Opinion: A new beginning for hydrogen around the corner

There is a heightened interest in hydrogen, with many business entities, the world over, tapping into the hydrogen market. Having announced its intention to reach net zero by 2070, it's imperative that India now scales up the adoption of hydrogen in its energy suite.

Globally, as countries look for options to reduce emissions and achieve climate targets, hydrogen is emerging as the frontrunner for decarbonisation strategies. Hydrogen has, indeed, come a long way from 2019, when only Korea, Japan, and France had hydrogen-specific policies, to today, with 31 governments having released their hydrogen strategies. There is a heightened interest in hydrogen, with many business entities, the world over, tapping into the hydrogen market. Having announced its intention to reach net zero by 2070, it's imperative that India now scales up the adoption of hydrogen in its energy suite.

Decarbonisation apart, the obvious benefits of hydrogen include energy security, impetus to renewable energy demand, and enhanced energy system flexibility.

Hydrogen, currently, is produced from renewable energy and through carbon capture technologies, besides many other existing and emerging technologies, such as natural gas reforming, coal gasification, and biomass gasification. The production cost of hydrogen depends on the technology used, with hydrogen produced from natural gas reforming costing around INR 200/kg and hydrogen from electrolyser costing around INR 450/kg. The cost parity can be addressed by increasing the current production and economy of scale.

In 2020, the global demand for hydrogen was around 90 Mt, driven mainly by refineries and fertiliser applications, and was mainly produced from fossil fuels, resulting in ~900 Mt of CO2 emissions. Though hydrogen supplies are gradually becoming clean, the progress is rather slow.

The global capacity of electrolysers, used in the production of clean hydrogen, has doubled over the last five years to reach 300 MW and is likely to reach up to 90 GW by 2030. Hydrogen production from electrolysers is expected to reach around 8 Mt by 2030. However, from a net zero perspective, the International Energy Agency's (IEA's) 'A Roadmap for the Global Energy Sector' projects a demand for 80 Mt of hydrogen production by 2030. While Europe presently leads electrolyser capacity deployment, Australia, the USA, and some Middle East nations are expected to go in for enhanced capacity deployment, eyeing the hydrogen export market. China is also expected to ramp up its capacity.

Hydrogen is also produced from fossil fuels through Carbon Capture, Utilisation, and Storage (CCUS) technology. This is a cost-effective means of producing low-carbon hydrogen. Canada and USA lead the utilisation of this technology with a total of 16 projects, yielding 0.7 Mt of hydrogen annually. IEA projections indicate that by 2030, ~ 9 Mt of hydrogen will be produced using CCUS, with 50 projects under various stages of development globally.

Key application areas

Hydrogen is a low-carbon option for commercial mobility applications, passenger vehicles, steel

production, etc., and as an energy vector in the energy mix. In the case of transportation, due to technological progress and an increase in the sale of fuel cell electric vehicles (FCEVs), the cost of automotive fuel cells has fallen by 70 per cent since 2008. Korea, the USA, China, and Japan are the major players in this segment. There is a paradigm shift from FCEV passenger cars to buses and trucks (long-hauls) in these countries. Despite this, the total number of FCEVs is still below the 15 million electric vehicles expected in 2030 (as per IEA) to address the issue of climate change.

Another major segment where hydrogen is expected to contribute towards decarbonisation is the hard-to-abate industry such as steel and cement. Sweden has already initiated carbon-free steel production using green hydrogen. Spain is attempting the use of green hydrogen for ammonia production. However, most technologies geared towards decarbonisation in the hard-to-abate sector are still in the nascent stage.

Projects and investments

Globally, around 522 hydrogen projects have been announced, with Europe and Asia having a share of 50 per cent and 23 per cent, respectively. While various state administrations have committed USD 37 Bn for hydrogen, the private sector has announced an investment worth USD 300 Bn. This still falls considerably short of the estimate of USD 1200 Bn of investment in hydrogen by 2050 to meet climate goals. Given this, there is a need for a policy push to increase the production of low-carbon hydrogen.

Meanwhile, the Union Government has proposed an outlay of INR 40,000 Cr in the National Hydrogen Mission to make India a global hub for green hydrogen production, utilisation, and export. The major objective is to produce 5 Mt of hydrogen by 2030 , replacing grey (hydrogen produced from natural gas or methane without capturing the greenhouse gases emitted in the process) with green hydrogen in refining, fertilisers, and steel industries, progressively by 2040. To make this a reality, India will need to ensure that the technologies and equipment required for production, supply, and utilisation are indigenously manufactured while creating the demand for hydrogen in industrial sectors, such as refining, fertiliser, steel, and city gas distribution.

Given India's enabling policies in place for access to low cost electricity, green hydrogen generation is not far from reality.

[This piece was authored exclusively for ETEnergyworld by Dr Rajalakshmi, advisor and Mr Thirumalai, head of the Strategic Studies group at the Center for Study of Science, Technology and Policy (CSTEP), a research-based think tank]