# Can we produce enough green hydrogen to save the world?

November 15 2018, by Jonathan O'callaghan


Using a proton exchange membrane electrolyser to produce hydrogen from renewable electricity and water can help industry slash emissions. Credit: Siemens

Around a fifth of all greenhouse gas emissions are produced by

industries such as steel and cement so if we're going to work towards an emission-free society then this is a good place to start. And one promising technology may have a key role to play.

'Hydrogen and fuels derived (from it) is capable of reducing the carbon dioxide emissions from fossil fuels in the very, very long term, down to zero,' said Klaus Scheffer, project manager at Siemens. 'You don't need fossil energies in a future world. I hope my kids will see that.'

The technology is green hydrogen – using an electric current to convert water into oxygen and hydrogen – and if this is powered with renewable energy then it produces no carbon emissions. If this is, in turn, used to provide a clean source of fuel for industry or to balance the electricity grid, it could help alter the future of the planet.

The main problem so far has been how to make hydrogen in large quantities cleanly. Currently, about 96 percent of global hydrogen is produced by reforming methane, which produces carbon dioxide as a waste product. Green hydrogen produced with this electrolysis method, however, is a much cleaner alternative.

Scheffer is helping to create a source of green hydrogen for use at a steel plant in Linz, Austria, as part of a project called H2FUTURE. The goal of this project is not just to produce green hydrogen from renewable energy, but to see if it can in turn be used to produce steel with a lower carbon footprint, dubbed green steel.

'Steel production is one of the industries which are dominating the carbon dioxide emissions in the world,' said Scheffer. 'The steel production process applied in Linz uses loads of coal for steel production, (so there are) a lot of carbon dioxide emissions.'

## Viable

The first step of this project is to test if the technology is viable for commercial use – the electrolyser is set to begin full operations in spring 2019. Running at a capacity of six megawatts, the plant will produce about 1,200 cubic metres of green hydrogen an hour when it is fully operational.

It is admittedly a small test – the electrolyser will reduce just a fraction of carbon emissions at the plant. But this is only a pilot project, with designs on scaling this up for bigger hydrogen production in future, using an electrolyser running at a capacity of 100 megawatts.

Near Cologne in Germany, meanwhile, under a project called REFHYNE, ITM Power is developing a ten-megawatt electrolyser which will begin operations in 2020. It is being installed on the Rhineland refinery, operated by Shell Deutschland Oils, which currently relies on steam reforming to produce hydrogen.


Credit: Horizon

This is Germany's largest refinery, consuming about 180,000 tonnes of

hydrogen a year. The new electrolyser will provide a modest amount of hydrogen towards this total – about 1,300 tonnes a year. But if the trial is successful, then the technology could be expanded.

Aside from producing hydrogen, REFHYNE has another purpose that helps make a business case for its use. The electrolyser can be turned on or off very quickly, meaning it can provide a grid balancing service to cope with periods of high or low demand in the electrical grid.

'The utility (companies) need to balance intermittent renewables with base plants,' said Dr Frithjof Kublik, senior consultant for business development at the Rhineland refinery. 'The electrolyser has the advantage that it can turn on or off very fast, in a few seconds, and from that point of view you can offer a grid balancing service.'

Grid balancing services benefit from flexibility, which 'the utility company is willing to pay a price for,' said Kublik.

It's also something being investigated in Denmark, where a project called HyBalance has developed a demonstration plant in Hobro that produces hydrogen from water electrolysis when the amount of electricity being produced by renewables exceeds that needed by the grid.

'The project is really to test how we can use the renewable energy from the grid and transform it into hydrogen, that can be used either in industry or for energy applications,' said Caroline Le Mer, Hydrogen Energy Europe Director at Air Liquide, which coordinates the project.

**Spikes**

The plant opened in September 2018 and will run for 15 years, using the same electrolysing process as H2FUTURE and REFHYNE to produce

hydrogen, which is known as proton exchange membrane (PEM) electrolysis. More traditional electrolysers rely on alkaline electrolysis, but PEM is advantageous as it can deal with spikes in supply, such as from renewable energies like wind and solar.

That's particularly useful in Denmark, where wind power is abundant – in 2015, 42% of its electricity was produced by wind power. At the HyBalance demonstration plant, this is used to produce hydrogen when electricity levels are low, such as at night, or when wind levels are high.

The gas is either sold to industry or used for powering hydrogen cars, with the overall goal being to show that hydrogen can be produced in large enough quantities via renewable energy to be useful to industries.

At a later stage, the hydrogen could be kept in salt caves for future use – a low cost way to store large quantities.

Provided by Horizon: The EU Research & Innovation Magazine

Citation: Can we produce enough green hydrogen to save the world? (2018, November 15) retrieved 20 April 2024 from https://phys.org/news/2018-11-green-hydrogen-world.html