THE TWO FACES OF HYDROGEN

Renewable hydrogen is a big opportunity for Australia,
but beware the fossil-fuel industry co-opting "clean" hydrogen
to further delay climate action.

RENEWABLE HYDROGEN: AN ENORMOUS OPPORTUNITY FOR AUSTRALIA

Renewable hydrogen - hydrogen made from water and electricity created using the wind and sun - is an enormous opportunity for Australia, with many billions of dollars of investments possible (1). Domestically within Australia's future zero-emission economy, renewable hydrogen will be used as a chemical and energy agent in the manufacture of steel, other metals, fertilisers, and other products (2). Further, renewable hydrogen will have some future transport applications in long-haul electric vehicles (for example, freight) equipped with fuel cells that convert hydrogen fuel - stored on-board - into the electricity needed to propel the vehicle.

Also, renewable hydrogen will be used as a form of stored energy and as an "energy carrier" that will be integrated with Australia's electricity-supply network (3).

Renewable hydrogen, manufactured in Australia using Australia's vast renewable-energy resources, will be exported to overseas customers, who likewise will use hydrogen in manufacturing, for transport, and for integration with electricity and other energy-supply systems.

For those interested in hydrogen colour-coding, renewable hydrogen has been referred to as "green hydrogen".

HYDROGEN MADE FROM FOSSIL FUELS: NEITHER CLEAN NOR RENEWABLE

Australian fossil-fuel mining interests propose that rather than creating hydrogen using renewable electricity, fossil gas and coal can be used to manufacture hydrogen ("black hydrogen"). These fossil-fuel interests propose methods such as "carbon capture and storage" or tree planting can be used to reduce the climate impacts of such an industry, and thus convert "black hydrogen" into a hypothetical product being touted as clean "blue hydrogen" (4) (see Figure 1).

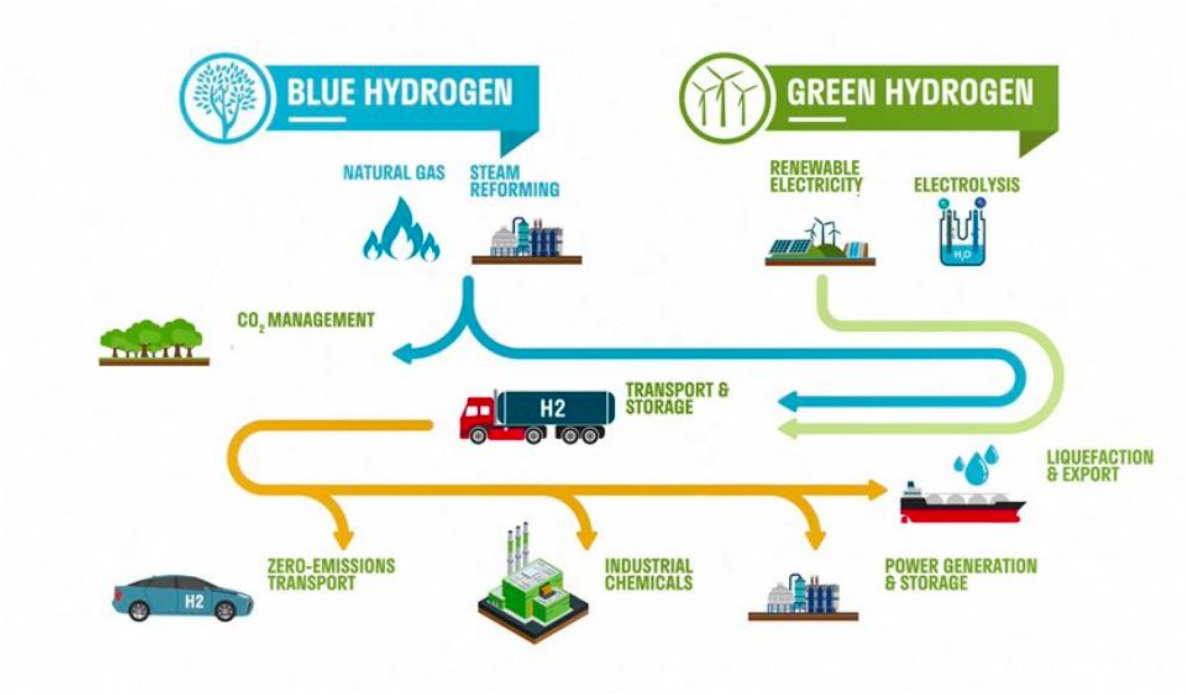

Figure 1: If you can't lock away Blue Hydrogen's greenhouse gas emissions, plant a tree.
Image from Woodside (5).

Co-opting the idea of "clean" hydrogen in order to preserve business-as-usual is a cynical but not unfamiliar fossil-fuel industry strategy. Over the last decade, the coal industry delayed climate action and strategically used the idea that cost-effective carbon-capture and storage technology (aka "clean coal") was "just around the corner". Hydrogen, now being conceptually married with fossil gas and coal (6), is the latest fossil-fuel industry strategy aimed at further delaying climate action.

Carbon-capture and storage technology, where it has been attempted, has been found to be high-cost, fraught with technical difficulties, and unable to provide legal guarantees that carbon-dioxide can be sequestered at scale for the necessary period of time: forever. Indeed, developments in carbon dioxide capture and injection technologies have been co-opted by the fossil oil industry for the sole purpose of producing more crude oil (enhanced oil recovery) (7,8).

Even if carbon capture and storage could be technically, economically, and legally established and the greenhouse-gas emissions of fossil-based hydrogen controlled, fossil-fuel mining remains a highly damaging practice.

The rapidly falling costs of renewable energy and energy storage are now apparent (9).

People living in, or near, present and potential fossil-fuel extraction communities are no longer willing to tolerate the health and environment-impacting mining practices of the 20th century, nor the more complex methods of the 21st century such as hydraulic fracturing aka "fracking" (10).

Carbon capture and storage has been found to have insuperable practical, legal and risk barriers and presents indefinite intergenerational inequity in that the gas must be stored in perpetuity - whilst delivering zero benefit to future generations (11).

HYDROGEN HAS NO ECONOMIC ROLE IN AUSTRALIAN GAS DISTRIBUTION NETWORKS

In addition to fossil-fuel miners co-opting the idea of "clean" hydrogen in order to preserve business-as-usual, the owners of Australian fossil-gas distribution networks are doing the same (12).

Fossil gas has become an uneconomic source of energy for space and water heating in Australian homes and other buildings. This is partly because of the high cost of Australian fossil gas, and also because of improvements in renewable heat pump and solar PV technologies, enhanced by their superior performance in Australian climate zones (13). Thousands of Australians are successfully disconnecting their homes from the gas-distribution grid and having gas meters taken away from their properties (14). For its owners, the future value of the gas distribution grid is becoming dire. Therefore, gas-distribution network owners have grasped the idea of supplying hydrogen to buildings in order to claim a viable future for the pipeline infrastructure they control.

It is technically possible to inject small amounts of hydrogen into the gas distribution network. However, switching the network to 100% hydrogen incurs high costs in replacing gas appliances, replacing network equipment such as valves and meters, and perhaps installing hydrogen detectors in buildings alongside smoke detectors. (15)

It is unlikely that hydrogen (green, clean, blue or black) will be able to economically compete with heat pumps (that are at times matched with solar PV) as a source of space and water heating in Australian buildings, where even today fossil gas is uncompetitive.

Beyond buildings, the present fossil-gas distribution network also supplies gas to light industry. As described by Beyond Zero Emissions in the report "Electrifying Industry" (2), these present fossil-gas users can economically switch to electrical energy solutions. Electrification is likely to

also be a more economical solution for light industry than using hydrogen.

BATTERY POWERED ELECTRIC VEHICLES IS THE MOST EFFICIENT TRANSITION PATHWAY FOR PASSENGER VEHICLES

Battery powered electric vehicles is the most effective and efficient pathway to zero emissions for passenger vehicles. The technology is proven and is being deployed at scale internationally. The slow take up in Australia is due to a poor policy environment to support the transition. (16)

A recent study found hydrogen fuel cell well-to-wheel losses are almost as high as fossil fuel vehicles. The study also found converting the Australian fleet to hydrogen would need approximately 157 TWh a year, which is a 63% increase in national electricity generation. In comparison, battery-powered electric cars would need around 37 TWh - a 15% increase in generation. (17) Further, a battery-powered electric vehicle fleet opens up opportunities for vehicle-to-grid integration, which can help improve the efficiency of the electricity grid. (16)

SUMMARY OF RECOMMENDED HYDROGEN USES

Use of hydrogen	Green hydrogen	Hydrogen from fossil fuels
Electricity generation	✓	X
Hydrogen export	✓	X
Industrial feedstock	✓	X
Industrial heat processes*	✓	X
Gas network	X	X
Building heating	X	X
Cars & buses	X	X
Large trucks, ships, trains	✓	X

**For most industrial heat processes it will be cheaper and more efficient to use other forms of renewable energy, such as renewable electricity. But for some large energy users it may be economic to generate hydrogen fuel on-site when electricity is cheap (2).*

CONCLUSION

Australia has enormous opportunities in renewable hydrogen but must act now to ensure that the clean energy potential of green hydrogen is preserved.

Fossil-fuel mining interests must not be allowed to:

- greenwash polluting, black hydrogen in future markets
- misdirect support away from tangible and readily adoptable technologies.

Realising hydrogen opportunities and moving to a zero-emissions future will both be delayed if fossil-fuel producers and infrastructure owners are allowed to co-opt the idea of clean hydrogen as they work to preserve business-as-usual.

We can meet all our energy needs with the sun and wind - including making significant quantities of renewable hydrogen to power our future.

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