

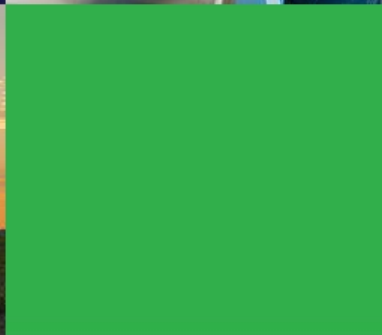
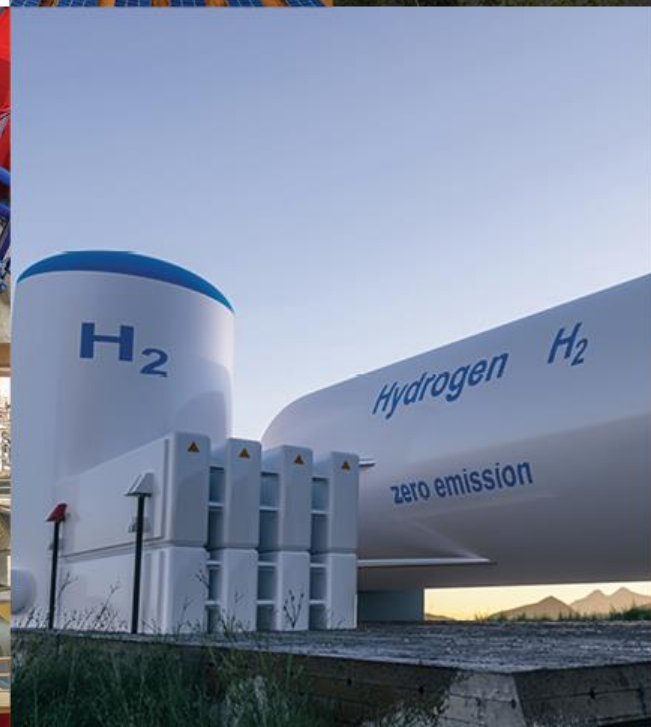


COUNTRYWIDE
RENEWABLE HYDROGEN

Hydrogen, the emission-free bus option

**BusVic Management Forum & AGM 21
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**Geoff Drucker
Managing Director**



What is HYDROGEN?



- **Hydrogen is the most common chemical in the universe**
- **Can be produced as a gas or liquid**
- **Has many uses such as fuel for transport or heating, a way to store electricity, or a raw material in industrial processes**
- **When it is produced, hydrogen is a way of storing energy for use when it is needed**
- **Can be stored as a gas and delivered through existing natural gas pipelines**
- **When converted to a liquid or another suitable material, hydrogen can also be transported on trucks and in ships - exported as an energy commodity**



The colours of HYDROGEN - how it's produced



BROWN – produced by using coal where the emissions are released to the air

GREY – produced from natural gas where the associated emissions are released to the air

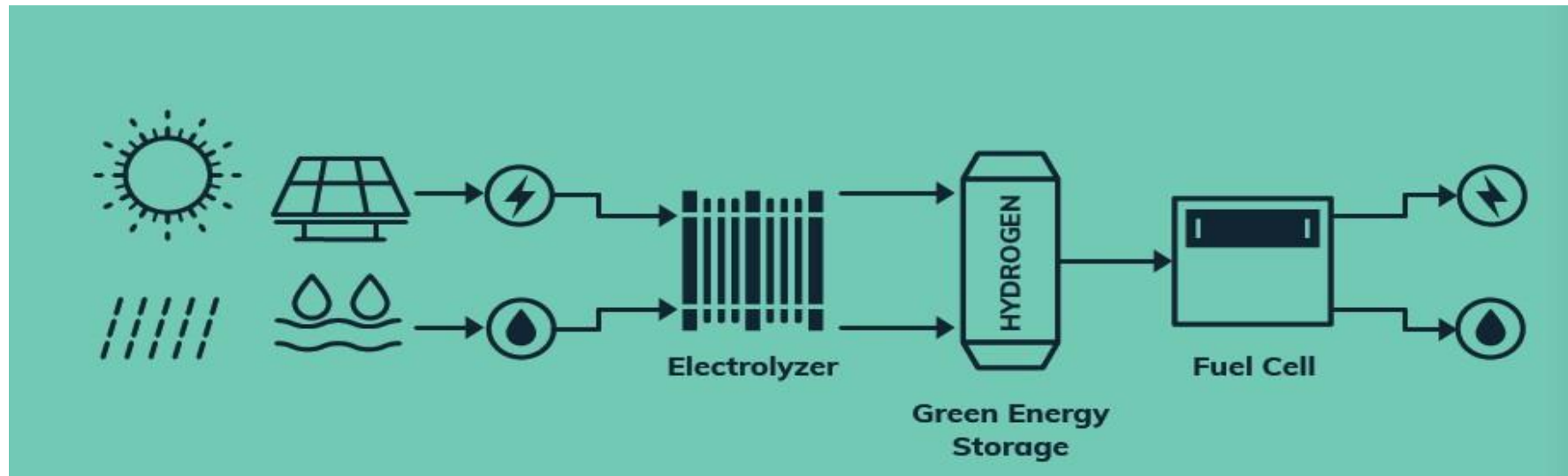
BLUE – produced from natural gas, where the emissions are captured using carbon capture and storage

GREEN – produced by electrolysis that is powered by electricity generated from renewables (solar, wind, hydro)



What is ELECTROLYSIS?

- An electrolyser passes an electric current through clean water and splits the H₂O into Hydrogen and Oxygen
- Both gases can be captured or the oxygen released to the atmosphere
- Electrolysers require 9 litres of water to produce 1kg hydrogen
- 6kgs of hydrogen will drive a passenger car up to 800kms – Toyota Mirai recorded 1,003kms on one fill





LOOSE PARTS

BY DAVE BLAZEK



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Blazek

How does a HYDROGEN-powered bus work?



- Hydrogen is stored as a gas in tanks within or on the bus roof
- When the hydrogen is released into a fuel cell (the engine) and it meets with air, the chemical reaction generates electricity
- It's an electric bus – like a battery electric bus, electricity drives the wheels and bus equipment
- Fuel cells are highly efficient, have no moving parts and can operate continuously
- Only tailpipe emission is water





BEV vs FCEV – pros and cons

- FCEV is more expensive to purchase – double a diesel bus but CAPEX is falling
- FCEV OPEX is cheaper than a diesel bus
- BEV buses are ideal for short runs to allow recharging between routes eg school buses
- FCEVs can take an 800km route on one fill
- Refuelling a FCEV bus takes around 15 mins – either depot or station refuelling
- FCEVs are not challenged by hot and cold weather or hilly routes
- Recharging a number of BEVs requires significant electrical infrastructure at the depot
- Both are noise, vibration and odour free

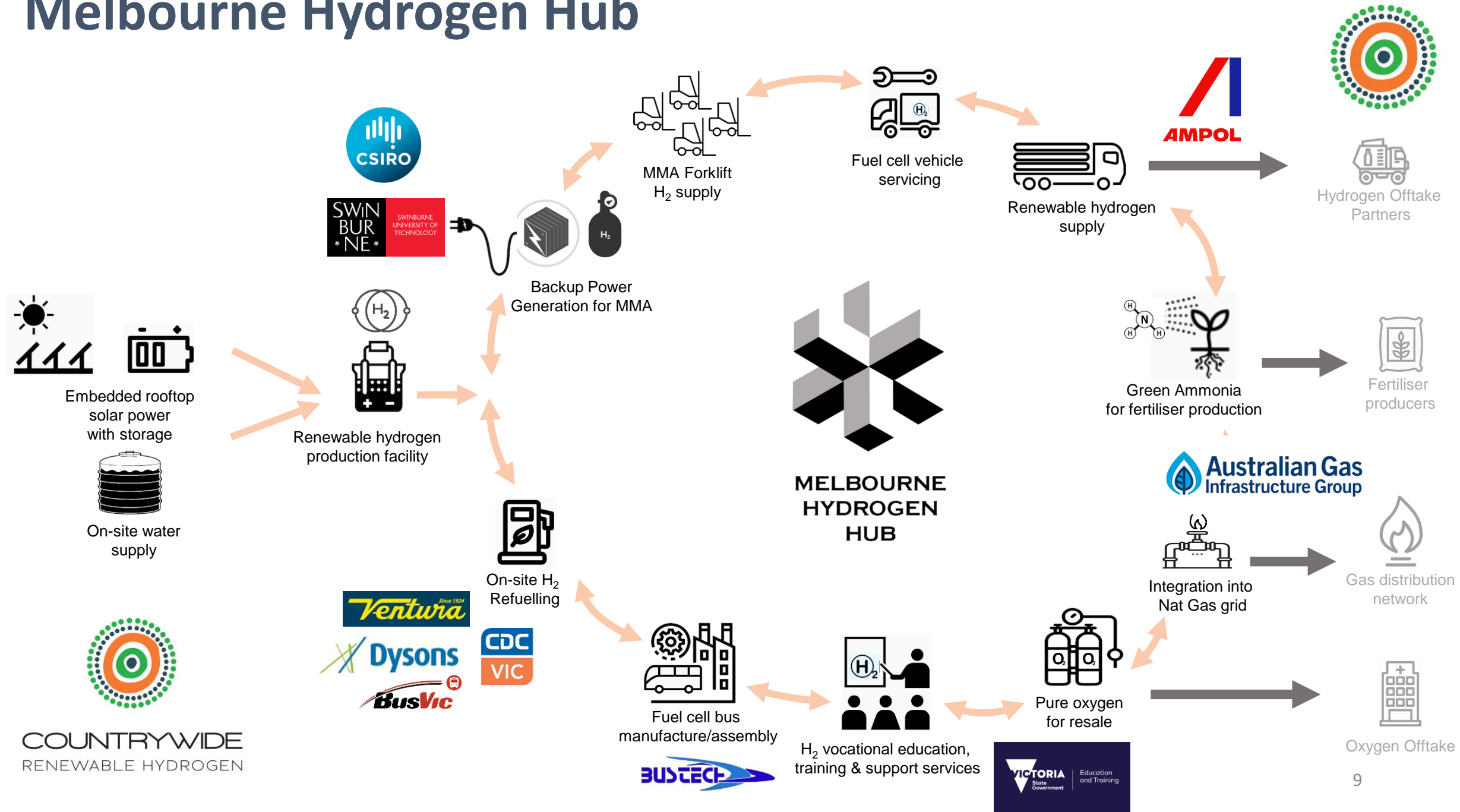


Who is backing the HYDROGEN wave?

- Fuel cells – Cummins, Toyota, Hyundai, Ballard, Air Liquide, ITM (Linde)
- Fuel Cell production forecast 1mill units by 2028, CAGR 70%
- Refuelling – most petroleum companies, Ampol leading in Australia
- Buses – Bustech from Australia, many in Europe (WrightBus) and China (Bon Luck)
- Massive corporate investment in green hydrogen – Cummins, BP, Shell, Fortescue, Origin, Linde, Siemens, ThyssenKrupp, Plug Power
- Significant Government funding support to reduce emissions



Melbourne Hydrogen Hub





About CRH

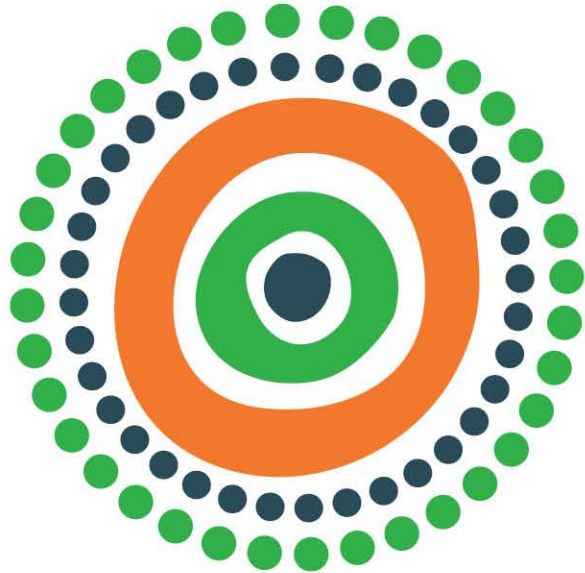


Renewable **HYDROGEN** project originator and developer

Three projects in Australia – Melbourne Hydrogen Hub (MHH), Burnie (Tas) and Portland (Vic)

MHH to supply hydrogen to 90 fuel cell buses across three companies

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