



# The Hydrogen Home

James Heathcote is the CEO of ITM Power, a developer of solid polymeric fuel cell and electrolyser technologies which is listed on the AIM market of the London Stock Exchange. He is one of the UK's foremost thinkers on energy security and the hydrogen economy. James discusses his vision of the hydrogen home – and the hydrogen economy – with Cleantech magazine editor Anne McIvor.

**Q - Why do you believe that the hydrogen home is the way forward?**

**A -** Oil and gas reserves are depleting rapidly and the world is facing a very serious resources challenge. If we can make a home energy independent through domestic production of a clean renewable fuel, hydrogen, then we can make a village, town, city – and therefore a country – energy independent. The hydrogen home might be seen as a microcosm of a country – or even of the world. It is a symbol of the hydrogen economy. Hydrogen, in my opinion, is the





Courtesy of ITM Power

only fuel which can displace fossil fuel and which offers a sustainable solution for the world's energy requirements.

**Q - Who is investing in the hydrogen economy?**

A - I recently spoke at the National Hydrogen Association in the USA outlining our vision for the transition to a renewable, clean, sustainable hydrogen economy. Conference participants included multinational companies such as General Motors and Shell. The growing interest on the part of multinational companies underlines the increasing level of importance being attached to hydrogen as a route towards energy security.

**Q - Why do we need hydrogen? Why not just convert the energy directly from the wind or the sun?**

A - The amount of energy mankind uses in a year is less than the amount of energy which arrives at the earth from the sun in one hour. There is roughly 10,000 times more energy available than we need. The reason we used fossil fuels is because the arrival of the energy does not match our demands. In order to displace fossil fuels we need to be able to make a fuel that is clean and cost competitive with existing fuels and that meets the timing of our energy requirements. It is not possible to run a home, village or city on wind power or solar energy unless there is a parallel power system operating in case the wind drops or when the sun is not shining (for example at night time). So, wind and solar do not reduce our dependency on existing energy systems. Take the example of Denmark: Tony Lodge of the Centre for Policy Studies points out that Denmark has not been able to turn off one conventional power plant even though they have gone through the enormous expense of converting their energy generation to 19% wind.

**Q - So do you consider that wind energy is a complete waste of time?**

A - Connected to the grid, wind is – in my view – unlikely to produce any reductions in CO<sub>2</sub> or offer any energy security on a national basis. In my opinion, if economically viable, wind turbines should be sited offshore to produce hydrogen which is fed into the North Sea gas pipeline and used as a fuel to reduce our gas imports. This eliminates the requirements for back-up power systems and the intermittency problems of wind energy while usefully increasing the UK's energy security and displacing fossil fuels. In the United States there have been proposals that wind farms located in the mid western states of the US are used to produce hydrogen which would be piped to the eastern seaboard to meet the energy demand of the higher population areas. There is a lot of energy available, but if it doesn't match our demands it is useless. Storage is the key.

**Q - What is the role of fuel cells in the hydrogen home?**

A - Fuel cells are a wonderful technology that have proved difficult to commercialise due to costs and durability. They silently create electricity more efficiently than internal combustion generators running on hydrogen and, for



residential use, noise will be a major issue. The ideal hydrogen home will probably have a PEM fuel cell. But, to start with, it is likely that the first homes will use a hydrogen internal combustion generator because they are available and affordable.

**Q - How is ITM Power working towards the goal of the hydrogen home?**

A - A hydrogen home is a technical possibility today – and in fact one has already been built in the US – but it's expensive. There are three critical pieces of technology: the solar panels, electrolyser and fuel cells. These are all expensive technologies, but there are tremendous advances taking place in the US and Germany to reduce the cost of solar panels. ITM is working on the electrolyser and fuel cells. The most expensive components in an electrolyser or fuel cell have been the membranes. ITM has developed a new membrane technology that is 1% of the cost of conventional membrane materials and has higher ionic conductivity. This means that ITM has been able to develop much lower-cost fuel cell and electrolyser stack technology which has achieved long term durability testing.

Moving forward, we anticipate a great expansion in the electrolyser and fuel cell markets as we reduce the cost of our products. ITM is currently building a hydrogen home demonstration unit at its site in Sheffield. This will demonstrate that it is possible to have zero carbon housing (which is a target for the UK Government for new build properties by 2017).

**Q - Where does ITM fit in strategically in the hydrogen economy of the future?**

A - ITM is working towards solving energy security and ecological challenges. ITM has identified low-cost electrolyser technology as the vital component for converting carbon-free energy into clean hydrogen fuel (on site and on demand).

ITM is working towards the commercialisation of low-cost fuel cells and electrolysers to enable the hydrogen economy to become a commercial reality.

**Q - Does your technology have applications for transportation?**

A - Internal combustion engines and fuel cells can both run on hydrogen and their only emissions are water vapour. ITM has developed a two litre petrol-fuelled Ford Focus so that it can run on either gaseous hydrogen or petrol. We expect, ▶



▶ as a further development of the hydrogen home, that it will be possible to refuel a car from the hydrogen store that you have generated at home. In this way it may be possible to not only achieve security of supply for your home's needs, but also for your transportation needs.

**Q - How do you see the medium term outlook in terms of the development of the energy infrastructure?**

**A -** Solar appears to be eclipsing wind on an economic basis. Currently, I believe the future will be a nuclear/solar future where every roof has solar panels and additional power is supplied from clean and secure nuclear energy.

I hope that both Britain and other governments around the world recognise that we are facing a major energy crisis and that they focus on developing reliable and secure power for their populations.

We cannot afford to rely solely on governments, and the development of hydrogen homes will enable individuals to achieve their aspiration of personal energy security irrespective of global or national events. **CT**



Jim Heathcote (left) receiving an award from Prince Albert of Monaco earlier this year at the Clean Equity Monaco Conference which was sponsored by Barclays Wealth and Barclays Capital. The award is for "Excellence in the Field of Environmental Technology Research". ITM Power was the winner in the category.

The feature above was first published in Cleantech magazine, September 2008



**Cleantech**  magazine

Take an annual subscription to Cleantech magazine and receive all Infocus publications. For subscription information email: [subscribe@cleantechinvestor.co.uk](mailto:subscribe@cleantechinvestor.co.uk) or visit the Cleantech Investor website:

[www.cleantechinvestor.co.uk](http://www.cleantechinvestor.co.uk)