HRA green hydrogen

Hydrogen

What is green hydrogen?

Green hydrogen is hydrogen which is produced using purely renewable energy such as wind or solar. Decarbonising energy systems is an important step in preventing irreversible damage to Earth's climate. In the future, we all need clean, flexible, storable and safe fuels, of which hydrogen ticks all of these boxes.

What are the benefits of hydrogen?

Hydrogen is an excellent energy carrier and an efficient way to store and transport energy. Each kilogram of hydrogen contains 2.4 times as much energy as natural gas. Similar to natural gas, hydrogen can be used as an energy source to heat buildings, power vehicles and generate dispatchable electricity.

This energy can be released as heat through combustion, or as electricity though a fuel cell. In both reactions, the only other input needed is oxygen and the only by-product is water.

Not only is it a clean energy source, the worldwide demand for hydrogen is set to increase substantially over the coming decades. Production costs are falling, technologies are progressing, and the push for non-nuclear, low emissions fuels is building momentum.

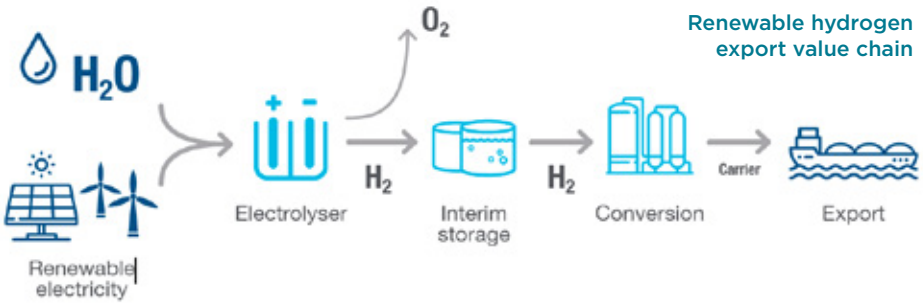
Is hydrogen renewable?

Unlike natural gas or petrol, when hydrogen is burned there are no CO2 emissions. The only by-products are water vapour and heat. Unfortunately, we don't usually find hydrogen in the form we can use as a fuel; hydrogen is bound up in substances like water, natural gas, coal and biomass. This means that we have to extract it.

We can extract hydrogen from water using renewable energy and this method releases no carbon emissions. We can also extract hydrogen energy from natural gas, coal and biomass, using heat to drive chemical reactions with water. This method does release carbon emissions and we need to make sure these are captured and stored safely in underground storage sites.

How safe is Hydrogen?

Given their combustible nature, all conventional fuels have some degree of risk associated with their use. Hydrogen is the lightest gas, meaning it rises faster and disperses quickly, reducing the risk of a gas explosion. Additionally, hydrogen is odourless, colourless and non-toxic which makes it difficult to identify leaks or fires, but this can be avoided by adding coloured compounds and odorants.



How is renewable hydrogen produced?

Renewable hydrogen is produced by splitting water molecules into hydrogen and oxygen powered by solar, wind or hydroelectricity. This process occurs in a device called an electrolyser, consisting of a positive and negative electrode separated by an electrolyte or a membrane. When an electrical current is applied between the electrodes, hydrogen is formed at the negative electrode and oxygen at the positive electrode, with the hydrogen collected for use. The hydrogen is then compressed for transmission and the oxygen is realised into the atmosphere. The energy to produce the hydrogen is subsequently realised at the point of use.

How is hydrogen stored and transported?

Hydrogen is a very light gas. To store and transport it economically over long distances it must be liquefied, transformed into ammonia or chemically converted to a hydrogen-containing liquid or incorporated into a solid substrate. Hydrogen liquefication involves compression and cooling via processes similar to those used in the LNG industry.

Once hydrogen is liquefied, it can be stored in large insulated cryogenic tanks. A small amount of stored liquefied hydrogen is lost through evaporation each day. A variety of pressure vessels can be used for storage and distribution such as a compressed hydrogen 'tube trailer'. Hydrogen can be transported by truck and rail in pressurised cylinders or alternatively it can be injected into existing gas pipeline infrastructure.

Hydrogen is technically an energy *carrier* rather than an energy source.

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