



Sector: Automotive

# HYDROGEN FUEL CELLS - GAME CHANGER?

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## WHAT IS IT?

Hydrogen vehicles are run by hydrogen fuel cells that capture the electric reaction between pure hydrogen and the oxygen in the air and produce water as a byproduct. This allows it to be another avenue in the global goal of reducing carbon emissions.



# CURRENT DEVELOPMENTS IN THE MARKET

- ✓ Toyota – Mirai, oldest hydrogen car model, been around since 2014 and now entering its second generation. All time sales at 27,500. Pivoting R&D towards lorries and buses
- ✓ Hyundai – Nexo, available since 2019
- ✓ BMW – Partnered with Toyota to develop a hydrogen powertrain for the iX5 series to be launched in 2028
- ✓ Honda – Had Clarity Hydrogen cars between 2017 – 2021. Launching CR-V plug in hybrid hydrogen in 2025
- ✓ Oman – Launching hydrogen airport taxi fleet this year, partnership between Shell and Oman Airport



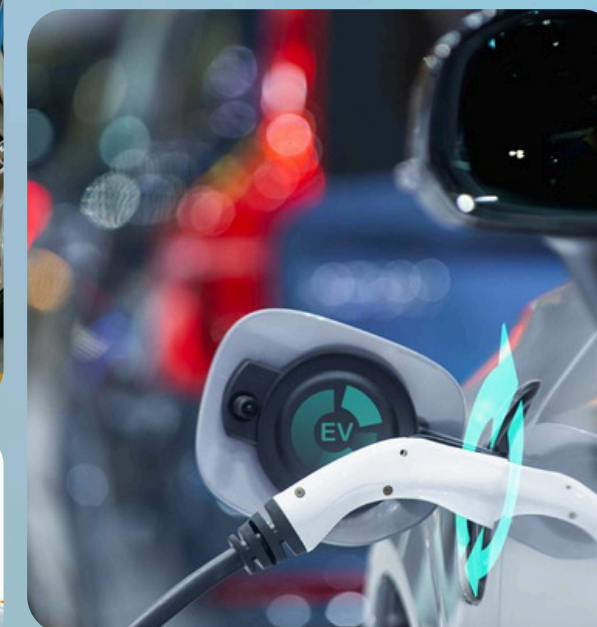
# HOW DO HYDROGEN FUEL CELL VEHICLES STACK UP VERSUS EVS?

	HYDROGEN CARS	ELECTRIC CARS
POWER SOURCE	Hydrogen Gas	Electric Battery
CAR EMISSIONS	None (Water Vapour)	None
INDIRECT EMISSIONS	Depending on Productionmethod, Green Hydrogen = none	Depending on Electric Grid Production. Lithium battery production a major issue for CO2 and environmental issues
REFUELING /	Few minutes	Depending on supply, can take hours
RECHARGING TIME		
EFFICIENCY (WELL TO WHEEL)	25-30%	59-62%
INFRASTRUCTURE	Limited	Widespread and growing
COST	High but would reduce as supply and demand increase	Reducing
AVAILABILITY	Limited but growing	Wide Variety (Tesla, BYD, electric ranges in major manufactures, etc.)
USAGE	Heavy Duty, Long Range	Short range



# THE 'GAME CHANGER'

Whilst currently its early days for hydrogen fuel cells, the quick refueling time, light weight and longer range of hydrogen may well make it the longer term winner (as well as the inherent environmental and emission issues associated with lithium batteries), especially given the major green hydrogen projects, especially in Oman and Saudi.





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