

“The Hydrogen Office”

1 - Project Aim

The Hydrogen Office project has been set up by the Business Partnership Ltd to support the accelerated development of the renewable, hydrogen, fuel cell and energy storage industries. The goal is to inspire people; promote the opportunity; improve access to and understanding of the technology; promote sector development; facilitate research and development; and enhance educational opportunities.

2 - Project Summary

Project title: The Hydrogen Office Project

Lead organisation: The Hydrogen Office Ltd (Non for profit organisation) owned by the Business Partnership Ltd

Key words: Education, skill development, technology transfer, renewable energy, hydrogen, fuel cell, green transport, energy storage

Country: Scotland, United Kingdom

Town: Methil

Project website: www.thehydrogenoffice.com

Project time span: 2007 to 2011

Project budget: GBP 3.6M

Funding sources: Scottish Enterprise, European Regional Development Fund, The Scottish Communities Renewable Household Initiative

The main project aim of the Hydrogen Office was to design, develop and construct a completely green commercial office using state of the art renewable and hydrogen storage technologies. Today the Hydrogen Office, shown in figure 1, is operational and provides a key location for promoting green hydrogen storage and buildings.

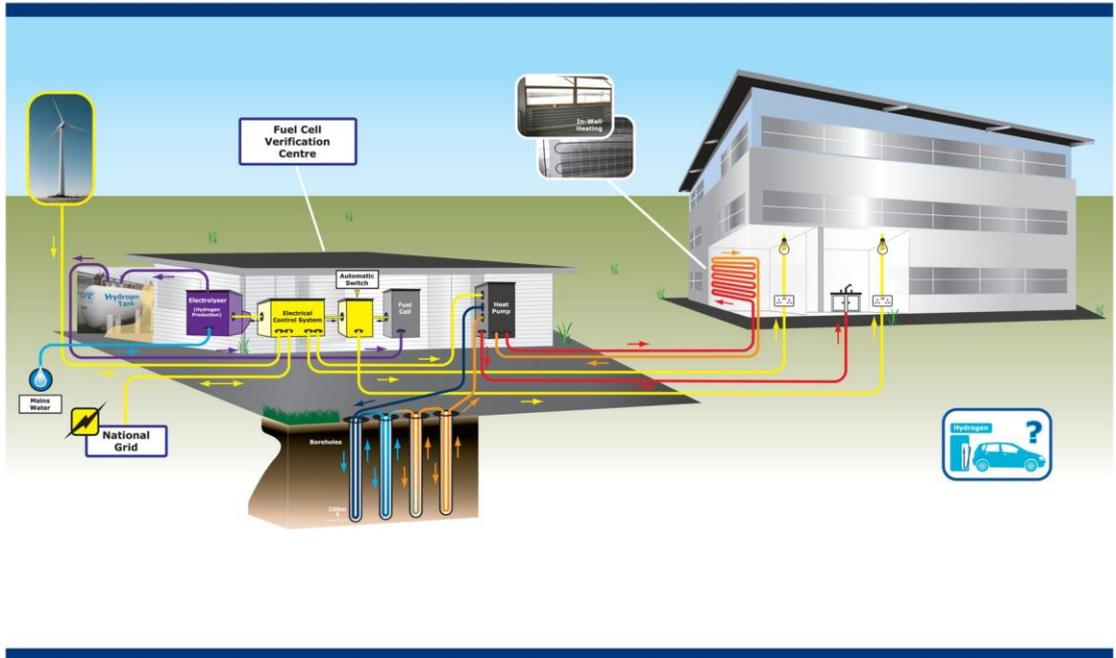


Figure 1: The Hydrogen office

The offices within the Hydrogen Office building are powered by a novel renewable, hydrogen and fuel cell energy system. A wind turbine (named 'Poppy' by the local pupils at school), generates electricity (see left of figure 2). The wind electricity is used to power all lightings, computers and make coffees and teas as needed in the Hydrogen Office building. Any surplus wind electricity is then used to produce hydrogen from water. This hydrogen is stored in a tank for later use.

When there is insufficient wind or even when there is no wind at all to supply the Hydrogen Office, then the hydrogen is used in a fuel cell. The fuel cell generates electrical power, which is then used to supply electricity to the Hydrogen Office Building. The only by-products of the fuel cell are heat and water, thereby providing a unique working environment for businesses to set up where true clean, non-polluting and green building is a reality.

A Ground Source Heat Pump (GSHP) has also been installed to supply heat to the offices. The GSHP operates from both the wind turbine and fuel cell, hence providing the offices with heat during working hours.



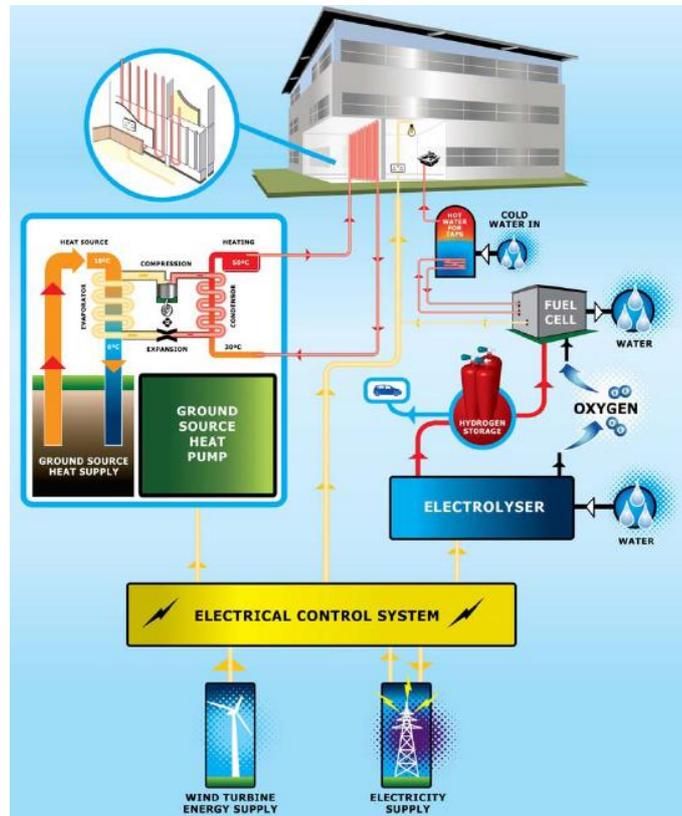


Figure 2: The Hydrogen office system

3 - The project

The Hydrogen Office project has been developed by the Hydrogen Office Ltd, a not-for-profit organisation whose primary aim is to support the accelerated development of the Renewable, Hydrogen and Fuel cell sector in Scotland by raising the visibility of the technology. Based in Fife, on the east coast of Scotland, the project is an hour's drive north of Edinburgh. Situated on the Methil 3 Dock, the project represents the next generation of energy technologies in an area for which the energy sector has been one of the most significant local employers for well over a hundred years.

At the start of the last century the area was a major coal mining and exporting area, and more recently a key location for the development of offshore oil and gas platforms. The Hydrogen office project is seeking to develop a cluster of renewable, energy storage and fuel cell activities which will see the area lead the transition from the old carbon based fuels of the past, to the new low or zero carbon based fuels of the future.

Formally opened in early 2011 by the Scottish First Minister as seen on the below picture, the project has already started to achieve its aims of raising the visibility of the sector in Scotland, and is delighted to have been nominated and shortlisted as a

finalist for the prestigious Scottish Green Energy Awards 2010, as the most innovative project's in Scotland.



Figure 3: Hydrogen office opening with First Minister Alex Salmond, Derek Mitchell of Hydrogen Office Ltd, Adrian Gillespie of Scottish Enterprise and Dr Daniel Aklil of Pure Energy Centre [1]

The project includes a 750kw wind turbine (see figure 4), and a cutting edge hydrogen and fuel cell system, including a large hydrogen storage tank (see figure 5). The system allows the project to store zero carbon energy from renewables when available, for use when it is not available.



Figure 4: The H2Office wind turbine (called poppy)

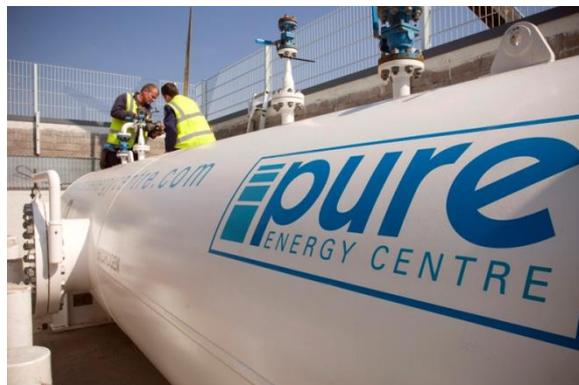


Figure 5: The H2Office storage tank

In a Scottish context these technologies are key to supporting the transition to a low carbon economy supported by renewable energy. It is estimated that Scotland has six times more renewable energy potential than it currently uses in electrical energy annually.

Energy storage technologies such as hydrogen increase Scotland's capability to more fully harness its vast renewable energy resources, offering significant long-term employment and carbon reduction benefits.

Notably, energy storage technologies bring into play opportunities not currently open to intermittent renewable energy sources, including: grid balancing and peak power provision; demand for renewable electricity during surplus production; a scalable low carbon transport fuel with capacity to power heavy and long distance

transport needs; and the production of industrial feedstock's (such as ammonia for fertilizer).

As demonstrated at the Hydrogen Office, this technology is operational now and is a technology that Scotland has a competitive advantage in. Fuel cells offer significant efficiency and carbon benefits. They are technically, and increasingly commercially viable today, for a wide range of applications using a number of fuel sources, including natural gas, biogas, methanol and hydrogen, and are capable of delivering zero carbon energy.

In short, energy storage technologies enable Scotland to harness its vast renewable energy resources with greater ambition, scope and reliance by bringing into play new uses for this energy. Hydrogen is a technically proven and versatile energy vector that covers a wide range of applications. It is a technology that Scotland enjoys a genuine competitive edge. Fuel cells offer significant efficiency and carbon reduction benefits.

To achieve its aims of supporting the accelerated development of the renewable, hydrogen and fuel cell sector within Scotland the project has three primary areas of focus. To support education, skills development, and research and development, to which end the project has undertaken significant community engagement which are summarised below.

The project wind turbine, which is currently Fife's largest turbine and the only turbine on a dock wall in Scotland was named Poppy by the children of the local Childcare Centre. The turbine naming ceremony was officiated by local Fife Council Councillors, Douglas Chapman and Jim Young and the children of the local Childcare Centre. The Childcare Centre manager commented that "The children have all shown great interest in the turbine and we have watched it arriving, being constructed and even saw the men coming out of the top of it before the blades were attached! It's great to have something so interesting right on our doorstep as it gives us so many opportunities to talk to the children about looking after our planet. We are all excited to be part of the official naming ceremony."

The project has also been working with Adam Smith College. The Hydrogen Office and Adam Smith College are jointly providing 'Roadshows' for schools in Fife. These provide young learners with the opportunity to learn more about renewables and sustainability and to gain an understanding of present and future jobs in the renewable industry. The partnership has been established to provide expertise and innovation for energy education by the two organisations, both of whom champion learning in the renewables and new clean energy sector. The Roadshows are being run throughout Fife with pupils aged 12 to 15 years, highlighting the benefits of new energy sources and inspiring youngsters about careers in this dynamic industry.

The Hydrogen Office Ltd has also set up and run the 2010 Hydrogen Challenge sponsored by Babcock. The competition saw teams from 6 local primary and

secondary schools build miniature hydrogen fuel cell powered buggies. Figure 6 shows one of the participants and his hydrogen fuel cell vehicle.



Figure 6: The H2Office hydrogen fuel cell competition

As well as producing a poster exhibition detailing how the team had designed their vehicle, the teams had to prepare for a sprint challenge with buggies timed over a set distance, an endurance test to see how far they travel on one tank of hydrogen and manoeuvrability, weight and measurement assessments of each buggy. One of the judges for the event was Dr Daniel Aklil, Managing Director of the Pure Energy Centre and one of the world's leading experts on hydrogen systems, who said "It was fantastic to see such innovation and enthusiasm shown by the competing teams, what a great way for school children to learn about this exciting technology." The winners' certificates were presented by Robert Dick, Energy & Support Services Manager of Babcock, which sponsored the Challenge who commented "This competition has been very exciting and inspiring, it's great to see how it has fired the pupils' imaginations and interest in engineering and energy. As a company we were very happy to sponsor the Challenge and support scientists and engineers of the future."

Renewable, energy storage and fuel cell technologies are key for the transition to a low carbon future. Today's children are central to this transition as they are the generation that will both have to manage the consequences of the global changes driven by climate change, and are also the generation that will have to implement

and live with what is likely to be the most significant change in energy technologies since the industrial revolution.

Reference:

[1] Scotland's Hydrogen Office opened by First Minister, Scottish Enterprise, <http://www.scottish-enterprise.presscentre.com/Press-releases/Scotland-s-Hydrogen-Office-opened-by-First-Minister-311.aspx>