

India Energy

India aims to be global producer of green hydrogen, ACME to launch plant soon



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Green hydrogen is poised to enable the world to transition into a sustainable future in a clean, safe and cost-effective manner. (Photo: Ohmium)

By Atul Ranjan

NEW DELHI, NNA - Envisioning green hydrogen as the future energy of the world, Indian prime minister Narendra Modi recently announced the country would be setting up a national hydrogen mission to develop the country as the global hub of the new fuel as well as its largest exporter.

Although he gave no details on production targets, his message was of utmost significance as it was enunciated in his Independence Day address to the nation on August 15.

The cleanest and highly efficient form of energy, green hydrogen has been touted by energy experts as the new superfuel to solve the world's energy needs and facilitate the urgent transition to sustainability and zero-emissions in addressing the worsening climate crisis.

While green hydrogen, produced without pollutive fossil fuels, is still at a nascent stage of development in the world, some pioneering producers have managed to achieve safety standards and cost-competitiveness necessary for the fuel to be commercially viable.

Coupled with green ammonia, an end-product which makes the storage of green hydrogen safe, the superfuel duo are at the cusp of disrupting the energy industry as billions are poured into their development.

Increasing investments in electric vehicles recently have raised further interest in the new hydrogen market significantly.

Green hydrogen can be obtained easily from water electrolysis using renewable energy like solar or wind.

When the idea of India going big on green hydrogen was first broached officially in the union budget address in February, it inspired some state and private companies to take keen interest in the new endeavor and support the country's journey towards energy independence.

Indian Oil Corp. plans to build a green hydrogen plant in Uttar Pradesh, while NTPC, the country's largest electricity producer, will set up India's first green hydrogen fueling station in Ladakh.

On August 24, the Indian subsidiary of US-headquartered renewable energy startup Ohmium International announced the launch of India's first electrolyzer giga-factory to produce proton exchange membrane (PEM) electrolyzers for making green hydrogen.

Located in the southern city of Bengaluru, the plant will supply the products to green hydrogen producers so that they need not have to rely on imports.

In its press release, Ohmium said, "With zero carbon footprint, the green hydrogen can be utilized for fertilizer production, refinery processing, steel production, conventional vehicle transportation with methanol blending, and direct hydrogen transportation in fuel-cell based vehicles."

ACME group, which runs renewable firm ACME Solar Holdings Pvt. Ltd, said it is also banking big on the new-age fuel and will commission what could be the world's first integrated commercial green hydrogen-ammonia plant in India soon.

It has signed a land deal with Oman to build one of the world's largest green hydrogen-ammonia projects at the country's special economic zone in Duqm.

To provide insights on the exciting developments of this emerging industry, NNA spoke with Manoj Kumar Upadhyay, founder and chairman of ACME Group. In the Q & A below, he reveals details of the upcoming plants and the company's plans to be a pioneering global player.



A file photo of Manoj K. Upadhyay, founder and chairman of ACME Group which aims to be a major producer of green hydrogen and green ammonia globally. (Photo: ACME)

NNA: ACME Solar Holdings is betting big on the green hydrogen revolution. Tell us more about it.

Upadhyay: We are in the process of commissioning probably the world's first integrated green hydrogen and green ammonia plant at Bikaner in the northern Indian state of Rajasthan. The plant is being developed with an investment of \$20 million. The green hydrogen will be produced at the plant using 7.5 MWp (megawatts-peak) power from our own solar plant, which is an integral part of the project.

In fact, the green hydrogen unit is already operational and green ammonia production will start by end-August. Once fully operational, the plant will be producing 5 tons per day (TPD) of green ammonia with an annual output of 1,750-1,800 tons of green fuel.

ACME is also in the process of developing one of the world's largest green ammonia projects at Port of Duqm in Oman. The plant will be an integrated facility using 3 GWp (gigawatts-peak) of solar and 0.5 GWp of wind energy to produce 2400 TPD of green ammonia with an annual production of approximately 0.9 million tons. This would be the first facility of this scale to be operational by 2024.

NNA: Will the Oman plant export the green fuel? How much is the investment and when will it be ready?

Upadhyay: Yes, the facility is being built to export green ammonia to demand centers like Europe and Asia. The investment is around \$3.3 billion. The plant would be developed in phases, and the first phase is likely to be commissioned by the end of 2022 or early 2023.

The location was selected as it is one of the best sites in the world with high solar irradiation as well as wind speeds. Hence, a high CUF (capacity utilization factor) can be achieved, which is the key input for green ammonia production.

NNA: Is the company planning to have more of such plants in near future?

Upadhyay: Yes, we are at the planning and developmental stage for similar facilities in other parts of the world as well. The locations should be places with good renewable energy sources like solar or wind available and are also closer to demand centers or have domestic demand for such green fuels. Some of the geographies we are exploring include Chile, Australia, Portugal and Qatar.

NNA: What are your targets for setting up these plants?

Upadhyay: Globally, there are plans by players to set up capacities to the tune of 30-35 million tons per annum by 2030. ACME Group aims to be a major producer of green hydrogen and green ammonia globally and plans to have capacities of about 10 million tons per annum by 2030

NNA: Which are the key export markets?

Upadhyay: Currently, the key markets we are targeting include Europe and Asia. Europe is at the forefront in the decarbonization effort followed by countries like Japan and South Korea. There is a major push to decarbonization in these geographies in the existing industries, which use grey hydrogen or grey ammonia (or the production of hydrogen/ammonia using natural gas) in their final products. Such as fertilizers, chemicals, steel production, marine fuel and gas networks.

Also, new users of green fuel are emerging in sectors like long-haul trucking, power generation (thermal and gas-based), and sustainable aviation fuel. Japan is leading the way in the invalidation of ammonia blending with coal in thermal power plants. This step will create a huge demand for green ammonia and pave the way for not shutting down the existing thermal units, but running them effectively on the greener fuel. We see such demands are also arising in India, a major ammonia consumer, as well as the Americas.

NNA. Are you in talks with any buyers now? What are your prices like?

Upadhyay: Historically, the grey ammonia market has been functioning on a spot price-based mechanism. This also leads to a large variation in ammonia prices. As of today, we can see the ammonia prices are all-time high in the range of \$700 to \$750/MT.

We believe that green fuels, which do not use any natural gas or coal in their production, cannot be linked to these price variations. Here the main feed for production is renewable energy, which becomes fixed for 25-30 years. Long-term fixed price contracts make more sense for such fuels as there is no dependence on oil or gas markets. Also, it will help users to define their final production cost in a much more stable manner as the raw material (green ammonia) price for them becomes fixed.

We are in discussion with major fertilizer and chemical industries, power generation companies, and traders and they have shown immense interest in our project and green ammonia as a fuel. We have some long-term (20-25 years) contracts under discussion that will have fixed pricing with floor and ceiling mechanisms. We expect our green hydrogen price to be \$1.5-2.5/kg and the end-product green ammonia to be fairly competitive with the current grey ammonia prices.

NNA: What are the key factors and segments that will drive demand for green hydrogen and ammonia in India and overseas?

Upadhyay: The Indian government has taken a lead in the decarbonization of the Indian economy. After the Paris Agreement, substantial renewable capacity has already been added in the country - currently around 100 GW. Also, the government has plans to take this renewable capacity increase to 450 GW by 2030.

Prime Minister Narendra Modi in his address to the nation on the country's 75th Independence Day announced the national hydrogen mission aimed at making India a global hub for green hydrogen production and export. The policy is expected to bring in mandates for the usage of green hydrogen/green ammonia/green methanol in various industries like fertilizers, chemicals, steel and cement.

It will be similar to renewable purchase obligation (RPO) which spurred the demand for renewables in India, and due to which, economies of scale could be established. Today, renewable energy in India is one of the lowest in the world (\$2.6 -3 cents/KWh). This low-cost renewable energy with usage mandates in place will spur the demand for green hydrogen and ammonia in India.

The major sectors using green fuels in near-term to mid-term will be fertilizers, refineries, city gas networks, steel and cement production followed by some new sectors like transportation and round-the-clock green energy.

NNA: How big is the market potential in India and globally?

Upadhyay: With green hydrogen expected to penetrate every major sector around us in the next 20-30 years and seeing the net-zero targets being adopted by countries for 2030 and 2050, the green hydrogen ecosystem will be a \$12-13 trillion industry by 2050.

India will have its green hydrogen demand as well as the opportunity to be a major exporter to other countries considering the renewable energy potential and the government's push. This would make the green hydrogen ecosystem in India a \$1-2 trillion industry in the next 20-25 years.

NNA: Will the introduction of hydrogen fuel cells for electric vehicles in the near future significantly increase the demand for green hydrogen?

Upadhyay: Hydrogen fuel cell vehicles would first be adopted as the transportation systems for marine operations and also long-haul trucks. Electric vehicles have limitations such as the availability of charging infrastructure especially for long routes which are typically undertaken by good carriers.

Eventually, as the ecosystem develops and larger adoption happens in the personal vehicle segment, they would help in bringing economies of scale and a large demand especially in big cities which are already facing air pollution challenges. Hydrogen vehicles in countries like India which are major oil importers will make more sense and create a large new demand for green hydrogen to start within cities and eventually spread to other parts of the country. We will also see the adoption of green ammonia-hydrogen combustion engines for marine operations and power generation.

NNA: Are you expanding your solar capacities to support the new fuel business?

Upadhyay: Currently, we have 2.6 GWp of solar projects under construction. They are expected to be commissioned by Q1 of 2022-23. We plan to add 1.5 to 2 GW to each over the next few years. It would entail an investment of around \$1-1.35 billion. ACME Solar's current portfolio is 4.8 GWp, which

includes 2.2 GWp of operational capacity, while another 2.6 GWp is under construction, spread across 12 Indian states. The group has invested around \$2-2.3 billion for creating these fundamentally strong assets.

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