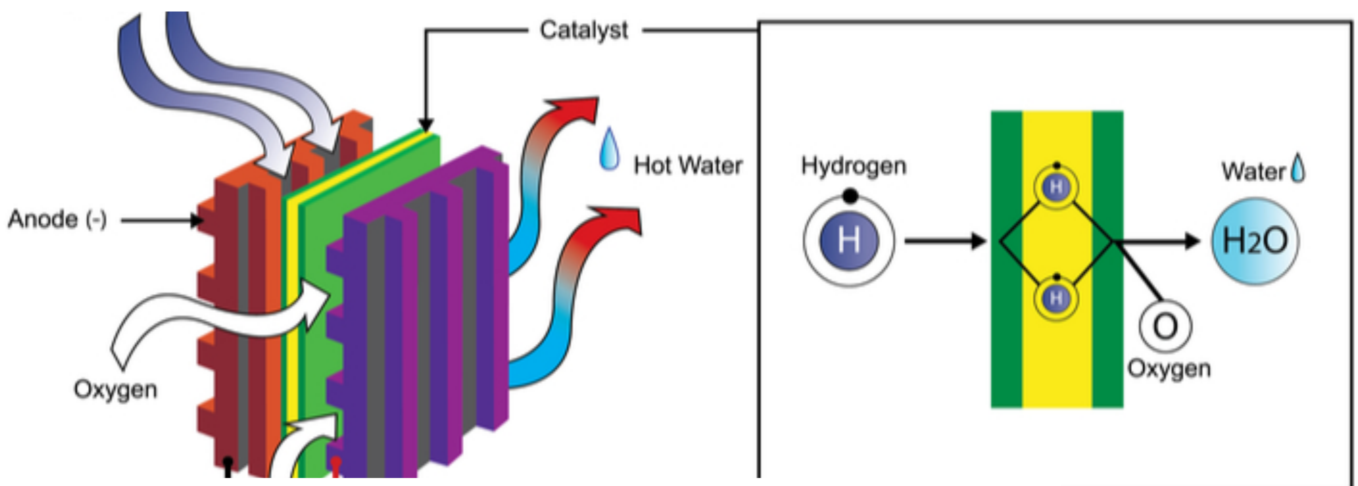
Comment

Realising the hydrogen economy

MEED | 11 October 2019 (Last Updated October 23rd, 2019 08:26)

Although less efficient than electric batteries, today's hydrogen fuel cells compare favourably with internal combustion engine technology, which converts fuel into kinetic energy at roughly 25 per cent efficiency. A fuel cell, by contrast, can mix hydrogen with air to produce electricity at up to 60 per cent efficiency.



Although less efficient than electric batteries, today's hydrogen fuel cells compare favourably with internal combustion engine technology, which converts fuel into kinetic energy at roughly 25 per cent efficiency. A fuel cell, by contrast, can mix hydrogen with air to produce electricity at up to 60 per cent efficiency.

Share

In the wake of 'hydrogen and fuel cell day' in the US on 8

Article

October, MEED took a closer look at the hydrogen economy.

———————————————————————————————————

Most observers of current events will be aware of the growing transportation trend towards electric cars, and many will certainly have heard the name Tesla. Indeed, such is the fervour that it can be hard at times to remember the alternatives and that one of these is hydrogen technology.

The 'hydrogen economy' refers to the idea of transforming our existing hydrocarbon-based infrastructure – from static power generation to a full range of transportation applications – to run on hydrogen in order to cut carbon and carbon dioxide emissions.

This transformation can occur wherever hydrocarbons are used as fuel, but there is particular interest in the potential transport applications, where fuel cell electric vehicles (FCEVs) are seen as a particularly viable alternative to conventional hydrocarbon-powered vehicles.

Hydrogen_Infographic (1)

Inside a fuel cell

A fuel cell works much like an electric battery, converting chemical energy into electrical energy using the movement of charged hydrogen ions across an electrolyte membrane to generate current. There they recombine with oxygen to produce water – a fuel cell's only emission, alongside hot air.

Although less efficient than electric batteries, today's fuel cells compare favourably with internal combustion engine technology, which converts fuel into kinetic energy at roughly 25 per cent efficiency. A fuel cell, by contrast, can mix hydrogen with air to produce electricity at up to 60 per cent efficiency.

FCEVs also present relatively low barriers to entry in terms of societal changes, as they operate and perform similarly to conventional vehicles, refuelling at stations in minutes and driving for 500 to 600 kilometres on a single tank, all with no harmful emissions.

Making hydrogen

The hydrogen fuel itself can be produced with ever-increasing cost-effectiveness through electrolysis, by splitting water into its constituent hydrogen and oxygen atoms. This generates two useful gases and, when powered by green energy, makes hydrogen production a carbon-neutral act.

At present, however, just 2 per cent of the 600 billion cubic metres of hydrogen manufactured each year around the world is produced by water electrolysis, while 98 per cent is produced from natural gas, with carbon dioxide as a by-product.

More than 90 per cent of this hydrogen is used as a building block for fertilisers or is consumed within the oil, refining and wider petrochemicals industry.

The development of the hydrogen economy, therefore, relies on government investment in the initial phases. Investment in both hydrogen production and distribution infrastructure is needed, alongside the renewable power projects required to supply carbon-neutral energy.

For the moment, the scarcity of such infrastructure represents the single largest obstacle to the adoption of hydrogen technology.

Middle East trials

Efforts are nevertheless underway to bridge this capacity gap, not least in the Middle East.

While there is a long way to go, work is currently underway on the regions' first solar-powered water electrolysis plant at the Mohammed bin Rashid al-Maktoum Solar Park, in a joint scheme by Dubai Electricity & Water Authority (Dewa), Siemens and Expo 2020 Dubai.

Related Report

Thematic Reports

Are you worried about the pace of innovation in your industry?

GlobalData's TMT Themes 2021 Report tells you everything you need to know about disruptive tech themes and which companies are best placed to help you digitally transform your business.

Find out more

This project will have the capacity to produce 240kg of hydrogen a day – enough to fill the tanks of 50-passenger FCEVs and power them for a total of 30,000km – and is set to deliver hydrogen to the Expo 2020 site for several applications, including a pilot FCEV transport solution.

The Toyota Mirai, the world's most popular FCEV, was meanwhile launched in the UAE back in October 2017, when the country's first hydrogen station was opened by local Toyota distributor Al-Futtaim Motors, Abu Dhabi's Masdar City and France's Air Liquide.

Although pilots, these regional projects are backed by the increasingly evident reality of the hydrogen economy in Asian markets and particularly Japan, where 100 refuelling stations have already been established, and the government aims to have 800,000 FCEVs on the road by 2030, alongside a 90 per cent reduction in the cost of hydrogen by 2050.

Electric competition

The fact remains, however, that recent funding into the research and development of electric vehicle (EV) technology has vastly outstripped that of water electrolysis and fuel cell technology.

This situation has been driven by the rapid development of more efficient and cost-effective electric battery technology, lowering the potential costs of electrified transport systems.

EV and hybrid vehicles have an additional edge in terms of overall energy efficiency. Batteries now lose only about 17 per cent of the initial input of electrical energy through inefficiencies when charging and discharging, while the cycle of using electrical energy to split water into its constituent atoms and recombining hydrogen with air inside a fuel cell wastes more than 50 per cent.

Installing EV charging points at key locations, such as at facility car parks, is also simpler and promises governments more immediate and obvious returns than the more complex task of establishing hydrogen distribution infrastructure.

The upshot of this is that, to date, while EV and plug-in hybrid vehicle sales number in the millions, the most popular model of FCEV, the Toyota Mirai, has sold just 5,000 units.

Finding the right niche

However, while passenger FCEVs have recently lost ground to electric vehicles, interest in hydrogen technology is growing both for a range of niche transport market segments and other applications.

FCEV technology could be especially useful for commercial applications where bulkier vehicles need to travel long distances, carry heavy loads and refuel with minimal downtime.

To this end, hydrogen trials have been conducted on everything from public buses and forklifts to trains, planes and boats. For such applications, especially with the larger craft, electric batteries would need to be problematically large.

In the short to medium term, hydrogen could also be used to replace some of the compressed natural gas used in domestic applications, with minimal changes to existing infrastructure.

A study by Swansea University in the UK found that up to 30 per cent of domestic gas could be safely replaced with hydrogen, thereby reducing carbon emissions by 18 per cent, with no changes to existing infrastructure.

In Europe, the ‘EUTurbines’ group of manufacturers has pledged to make their gas turbines run on up to 20 per cent hydrogen gas by 2020, and develop turbine technology to allow all manufactured units to run, or be retrofitted to run, on 100 per cent hydrogen gas, and be carbon-neutral, by 2030.

Rising efficiencies

Globally, the cost of hydrogen is already coming down, partly in line with the fall in the cost of renewable energy, but also due to improvements in water electrolysis and hydrogen fuel cell technology.

The Paris-based International Energy Agency expects the cost of producing hydrogen to fall by a further 30 per cent by 2030, but the rapid reduction in the cost of recent photovoltaic solar energy projects in the Middle East could mean the local cost of commercially producing hydrogen will fall even faster.

As investment in hydrogen infrastructure grows and net costs continue to fall, the hydrogen economy could prove to be an indispensable tool in the transition away from hydrocarbons.

Related Report:

Solar Thermal Power in China, Market Outlook to 2030, Update 2018 – Capacity, Generation, Investment Trends, Regulations and Company Profiles

MEED
This article is sourced from Power Technology sister publication www.meed.com, a leading source of high-value business intelligence and economic analysis about the Middle East and North Africa. To access more MEED content register for the 30-day Free Guest User Programme.

Related Report

Energy

Get the Report

Latest report from GlobalData. Browse over 50,000 other reports on our store.
Visit GlobalData Store

Related Companies

AAF International

Gas Turbine Equipment, Filters, Services and Noise Control

Bridgestone Associates
Energy Consultants and Engineers

BarkerBille
Industrial Fans for Power Applications

Top 5 Most Read

Analysis 7 hours
Q&A: how the UK and Japan are partnering on nuclear robotics with LongOps 1

News 4 days
Rebel Energy reaches 157% of its funding target in seven days 2

News 4 days
Sellafield accused of sexist, racist, and homophobic abuses by whistleblowers 3

Sponsored 5 days
Strategic Asset Optimisation: Driving decisions through lifecycle cost planning 4

Industry News 6 days
Three key points for power generation from China's five-year plan 5

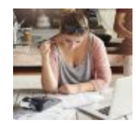
Posts tagged Coronavirus

Q&A: Insuring renewable assets at the dawn of clean energy transition

“It makes little sense to divest from Total, Shell, and Exxon, just because of climate change,” Total CEO

Five things we learnt from the ‘Redesigning wind energy for the next era’ webinar

Ofgem raises price cap on UK energy bills to cover Covid-19 costs



Report: wind generation to become ‘the backbone’ of the energy sector

View all >

Tweets by @WHO

World Health Organization (WHO) Retweeted

Tedros Adhanom Ghebreyesus
@DrTedros

Replying to @DrTedros

I used the opportunity to commend the government and people of #Qatar for their dedication and commitment in implementing a robust #COVID19 national response, as well as to thank them for the strong role they are playing in global health security and sustainable development.

2h

World Health Organization (WHO) Retweeted

World Health Organization (WHO) Retweeted

Tedros Adhanom Ghebreyesus
@DrTedros

Replying to @DrTedros

#COVID19 has proven that health isn't a luxury item or a product of strong & prosperous societies; it's a fundamental human right & the foundation of social, economic & political stability. I thank 🇶🇦 for supporting @WHO to promote health, keep the 🌍 safe & serve the vulnerable.

Embed View on Twitter

Up Next

News

Minesto and Schneider Electric collaborate on ocean energy farms

15 Mar 2021

News

RWE acquires controlling stake in British offshore wind farm Rampion

15 Mar 2021

News

LG Energy Solution to invest $4.5bn in US battery production expansion

12 Mar 2021

News

Eni and CDP Equity to develop renewable energy assets in Italy

12 Mar 2021

Power Technology

Powered by GlobalData.

About Us Editorial Approach Contact Us Terms and Conditions
Privacy Policy

We use cookies to ensure that we give you the best experience on our website. If you continue to use this site we will assume that you are happy with it.

Continue Learn more