ESG Insights

Gray, Blue, and Green Hydrogen: Why Does It Matter for Energy Transition and Security?

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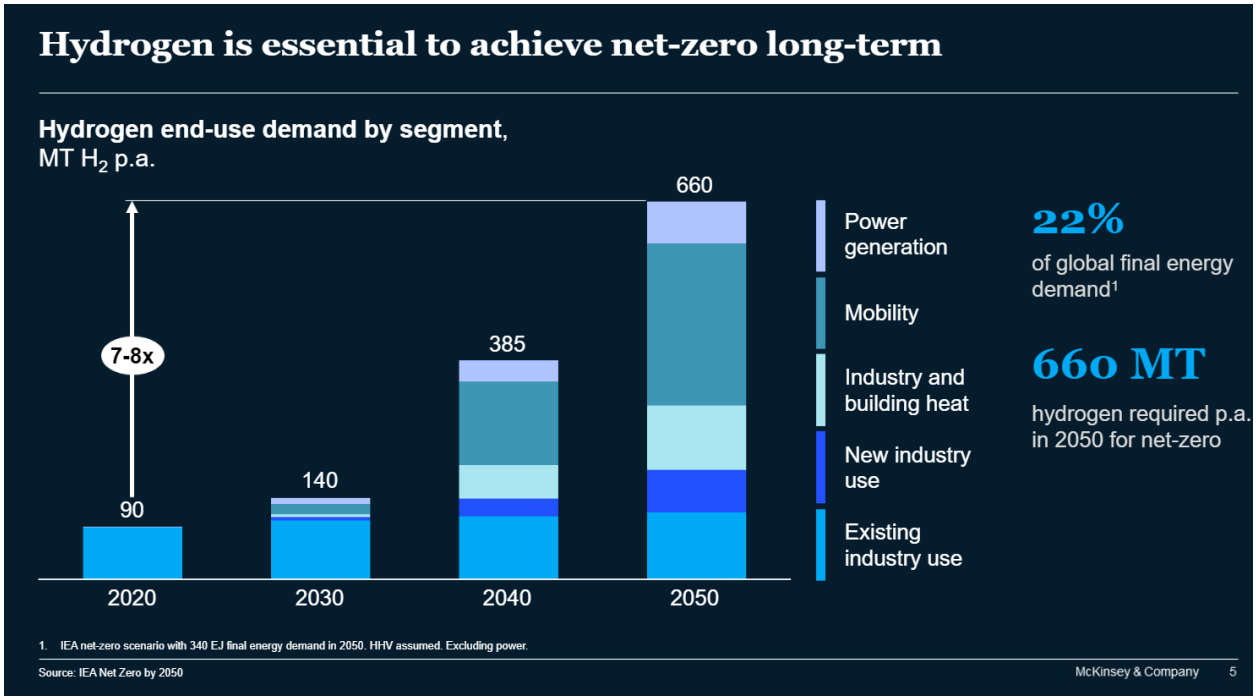
The energy transition, which refers to the global shift from fossil forms of energy such as oil, natural gas, and coal, to renewable energy sources, will occur. The glide path, however, may be longer in duration than many expected just a few years ago. Geopolitical developments between Russia and the Ukraine have heightened awareness around energy security and while hydrocarbons will continue to be needed for many years, we believe hydrogen (H_2) will play an increasing role in the energy transition and ultimately energy security.

Hydrogen: a key building block in the energy transition

Globally, countries are increasingly looking at low- or no-emission forms of energy to decrease reliance on hydrocarbons and meet climate objectives. Achieving the goal of many developed nations to reach net zero by 2050 will require a meaningful increase in energy produced from renewables such as hydrogen. The beauty of hydrogen is that it is abundant and emits no carbon dioxide (CO_2) when used to generate energy. However, hydrogen only exists naturally as a compound combined with other elements such as water (H_2O) and natural gas (CH_4). As such, separating H_2 from the other molecules requires energy, which leads us to gray, blue, and green forms of hydrogen.

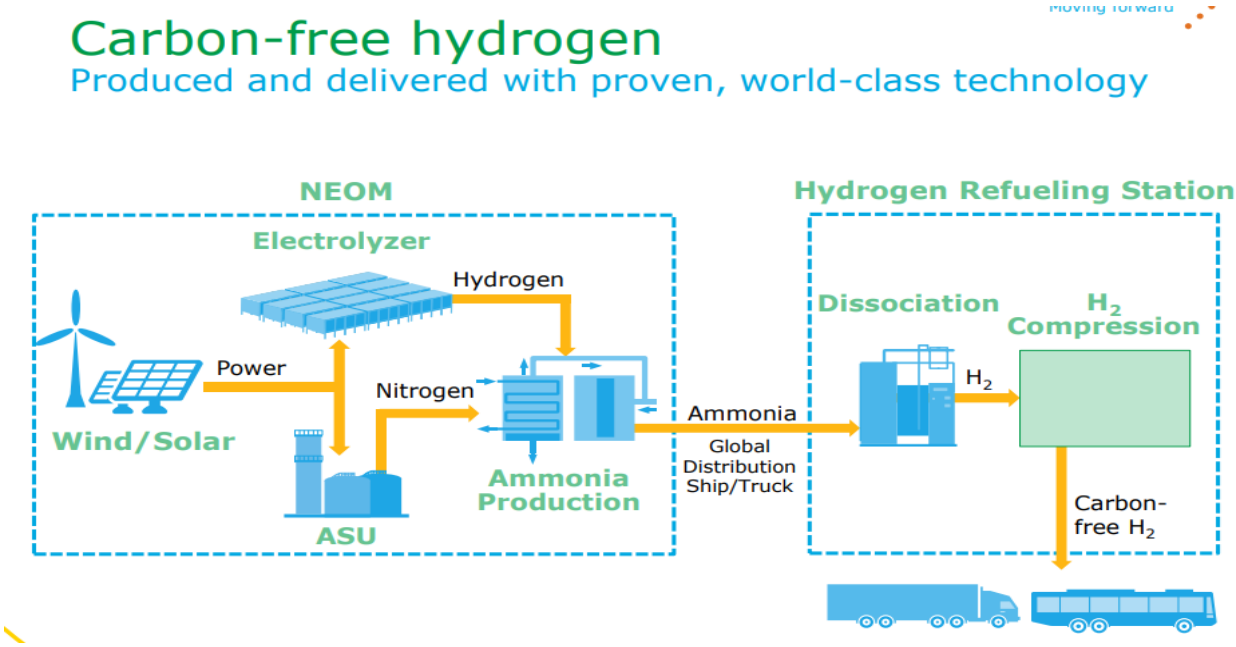


Gray, blue, and green hydrogen

Today, more than 94% of all H_2 is what is known as gray hydrogen. Gray is mainly made from natural gas in a process called reforming, where natural gas is mixed with steam at high temperatures to separate the gas into hydrogen and carbon dioxide. Unfortunately, the CO_2 byproduct gets released into the atmosphere.

Blue hydrogen uses the same manufacturing methods as gray; however, the CO_2 produced is captured and stored rather than being released. The challenge with blue hydrogen is the carbon capture and storage element of the process remains costly. Nonetheless, carbon capture technologies will improve over time making blue hydrogen a key stepping stone in the move to green.

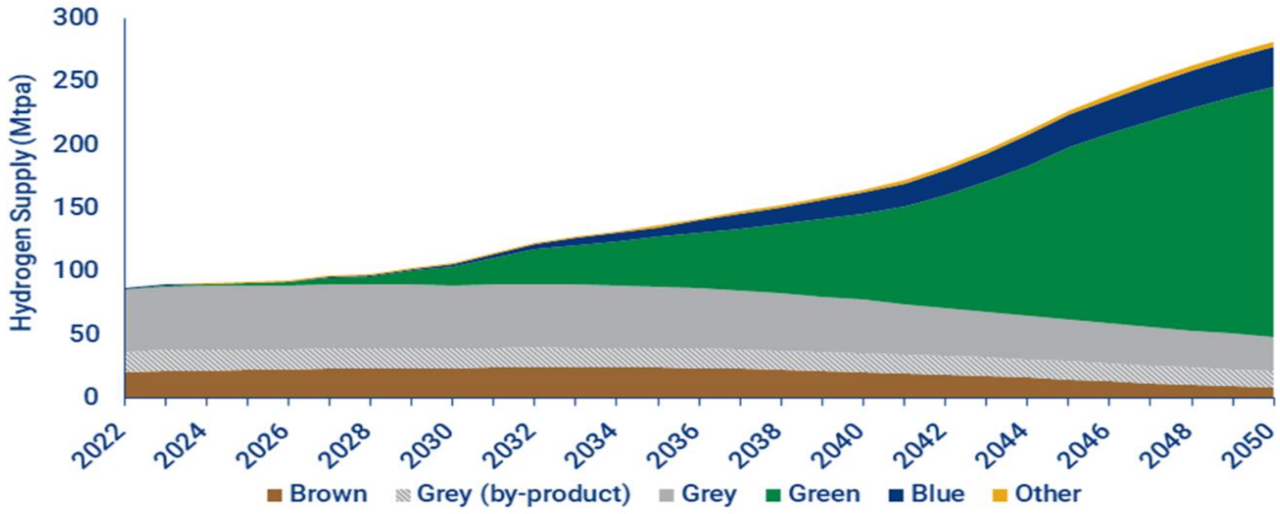
Green hydrogen may be the holy grail of sustainable energy in the years ahead as it emits no carbons in the manufacturing process. It has a zero-carbon footprint. The manufacturing process for green hydrogen is completely different than gray and blue, but is also more costly. Essentially, hydrogen is separated from water using electrolysis. Renewable energy sources including wind and solar power are used to generate the electricity required for the electrolysis. In the chart below, we show the example of the world's largest green hydrogen project, which involves Air Products Ltd. (APD), a company in the Coho 250 investment universe. This is a joint venture between APD, a power generation company, and NEOM (a sustainable green city in Saudi Arabia). The power company is supplying 100% wind and solar power, which Air Products uses for the electrolysis of water to produce hydrogen. APD also uses its air separation capabilities to produce nitrogen, which will be combined with the hydrogen to produce green ammonia. This liquid ammonia will then be transported around the globe and disassociated into green hydrogen at refueling stations located at bus and truck terminals, which ultimately use the hydrogen. The green ammonia is solely a means of transporting the hydrogen as it is cheaper and easier to transport across the globe than pure hydrogen.



Source: Air Products Ltd.

The rapid rise of green hydrogen will dwarf fossil hydrogen

Global hydrogen production by colour: 2022 to 2050 (Mtpa)



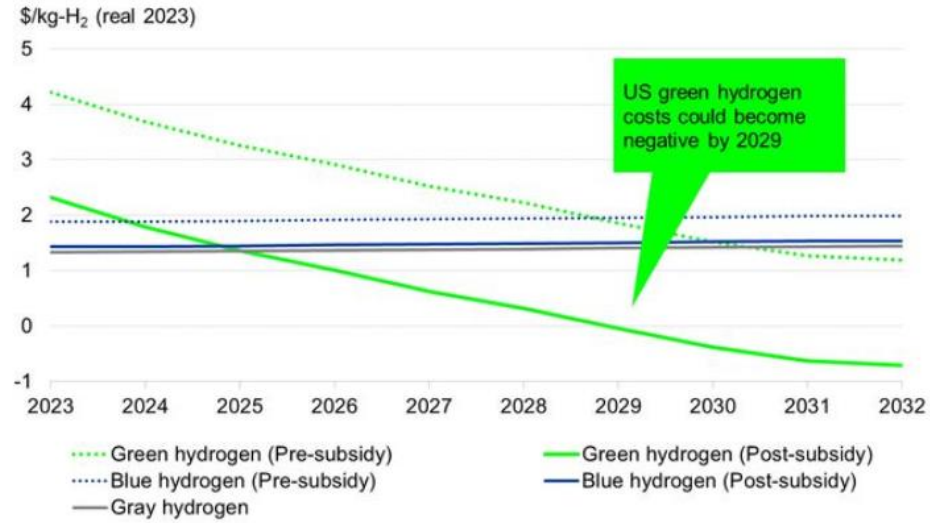
Source: Wood Mackenzie

The challenge on the green hydrogen side centers on the current high costs of the electrolyzers which run at about $1,000/KW today but are expected to decline to $300/KW by 2030 according to most industry experts. The Air Products project is large in scale (650 million tons of hydrogen per day or more than 100x the current largest production plant) and capable of eliminating CO_2 and other emissions from the equivalent of over 700,000 cars annually. Another company in the Coho 250 investment universe, Linde, the largest liquid hydrogen producer in the U.S., recently announced plans to increase its green hydrogen production capacity in California and New York. Last month Linde also announced plans to supply blue hydrogen to OCI N.V, a global leader in the initiative to decarbonize energy-intensive industries, at its 1.1 million ton-per-annum blue ammonia plant in Beaumont, Texas.

Why does green hydrogen matter?

Green hydrogen holds the potential to completely decarbonize the global economy including end markets such as electricity generation, transportation, and many other industrial uses. We are clear-eyed and recognize the hydrogen economy is still in its infancy and will take many years to fully mature; however, the wheels are in motion and irreversible. Cost and scale are clearly an issue today yet both are expected to improve materially in the years ahead as production technologies improve. While regulations are always a wildcard, there is growing support by governments in the developed world to incentivize (see chart below showing the effect of IRA tax credits on the cost of hydrogen in the U.S.) the production of sustainable energy sources, while ensuring the transition is smooth as the world steadily moves to decarbonize the economy.

Effect of IRA tax credits on levelized cost of hydrogen in the US



Source: BloombergNEF

Traditional hydrocarbons such as oil and gas will play an important role in the energy transition for years to come as many countries look to avoid the problems caused by energy poverty. Nonetheless, we expect hydrogen to play a meaningful role in the move to decarbonize the global economy and meet climate objectives. As the CEO of Air Products recently stated, "If the world is truly to move forward with the energy transition and build a cleaner, more sustainable future, hydrogen must play a key role." The Coho Investment Team will continue to monitor hydrogen's progress and investment implications for the energy transition in the years ahead.