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analyst view

Islands as Hydrogen Infrastructure Demonstrators

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The coast of Hawaii's Oahu island at night (Source: Flickr/madmarv00)

As smart grid and hydrogen infrastructure technologies advance, stakeholders are looking to move beyond conceptualisation to real world trials and demonstrations. Islands represent the perfect platforms for such efforts as they offer a defined project scope: the boundaries of the island and the population are set, the locations for and distances between power generation and distribution sites are known, and the necessary range of vehicles can easily be determined. Generally an island's energy is more expensive, infrastructure costs higher and grid balancing more difficult so there is often demand from the islanders for new energy solutions too. As such islands can be more accessible for the integration of new technologies and they make for grander, and more manageable, showcases than the conversion of a county, for example, to a new technology.

There are several island demonstrations of hydrogen and fuel cell infrastructures of varying significance, the most recent of which is the Isle of Wight's EcoIsland project, launched at the House of Commons last week. EcoIsland aims to make the UK's Isle of Wight, population c. 150,000, a net energy exporter by 2020 through the integration of its increasing wind, tidal and photovoltaic renewable energy supplies via an IBM and Cable and Wireless smart grid, battery and hydrogen storage for grid balancing and the provision of clean transportation.

One island that has already harnessed its renewable energy potential and become a net energy exporter to the mainland is the Danish island of Lolland, population c. 70,000. In 2007 the island generated 1,150,000 MWh of electricity and consumed just 750,000 MWh. Locally referred to as 'the pancake' due to its topographical flatness, approximately 90% of the island's electrical generation comes from the largely unobstructed wind that sweeps the land; the remaining generation is also green, coming from biomass, waste and to a lesser extent biogas. The Lolland

Hydrogen Community in the village of Vestenskov is the EU's first full-scale residential fuel cell combined heat and power demonstration, with installations in 35 homes. Hydrogen for the community is produced through excess wind-powered electrolysis; the by-product oxygen created in the process is used to accelerate biological reactions in a nearby municipal water treatment plant.

Since 2004 the small Nordic island of Utsira, population c. 250, has been demonstrating the world's first full-scale autonomous combined wind power and hydrogen plant powering ten local households. The system comprises two 600 kW Enercon E40 turbines, a 5 kW flywheel, a 48 kW electrolyser, a 55 kW hydrogen internal combustion engine (HICE) and a 10 kW fuel cell. During peak wind, electrical demand is met directly from the turbines and excess electricity is used to generate hydrogen via electrolysis. When wind power falls below demand, the stored hydrogen is processed through the fuel cell and the HICE to generate electricity for the homes.

Promoting Unst Renewable Energy (PURE) is a community-owned clean energy project on the Scottish Shetland island of Unst, population c. 700. Started in 2001 with a budget of £400,000 the project, which launched in 2005, consists of two 15 kW wind turbines, a high-pressure electrolyser, hydrogen storage, and a dispenser for a FCEV. There is also a 5 kW fuel cell backup system at the project's offices and a wind-to-heat system. The PURE Energy Centre has grown to now sell energy solutions, including fuel cells, and earlier this year designed a hydrogen production system based around the Unst installation for a new GBP £4.7 million facility – The Hydrogen Office, located in Fife, mainland Scotland.

Undoubtedly the largest island demonstration of hydrogen and fuel cell solutions is Hawaii. With a 90% dependence on imported oil, Hawaii, population c. 1.4 million, is America's most fossil fuel dependent state resulting in exceptionally high fuel and electricity prices. This has driven both islanders and the US Government to actively pursue sustainable energy solutions for Hawaii and a roadmap aiming to achieve 70% clean energy use by 2030 has been set. After a handful of previous hydrogen projects, a consortium of twelve companies, agencies and universities last year launched the Hawaii Hydrogen Initiative (H2I). H2I aims to make Hawaii the first US 'hydrogen state' beginning by installing twenty to twenty-five hydrogen stations at strategic locations across Hawaii's most populous island, Oahu, by 2015. Oahu is also to see the construction of a 65 kg per day Proton OnSite hydrogen generator for installation at the Marine Corps Base Hawaii to fuel a fleet of GM Equinox FCEV. More information on Hawaiian efforts can be found in a previous analyst view: Integrated Hydrogen Projects in Hawaii.

Subject to unique pressures and drivers, islands are presenting equally unique opportunities to demonstrate the viability and real-world accessibility of future energy solutions, including hydrogen and fuel cell technologies. Such projects can offer the triple benefit of bettering island life, increasing energy security and highlighting the feasibility of new energy.

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