



Green hydrogen and india's transition to clean energy

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(Mains GS 3 : Science and Technology-Recent developments and their applications and effects in everyday life)

Context:

- Energy is a master resource which has the ability to catapult or cripple a growing economy.
- The rising threat of climate change has transitioned from climate-science conferences to billions being spent on disaster relief expenses.
- Realizing the impending threat to their economies, several countries have announced net-zero targets.

The energy sector:

- 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).
- The volatility in the prices of these fuels has a huge impact on the import bill, to the tune of \$160 billion.
- These numbers will double over the next decade as demand grows.

India needs sustainable energy:

- According to the International Energy Agency (IEA), India will overtake the European Union as the world's third-largest energy consumer by 2030.
- In its recent forecast, India will account for the biggest share of energy demand growth over the next two decades.
- This will create challenges for India but also opens new avenues of growth.
- 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.

- In the process, India can show the way to developed countries that sustainability and rapid growth can go hand-in-hand.

Green hydrogen and India:

- Green hydrogen (H₂) is made by splitting water (H₂O) via renewable power.
- Over time, green hydrogen, as an energy carrier, can replace some of India's energy imports.
- This is feasible, given India's record-low renewable power prices (₹1.99/\$2.7 cents per kWh).
- The Global Hydrogen Council has in a recent study classified India as a net exporter of green hydrogen from 2030, thanks to cheap renewable tariffs.
- Hydrogen is also a chemical feedstock with an existing global market of about 70 million tonnes.
- India already consumes about 6 Mt of hydrogen (8.5% of the global demand) annually that is made by reforming 18 Mt of import-dependent natural gas.

Green hydrogen plays greater role in India's development transition:

- Recently more than 25 nations have set up roadmaps for green hydrogen, including mandates and financial incentives to accelerate the transition to it.
- Wind and solar energy can provide the electricity to power homes and electric cars, but green hydrogen could be an ideal power source for energy-intensive industries like refining, steel, cement, heavy mobility and industrial heating.
- India is the world's third-largest emitter, with 3.6 gigatonnes of Co₂ equivalent across sectors, and green hydrogen will have to play a role in our development transition.

India's renewable energy target and green hydrogen:

- Green hydrogen is critical to meet India's ambitious target of 450 gigawatt of renewable energy by 2030.
- Due to surplus generation of renewables in peak-generation hours, with further addition of renewables to its power grid, India will face a 'duck curve', as experienced by California.
- To utilize cheap solar power, currently at ₹2.0/kWh, we need to find other uses for solar power during its generation hours.
- 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.
- Electricity typically accounts for 70% of the production cost of green hydrogen.
- Hence, surplus electricity from India's renewable plants can augment green hydrogen economics and this will also protect the grid.

Learnings from other countries:

- West Asian countries, Chile and Australia are aiming to become major players in green hydrogen.
- An energy consortium in Australia has announced plans to build a project called the Asian Renewable Energy Hub in Pilbara.
- This project would use 1,743 large wind turbines and 30 square miles of solar panels to run a 26-gigawatt electrolysis factory that would create green hydrogen to be sent to Singapore.
- India can learn from global trends and leverage its vibrant clean energy industry to shape its green hydrogen market.

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.

Way forward for india:

- To build a global-scale green hydrogen industry, India needs a holistic approach.
- First, it should announce ambitious targets for green hydrogen and electrolyzer capacity by 2030 on similar lines as renewables.
- Second, 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).
- Third, India should aim to build a vibrant hydrogen products export industry, such as green steel, using a phased manufacturing programme.
- Fourth, India should form a regional alliance with South Korea, Japan and Singapore to export green hydrogen from coastal India to help them reach their net-zero ambitions.
- Fifth, capital cost contributes around 30% of green hydrogen costs, and dollar-linked contracts for procurement of hydrogen should be explored in relevant demand sectors, as is done for oil and gas.
- Last, India should plan to roll out a production-linked incentive scheme for electrolyzer manufacturing to address the huge global supply bottleneck.

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.