

Towards green hydrogen

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(Mains GS 3 : Conservation, environmental pollution and degradation, environmental impact assessment)

Context:

- Prime Minister Narendra Modi recently announced that India would aim for net-zero carbon emissions by 2070.
- India is the only major economy whose policies and actions are on track to limit global average temperature rise below 2°C above pre-industrial levels, as envisioned in the <u>Paris Agreement</u>.

Energy sector:

- According to the International Energy Agency (IEA), India will overtake the European Union as the world's third-largest energy consumer by 2030.
- Electricity dominates the public discourse on the energy economy, however it accounts for only 18% of India's total energy demand.
- The rest 82% comprises other energy sources such as coal, oil and gas, and biomass. Unfortunately, our energy sector is heavily import-dependent (85% for crude oil, 53% for gas and 24% for coal).

Re-imagine energy:

- India has the potential to completely re-imagine its energy economy in consonance with demand for clean and sustainable products.
- This can be achieved by leveraging the results of decades of innovation in the clean energy sector.

• Therefore, the synergy between renewable energy and green hydrogen must be tapped to tackle the dependence on fossil fuel and take greater advantage of India's solar capacity.

Green hydrogen and India:

- Hydrogen, especially green hydrogen, is a crucial weapon in India's arsenal to fight climate change as it improves the long-term energy storage capabilities of renewable energy.
- Over time, green hydrogen, as an energy carrier, also replaced some of India's energy imports.
- The Global Hydrogen Council has in a recent study classified India as a net exporter of green hydrogen from 2030 due to India's cheap renewable tariffs.

Different types:

- A low-carbon source of energy is required to generate hydrogen through electrolysis the splitting of a water molecule into hydrogen and oxygen.
- The hydrogen produced is coded with a colour, depending on the method of its production.
- While hydrogen generated through renewable energy sources is green, it is blue when the carbon generated from the process is captured and stored without dispersing it in the atmosphere.
- When the carbon is not captured, the generated hydrogen is labelled grey.

Scaling up the use:

- Nearly 70% of the investments required to produce green hydrogen through electrolysis goes into generating renewable energy.
- Through the scaling up of green hydrogen from renewables, India will require a significant amount of renewable energy capacity addition to help India march towards its 450 GW target.
- With India's solar capacity increasing nearly 3,000 times in less than a decade, the cost of solar energy has reached a low of ₹2 per kWh.
- This gives India a unique head start in scaling up the use of green hydrogen.

Lowest-cost decarbonization:

- According to the Hydrogen Council, "Hydrogen can provide the lowest-cost decarbonization solution for over a fifth of final energy demand by mid-century contributing a cumulative reduction of 80Gt of CO2 and is thus an essential solution to reach the 1.5°C climate scenario.
- Several major economies which are adopting legislation to reduce carbon emissions are also catalysing global efforts towards transitions to green hydrogen.

 Thus, India can reduce its carbon emissions and make a dent in its annual import bills by developing a value chain for hydrogen from its production to its diverse applications, including production technologies, storage, transport and distribution, infrastructure (ports, refuelling stations), vehicular applications, and electricity/gas grid.

Sector specific solution:

- Hydrogen's cross-sectoral capabilities should be exploited according to each sector's cost and ease of adoption.
- India should mandate blending a certain percentage of green hydrogen with grey hydrogen for existing applications like oil refining and fertilizers, depending on the viability gap.
- India also needs to mandate new greenfield capacities of hydrogen applications like oil refining and fertilizers to use only green hydrogen from a future cut-off date (to avoid long term lock-ins).

Enforcing policies:

- Enforcing time-bound mid- and long-term policies would inspire the private sector to invest more in green hydrogen and give the boost it requires in its nascent stages.
- India's current grey hydrogen production is six million tonnes per annum, which is around 8.5% of global annual production.
- India should replace this with green hydrogen and reduce dependence on imported ammonia.
- India has already taken the first step with the **Indian Oil Corporation** floating a global tender to set up two green hydrogen generation units at the Mathura and Panipat refineries.

New avenues of growth:

- Green hydrogen is a sunrise industry and will enable Indian entrepreneurs to capture new avenues of growth.
- Locally-available green hydrogen can attract high-value green industries, like green steel and green chemicals, to shift production to India.
- Localization of electrolyzer production and development of Green-H2 projects could create a new green technology market worth about \$18-20 billion in India and generate domestic jobs.
- In addition, there is a massive opportunity to create regional hubs to export high-value green products and engineering, procurement and construction services.

Conclusion:

• Green hydrogen is the future of energy and it has the potential to radically reduce imports and catalyse India's transition to climate-action leadership.

• Thus government funding and long-term policies that attract private investments within the standards and a progressive compliance framework are essential to boost green hydrogen.

At present, more than 30 countries have hydrogen road maps and over 200 large-scale hydrogen projects across the value chain. If all the projects come to fruition, total investments will reach \$300 billion in spending by 2030. Governments worldwide have committed to more than \$70 billion in public funding, according to Hydrogen Council, to develop a hydrogen economy.

With its abundant and cheap solar energy, India has the upper hand to tap into these investments and lead global efforts in transitioning to green hydrogen.