HYDROS GENEROS

Cleanly produced gas heralds the advent of truly zero-emission transport, says **THEODORE HOLTOM**

After years of successful demonstration, green hydrogen technology is finally starting to get deployed around the world. Green hydrogen is hydrogen generated from renewable energy as opposed to conventional hydrogen supplies which come from fossil fuel or non-renewable energy sources.

Electrolyser technology, which splits water into hydrogen and oxygen by use of electricity, is market ready. All related hydrogen components are available in order to create a hydrogen refuelling infrastructure. The high purity oxygen can also be sold to relevant customers or vented to fresh air. Hydrogen vehicles simply get their power by re-combining the hydrogen with oxygen and output water vapour which feeds back into the water cycle. Hydrogen storage is well demonstrated and while there are safety considerations, these are equivalent to the safety considerations associated with petrol fuel.

The huge German utility company, e.on, has announced that it will inject hydrogen from electrolysers on wind farms into the German gas grid. The hydrogen is mixed with the existing gas and e.on reckons that up to 15 per cent hydrogen is readily achievable. This would even allow the entire German renewable energy output to be absorbed into the gas grid.

Germany is also leading the way in relation to 'hydrogen corridors', opening networks of hydrogen filling stations around its cities and motorway networks in order to facilitate hydrogen transportation. It has recently been announced that Germany will increase the number of hydrogen filling stations from fourteen, currently, to fifty by 2015. There is progress also in the UK with a hydrogen filling station opening in Swindon and work is under way for a potential hydrogen highway here in Scotland, focusing on Aberdeen and Peterhead.

Hydrogen buses have been extensively trialled, especially across Europe, including in London. Vehicle manufacturers such as Daimler, Honda, Hyundai and others are looking to ramp up production soon. Hydrogen forklifts, boats, submarines, tractors, trains and aeroplanes all exist in some form. Hydrogen road haulage is being developed.

With around 31 million vehicles on UK roads, and even efficient diesel vehicles failing to meet carbon dioxide emission targets in many cases, there is a clear opportunity for zero emission transportation. Battery electric and plug-in hybrid vehicles are helpful but they are only as green as their electricity supply.

Since that supply is generally of mixed fuel and still only a minor part of it is generated from renewable energy, electric vehicles cannot generally be said to be zero emission. Hydrogen vehicles are also not zero emission if the hydrogen is generated from a chemical process which is not itself zero emission. But hydrogen can easily be generated on wind farms by installing electrolyser equipment. In this case, green hydrogen is generated allowing truly zero emission transportation, not only in respect of carbon dioxide but also in terms of other pollutants which produce a harmful health impact.

Hydrogen vehicles typically have advantages over battery electric vehicles in terms of range which can be of the order of 400 miles for hydrogen versus around 100 miles for battery electric. Hydrogen vehicles can be refilled at a pump similar to conventional vehicles and within around three minutes, compared with battery electric vehicle charging times which can be many hours.

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Aberdeen Council Leader Barney Crockett and First Minister Alex Salmond – the city will be the first in Scotland to run hydrogen powered buses

There are huge business opportunities and strategic advantages for Scotland and the UK. Scotland has many wind farms which could be exporting green hydrogen for a better price than their electricity exports. As one particular type of energy storage, hydrogen can contribute to the smart management of variable renewable generation, allowing the redirection of electrical power into other parts of the overall energy grid such as transportation, heating and cooking. Green hydrogen offers new revenue streams to wind-farm owners including green hydrogen export, but also for energy storage and energy trading, capturing curtailment energy and as an alternative to low electricity prices in case of supply imbalance.

Joined-up thinking with regard to the interactions across all energy infrastructure ranging from electricity generation, natural gas usage, transportation, heating, smart grids and variable renewable energy justifies further research and demonstrator projects to quantify the mutual benefits offered by hydrogen.

Scotland can stay ahead of the game, contribute to environmental improvement and become a major transportation fuel producer by generating green hydrogen on its wind farms. Scotland can join Germany in extending its hydrogen highway along the entire motorway network and by including all Scottish cities, as well as Scottish Highland and island communities which have already led the world in green hydrogen and renewable energy. An early hydrogen highway implementation could stimulate local hydrogen technology manufacturing, from electrolysers and fuel cells through to hydrogen vehicle manufacture.

Scottish farmers and rural communities can generate their own green hydrogen transportation fuel-using wind turbines. Farmers and other users can deploy hydrogen tractors.

Scottish local government vehicle fleets and commercial fleets should undertake cost-benefit analysis now to check the financial and environmental benefits offered by hydrogen vehicles. Introducing 10 per cent green hydrogen fleet vehicles can immediately reduce emissions by 10 per cent, quickly enabling targets to be achieved. Scottish wind-farm owners should undertake cost-benefit analysis now in order to check the investment case and obtain early green hydrogen market share. Deals can be done to match green hydrogen vehicle fleets with green hydrogen suppliers, enabling the virtuous circle of cheap, home-made zero emission fuel from renewable energy.

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