MOORE

HYDROGEN IN AFRICA

April 2024

Hydrogen is the most abundant element in the universe and in its stable form of hydrogen gas (H2), it can be a clean and potent energy source.

There are two main reasons hydrogen is a promising energy source for the transition away from fossil fuels – the first being the relative ease by which hydrogen gas can be generated through electrolysis which can be fed by other renewables like solar, wind, and hydro (AKA Green Hydrogen).

$$2H_2O + Electricity \rightarrow 2H_2 + O_2$$

i.e., applying an electrical current to water causes the molecules to split into two parts hydrogen gas, and one-part oxygen gas.

The second being that once hydrogen gas is consumed, the only emissions come in the form of pure water.

$$2H_2 + O_2 + Combustion \rightarrow Energy + 2H_2O$$

i.e., burning hydrogen gas in the presence of oxygen creates energy and water as a by-product.

Types of Hydrogen

Hydrogen is commonly categorised by colours to indicate the way in which it was produced. The three most common being Green, Blue, and Grey.

	Green H_2	Blue H_2	Grey H_2
Production Method	Electrolysis	Fossil Fuels with CO_2 Capture	Various (*often as a by-product*)
Inputs	Electricity	Natural Gas and Coal	Various

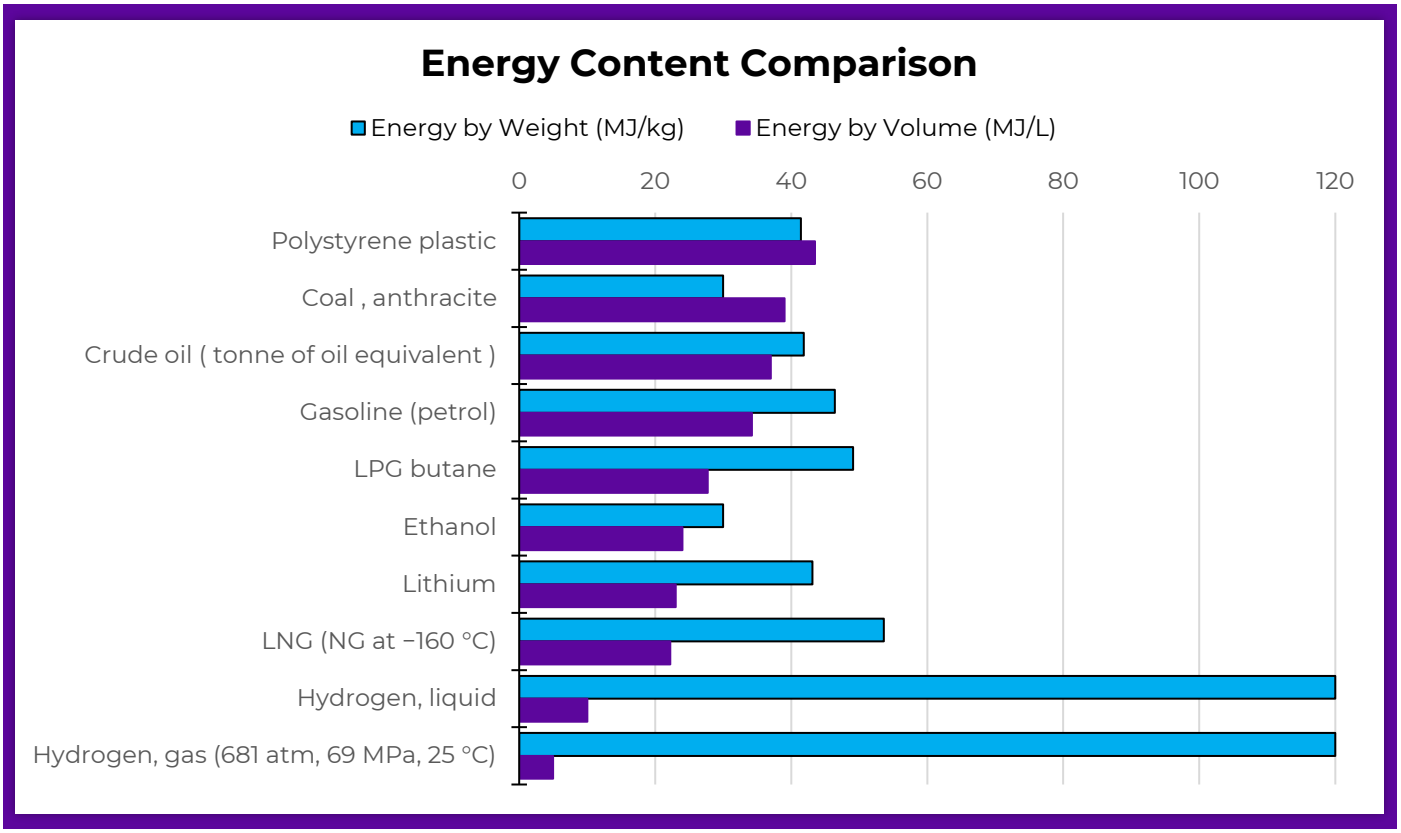
Hydrogen Compared to Existing Energy

Whilst hydrogen has the greatest energy density by weight at ~120 (MJ/kg);

i.e., 1kg of H2 has ~120 MJ of energy whilst 1kg of Gasoline has ~46 MJ.

Hydrogen also has a relatively low energy density by volume at ~10 (MJ/L) for liquid, and ~5 (MJ/L) for gaseous at high pressure (681 atm).

i.e., 1L of H2 has ~8 MJ of energy whilst 1L of Gasoline has ~34 MJ as Independent Power Producers are expanding.



Challenges

Despite the attractive properties of hydrogen as a clean and abundant energy source, some of its other properties make it challenging to adopt on a large scale:

Transport and storage being the lightest known element, hydrogen tends to leak from common container materials such as steel used in most existing natural gas pipelines meaning that relatively large volumes of gas are lost before reaching the consumer.

Density whilst H2 has extremely high energy per kg compared to most known fuel sources, it can be exceedingly expensive to cool and condense the gas into a liquid form before you can expect to receive energy anywhere close to what's worthwhile, and you'll still fall short of competing with energy-dense fuels like Gasolin

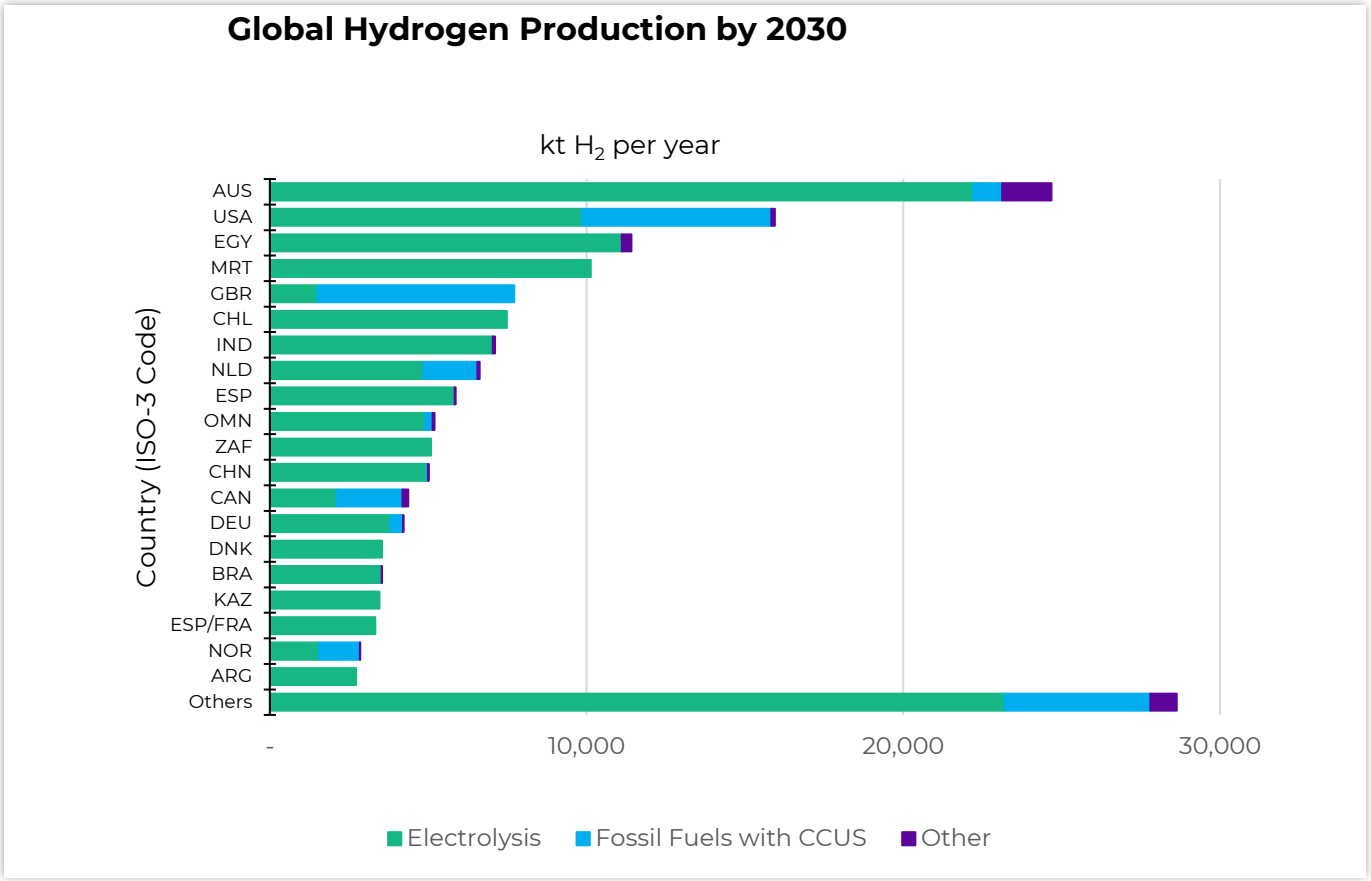
Safety and perceptions most people in the English-speaking world have heard and seen footage of the Challenger shuttle disaster in 1986 – failure of an O-ring seal in one of the solid rocket boosters, which led to the ignition of leaked hydrogen gas and the catastrophic breakup of the spacecraft – and whilst technology has come a long way since then, hydrogen gas is still extremely volatile and can be a tough pill to swallow before it is embraced as an alternative fuel source in your motor vehicle.

Growing Investment and Development

The IEA estimates that a net-zero world would require 306 million tonnes of green hydrogen to be produced each year by 2050.

Egypt, Mauritania, and South Africa are ahead of the curve in Africa with announced projects like:

- Egypt's Suez Canal Economic Zone (SCZONE) $12 billion agreement with India's ACME Group to produce 2.2 million tonnes of green hydrogen annually.
- Mauritania's agreement with CWP Global to produce 500,000 tonnes of green hydrogen annually.
- South Africa's project in Secunda to use green hydrogen to help produce 2.5 million tonnes of sustainable aviation fuels (SAF) annually.



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