

## Hydrogen: The Country's future fuel for vehicles - A Perspective



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Petroleum and its derivatives have exceptionally useful properties that have made them useful during the last centuries in most of the IC engines; however presently they are in phase of depletion, secondly the unstable prices of them are scaring the mankind and our country which majorly depends on import of the same. Last year country has spent approximately USD 62.2 billion on it. Even crude oil usage is associated with considerable environmental and societal difficulties. These are the strong drives for investigation, development and demos of alternative fuel sources for transport sector nowadays. Among the available alternative fuels considered today, hydrogen finds prominent place in view of its immeasurable source potential and clean-burning characteristics. Hydrogen is been known as a fuel having some exclusive and extremely desired properties for application in transportation vehicles and yields near zero emissions. Hydrogen can be used in fuel cell operated vehicles or directly in spark ignition engines.

The following table provides qualities of hydrogen compared with other present fossil fuels.

Properties			
Thermal, Transport & Premixed Combustible Characteristics of Hydrogen, Gasoline and Diesel .			
Property	Hydrogen	Gasoline	Diesel
Chemical formula	H <sub>2</sub>	C <sub>8</sub> H <sub>18</sub>	C <sub>12</sub> H <sub>23</sub>
Molecular weight g/mol	2.015	110	≈200
Flammability limits (%)	4-75	1-7.6	0.6-5.5
Minimum ignition energy (mJ)	0.02	0.24	—
Stoichiometric A/F ratio on mass basis	34.3	14.6	14.5
Flame temperature (K)	2318	2473	2600
Auto ignition temperature (K)	858	500-753	453-593
Quenching distance at NTP (mm)	0.64	2.0	—
Density at 1 atm and 300K (kg/m <sup>3</sup> )	0.082	730	830
HHV (MJ/kg)	141.7	48.29	44.8
LHV (MJ/kg)	119.7	44.79	42.5
Diffusion coefficient into air at NTP (cm <sup>2</sup> /s)	0.61	0.05	4.63
Flame velocity (m/s)	2.65–3.25	0.30–.50	0.22–0.25
Octane number	130+	87	30

The hydrogen, is a fuel, a carrier and a store of energy without carbon content and is topmost in the global green agenda as On August 15, 2021, our Hon'ble Prime Minister Narendra Modiji announced a "National Hydrogen Mission to make India a Global Hub for Green Hydrogen Production and Export" to boost country's energy self-dependence and to inspire clean energy transition all over the world. It is a substitute for today's transition fuel-compressed natural gas. In November 2021 at COP 26 in Glasgow, Prime Minister Modi made five commitments- achieves Net Zero emissions

by 2070, and by 2030, take cumulative non fossil fuel generation capacity to 500 GW, meet 50 percent of energy needs from renewable energy, reduce the energy intensity of the economy by 45 percent, and reduce carbon emissions by 1 billion tons. The main 3 criteria's to be addressed more urgently on green hydrogen are:

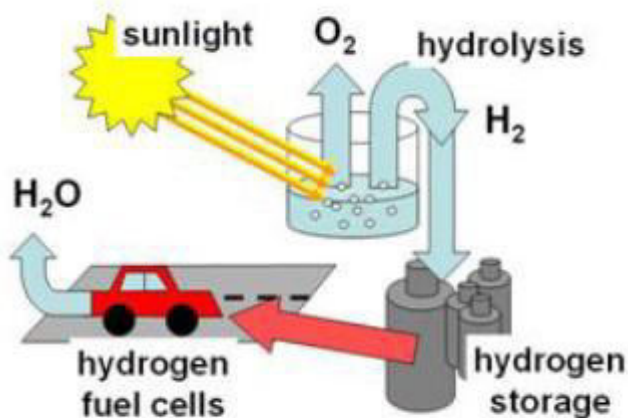
**1. Production of the hydrogen:** The hydrogen is produced from wide range of primary resources adopting wide range of techniques. It can be produced from water or from fossil fuels.

With just over a month to go for the fiscal year to end, the Ministry of Power announced on 17 February "phase one" of the policy, listing the initiatives it proposed to take for facilitating the manufacture of Green Hydrogen (GH) and planned to exempt paying of ISTC for next 25 years the industries producing the same.

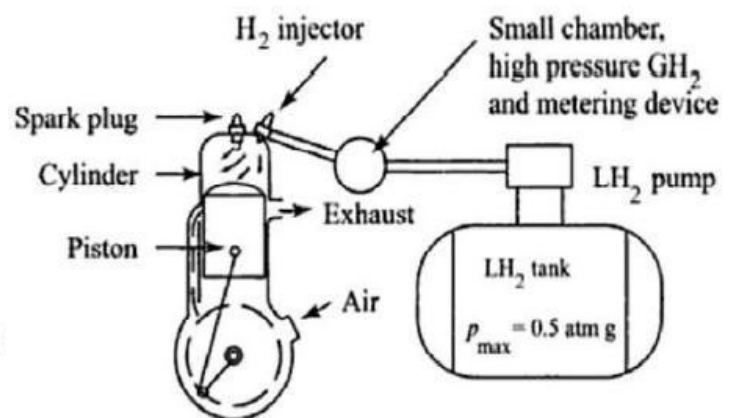
**2. Storage of the hydrogen:** Hydrogen can be stored in a liquid form via cryogenics or in compressed gaseous form.

**3. Use of the hydrogen:** Hydrogen can be used in Fuel cell vehicles (FCV) or in I. C. Engines called as H2ICE.

In cognitive to the government's announcement, Union Minister of Road Transport and Highways



Hydrogen Fuel Cell Vehicle



Use of Hydrogen in Spark Ignition Engines

Hon'ble Nitin Gadkari launched green hydrogen-based advanced fuel cell electric vehicle (FCEV), Toyota Mirai last Thursday 17<sup>th</sup> March 2022 in New Delhi. This is a mile stone for our country that an era of hydrogen vehicles has started in transportation to fleet vehicles on road soon. There were some old examples of blending of hydrogen with ethane in some of the auto rickshaws in New Delhi long back in 2009. Let us hope to have ecologically balanced transportation in India soon via use of hydrogen fuel operated vehicles.