to estimate carbon and cost impacts see https://es.catapult.org.uk/report/bills-and-carbon-impact-of-smart-local-energy-systems/.