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Hydrogen power

Enabling a virtuous decarbonisation loop

- Summary -

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Hydrogen is already attracting large inflows of "smart money" from sophisticated investors as recent technological advances are making hydrogen a potential catalyst for closing the loop of renewable energy generation. A very important part in achieving the goals of the Paris Agreement will play carbon-neutral sources of energy, including new types of fuel and technology for road transport and aviation.

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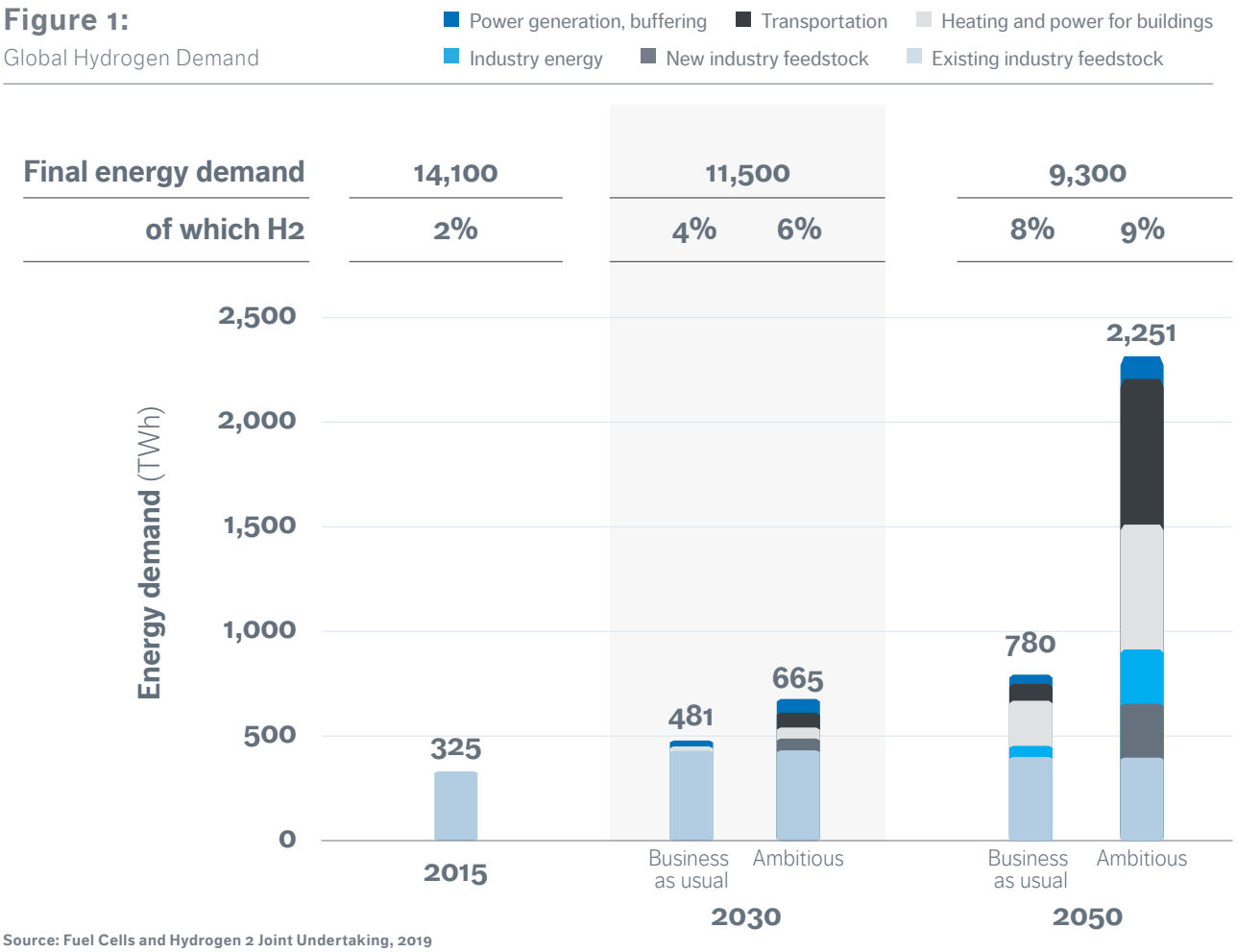
The European Commission is working on the proposals to increase hydrogen-based energy generation, in stages, to 6 gigawatts (GW) by 2024 and 40 GW by 2030. 40 GW is the maximum capacity of 20 Hoover Dams[1], which can also equal the electric consumption of about 20 million homes. The EU Commission estimated that, by 2050, this will require a remarkable investment of between EUR180bn and EUR470bn.

There has been a significant increase in investor interest in companies focusing on hydrogen technologies. Some key stocks have risen by an average of 300% so far in 2020[2] and brokers have been bombarding their clients with materials about investment opportunities in this areas.

Such positive market sentiment no doubt has the effect of boosting hydrogen's short-term market momentum. However, as long-term investors, we give primary attention to key factors such as the scale of the potential hydrogen market and at what stage of its development is each of the projects under consideration. Some, such as in trains, are already being tried, but others are not expected to be commercially viable for at least another 20 years. For investors, it presents an opportunity to diversify between projects of different timescales or between different business types (electrolysis, H2 producer or a fuel cell producer).

1 https://www.climatecentral.org/blogs/helpful-energy-comparisons-anyone
2 https://www.reuters.com/article/us-eu-hydrogen-breakingviews-idUSKCN24NoXo

Figure 1:
Global Hydrogen Demand



Source: Fuel Cells and Hydrogen 2 Joint Undertaking, 2019

Energy production

Over the past few years, the cost of renewable energy has been falling. For at least two thirds of Earth's human inhabitants, solar and onshore wind power are now the cheapest types of electricity[3]. This has helped the development of hydrogen technology as it has a synergetic relationship with renewables, as the success of one facilitates the outcome from the other. When renewable energy production is higher than demand, excess power can be fed through an electrolyser for the production of green hydrogen, which in turn can be stored and then reconverted to electricity when renewable electricity production is low. This creates a strong opportunity for accelerating energy transition in the power sector. Hydrogen also has the potential to help decarbonise energy-intensive sectors, which have very limited alternative solutions, such as steel production.

The conversion to hydrogen may come quicker than some anticipate. Hydrogen power generation can use existing energy distribution resources, without having to depend on the construction of major new electricity transmission lines. This is also relevant to transport as because it can make it possible to build hydrogen fuel stations, linked to hydrogen power plants, throughout the country[4].

We consider hydrogen as a potential catalyst for value creation in the energy sector over the long term. However, hydrogen is not yet a serious competitive option for the energy sector. There are also additional hurdles on the regulatory side, infrastructure development and technological advancement. On the top of that, it will be necessary to increase production capacity of "green" electricity that is required for the generation of "green" hydrogen.

3 https://www.bloomberg.com/news/articles/2020-04-28/solar-and-wind-cheapest-sources-of-power-in-most-of-the-world
4 https://cleantechnica.com/2020/10/11/usas-100-million-green-hydrogen-fuel-cell-plan/

Road transport

The transport sector will be a major target for the Paris Agreement-related innovation drive as it is responsible for a quarter of all direct CO2 emissions on our planet. In turn, cars, buses and motorbikes account for three quarters of those emissions, with the rest coming from the rapidly growing aviation and freight transport sectors. The most carbon-efficient mode of transport, rail, makes up only 2% of the whole transport energy consumption.

The European Union (EU) imposes very ambitious intermediate targets aimed at encouraging manufacturers to explore alternatives to the polluting combustion engines. The investment costs for developing new vehicles with combustion engines are currently the lowest but we believe that hydrogen-based engines will offer great potential for cost reduction if we look at the next 10 years. A hydrogen-based fuel cell solution has not reached the level when it can provide a cost effective option for light vehicles, so the choice remains between combustion engines and electric cars.

For the so-called 'heavy' mode of transport, the size of the electric battery makes it less practical. For example, a 40-tonne battery electric truck with a range of 500 km requires eight tonnes of battery power, making it less practical for transporting goods over long distances. Hydrogen providing three times more energy per kg than diesel, even though the tanks are heavier, could be a solution in this case. As a result, projects for hydrogen-powered semi-trailers are already well advanced. As for light vehicles, hydrogen could only become an alternative to combustion and electric engines around 2030, according to cost reduction scenarios.

Planes, ships and trains

Planes and ships are both accountable for 2.5% global CO2 emissions. However, in the case of planes, experts believe that the estimates should be at least doubled because the steam released by planes at high altitudes is also a significant greenhouse gas.

Hydrogen-based liquid fuels could offer an alternative to aircraft fuel. This would require combustion turbines rather than a fuel cell, as it does not have the power to lift a plane into the air. Storage would also trigger changes in aircraft design and infrastructure. Therefore, hydrogen seems far from being able to replace kerosene, with only the most optimistic scenarios expecting it to become a viable alternative for planes not earlier than 2045.

As for ships, the Maersk shipping company was the first to strive for carbon neutrality by 2050. This will require zero-carbon ships to be available by 2030.

Rail is already one of the most energy-efficient modes of transport, accounting for 8% of motorised passenger movements and 7 % of freight worldwide, but only 2 % of transport energy consumption. Rail is responsible for only 0.3% of CO2 emissions. However, hydrogen trains have been deployed on a trial basis and are currently under development.

Hydrogen is set to become a vital link in the alternative energy provision, a crucial part of the carbon neutral world we aspire for the future.

The technology has been around since the 1970s. Despite technological advancement and some government support in the recent years, deployment of hydrogen remains dependent on many factors. They include a favourable environment for reducing CO2 emissions, the price of renewable energies, and a European recovery plan that places a special emphasis on hydrogen in achieving carbon neutrality by 2050.

We believe that strong political action towards decarbonisation should speed up the process of hydrogen becoming powerful and economically viable alternative source for energy. However, even despite all of the progress made on the technological and regulatory side, much of hydrogen's success will depend on costs. The price of electrolysers and the cost of carbon-neutral hydrogen energy are still too high. Moreover, we believe that an increase in hydrogen energy production capacity and more powerful electrolysers can only be achieved based on more intelligent energy networks. While commercial application of hydrogen still account for a small part of major players' turnover, a growing market may change things very quickly.

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