ICRA

ICRA's CLIMATE SERIES

Green Hydrogen

Surge in commodity prices may delay India's hydrogen consumption goals

MAY 2022

CLIMATE CHANGE

The biggest crisis of our time

More incentives needed to achieve green hydrogen goals

- As part of our climate series coverage*, we analyse the economics and viability of plans for production of green hydrogen. Considering **98% of the hydrogen is produced with use of fossil fuels** currently (grey or blue hydrogen), **surge in fossil fuels prices has raised the levelized cost of hydrogen (LCOH) production by 3 - 4x**, bringing it at par with that for green hydrogen (~US$5/kg). This, if sustains, may augur well towards a faster adoption of green hydrogen technology

- The global (and in India's) drive towards **green hydrogen adoption is dependent on decline in its electrolysers' costs by ~50% by 2030** (to LCOH of US$2-3/kg). However, considering the recent **surge in metal prices on geopolitical disruptions,** the expected reduction in manufacturing **costs for electrolysers may be back-ended to close to 2030**, rather than in the immediate term.

- **Incremental RE capacity additions** required to meet the energy demand for the electrolyser capacities (as part of government's drive for Green hydrogen), **is estimated to remain significant at about 60 GW by FY2030**. This will **need more than Rs 3 trillion investments** over and above close to **Rs 1 trillion investments for electrolyser manufacturing**. These RE capacities are in addition to the 500 GW targeted by 2030

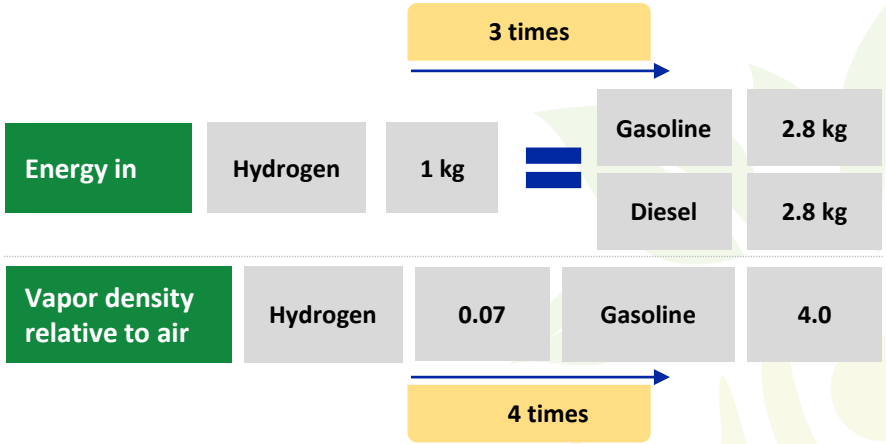
- **Green Hydrogen share** in total hydrogen production in India is expected **to increase to 30%/80% (from nil) by 2030/2050, along with 4-5x increase in overall consumption to ~30 mmt** (from 6 mmt currently). A major shift in demand is expected towards transportation (hydrogen fuel cell vehicles) and power generation sectors and will consume around 30% of the hydrogen demand by year 2050

- **Incentives from the government are critical** to spearhead investments **for infrastructure development for storage, transport and distribution**. Electrolyser being critical for production of Green Hydrogen, the **Governments' plans for PLI** on its manufacturing would be critical to achieve cost reduction targets for production of green hydrogen (especially considering the surging input costs)

*Source: ICRA Research, Note - * Please refer Climate Series reports on - https://www.icraresearch.in/Research/SubscribeSector/5*

Hydrogen has higher energy content; however, needs lower storage space

Hydrogen can be produced from variety of sources and acts as feedstock in refinery, industry currently



- Unlike conventional fuels, hydrogen can be produced from diverse domestic resources
- Hydrogen carries higher energy content by weight (about 3 times more than gasoline), but it has the lowest energy content by volume (about 4 times less than gasoline)
- Since hydrogen has a low volumetric energy density, it is stored onboard a vehicle as a compressed gas, to achieve the driving range of conventional vehicles

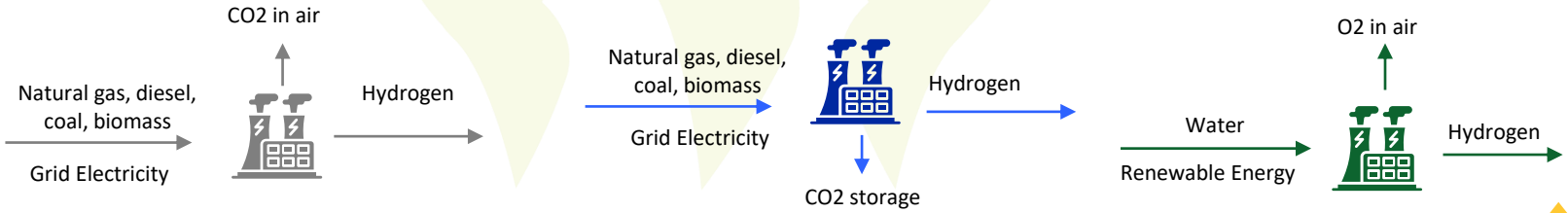
- **Grey Hydrogen**: produced from fossil fuels like coal, natural gas or petroleum
- **Blue hydrogen:** Grey hydrogen production combined with carbon capture and storage/sequestration
- **Green hydrogen:** Hydrogen produced using renewable energy

Energy sources for production	
Grey	Fossil fuels – Coal, Natural gas / petroleum products
Blue	Grey hydrogen with carbon capture technology
Green	Renewable energy

Source: Industry, US Department of Energy, ICRA Research

Conversion of Grey Hydrogen to Green currently the primary focus

Green Hydrogen is the cleanest source of energy with zero emission			
	Grey Hydrogen #	Blue Hydrogen	Green Hydrogen
Input	Natural gas, diesel, coal, biomass, grid electricity		Renewable energy
Process	Thermochemical processes (Reforming / gasification of natural gas, coal, or biomass using high temperature), Biological processes (Biological reactions on bacteria and microalgae)*		Electrolysis Process
Emission	CO2 in air	Nil	Nil
Storage	Nil	CO2 stored	Not required
Output	Hydrogen	Hydrogen	Hydrogen



Source: US Department of Energy, Industry, ICRA Research, Note - # Sometimes further divided into 'grey' for gas and 'brown' for coal * please refer annexure for details*

Analytical Contact Details

	Rohit Ahuja	Madhura Nejjur
	Head Research & Outreach	*Assistant Vice-President*
	rohit.ahuja@icraindia.com	Madhura.nejjur@icraindia.com
	+91 22 6114 3414	+91 22 6114 3417

Business Development/Media Contact Details

	L. Shivakumar	Jayanta Chatterjee	Naznin Prodhani
	Executive Vice-President	*Executive Vice-President*	*Head Media & Communications*
	shivakumar@icraindia.com	jayantac@icraindia.com	communications@icraindia.com
	022- 6114 3406	080 – 4332 6401	0124 – 4545 860

ICRA

Thank You!