Renewable · 4 Min Read

Green urea can boost decarbonisation while reducing India's import dependency

Urea is among the most consumed chemicals in India—as an indispensable fertiliser in agriculture, and, thereafter, as an important raw material for producing plastics, and nutr feed for cattle. In the conventional process of urea production, natural gas is the primary source of hydrogen and carbon dioxide that are used as raw materials.

Dr Suresh N S & Deeksha Shridhar , • ETEnergyWorld
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According to the Ministry s and Fertilizers, India aims to end its urea imports by 2025, which is highly desirable as it is one of the largest importers of urea. In 2022–23, India consumed over 36 million metric tonnes (MMT) of urea, of which 20% was imported (at a cost of

considering its net-zero goals, it is crucial that the nation looks at cleaner ways of producing urea, alongside its attempts at bringing down the urea import bill.

Urea is among the most consumed chemicals in India—as an indispensable fertiliser in agriculture, and, thereafter, as an important raw material for producing plastics, and nutrient feed for cattle. In the conventional process of urea production, natural gas is the primary source of hydrogen and carbon dioxide that are used as raw materials. According to Energy Statistics India, fertiliser production accounts for 32% of India's total annual natural gas consumption. India's dependence on imported natural gas is considerable—currently almost 50%—which makes it vulnerable to the volatility of global markets.

India emits 2.8 giga tonnes (Gt) of carbon dioxide (CO_2) annually. Even if emissions slow down with clean technological progress, the country will

Enabling decarbonisation through green urea production

Each kilogram of urea production requires 0.82 kilogram of carbon dioxide, 0.1 kilogram of hydrogen, and 0.47 kilogram of nitrogen. Both nitrogen and hydrogen are converted into ammonia before producing urea. Our proposed green urea production process utilises point-source CO_2 emissions (which form 60% of total country emissions)—particularly from the hard-to-abate sectors like iron and steel, cement, coal-based power, etc.—and employs renewable energy to obtain other raw materials for producing urea. Under this production approach, carbon dioxide is obtained from point-source emissions from industries, hydrogen is produced from water through electrolysis using renewable energy, and nitrogen is captured from air. Thus, this process can boost decarbonisation, while also promoting a circular economy.

Potential for avoiding imports

It is estimated that to produce the amount of urea imported (viz. 7 MMT), a capital expenditure (CapEx) of approximately INR 45,000 crore would be required, with an operating expenditure (OpEx) of INR 27,000 crore. About 92% of the OpEx is attributed to electricity costs for producing green hydrogen via electrolysis. The estimated cost of green urea production ranges from INR 56 to 80 per kilogram, depending on

economic growth.

Of the captured point-source emissions, utilising a modest 0.36% (5.7 MMT CO_2) for urea production can eliminate India's urea imports, and using 1.7% (28 MMT CO_2) of it to produce urea can meet the nation's total urea demand (approximately 36 MMT).

The bottom line

Green urea is a notable use case for carbon capture, which can aid India in avoiding urea imports, aligning with the goals of an *Atmanirbhar Bharat*. Besides decarbonising the carbon-intensive urea industry, the green urea production approach can offer a significant reduction in natural gas imports (2.5 MMT through avoiding imports of urea and 12 MMT by fully transitioning from the conventional to the green approach to meet total demand), allowing it to be used for other purposes.

Towards reducing green urea production costs and enhancing sustainability, reasonable opportunity exists for improving the technology of carbon capt[illegible]t, and urea synthesis, and for increasing the deployment of renewable energy.

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37.5 GW capacity, expands offshore wind plans for renewable goals

Addressing the 7th General Assembly of the International Solar Alliance (ISA), Joshi outlin India's ambitious renewable targets, which include advancing offshore wind projects to r a 30 GW capacity goal by 2030.

Saurav Anand , • ETEnergyWorld
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New Delhi: In a significant boost to India's renewable energy sector, the Union Ministry of New and Renewable Energy has approved 50 solar parks with a combined capacity of nearly 37.5 gigawatts (GW), Union minister Pralhad Joshi said.

Addressing the 7th General Assembly of the International Solar Alliance (ISA), Joshi outlined India's ambitious renewable targets, which include

has set a 500 GW renewable energy target by 2030, with solar energy already crossing 90 GW in installed capacity.

The ISA, a coalition of 120 countries, aims to mobilize $1,000 billion in solar energy investments by 2030 through its 'Towards 1000' strategy, which seeks to achieve 1,000 GW of installed capacity, provide energy access to 1,000 million people, and mitigate 1,000 million tonnes of carbon dioxide emissions annually. This international commitment aligns with India's domestic efforts, where renewable energy projects, particularly in solar, are witnessing unprecedented growth.

"Our journey in renewables is one of vision and progress, with both domestic and international support driving significant achievements," Joshi said, highlighting India's recent budget allocation, which saw a 110% increase in funds for solar power projects. New schemes like the PM-Surya Ghar Muft Bijli Yojana and tax exemptions on critical mineral imports underscore the government's push to bolster solar infrastructure. Additionally, India's rooftop solar initiative, one of the most robust globally, is enabling communities to generate renewable energy directly at the hous

Notably, India's rural-focused PM-KUSUM scheme is transforming

the world expected to reach 2 terawatts of installed solar capacity by 2024. Solar's role in the global energy mix is rapidly expanding, as highlighted by the ISA data, which shows an investment surge from $144 billion in 2018 to an anticipated $500 billion by the end of 2024. This surge is making solar power the most affordable source of electricity in many regions, surpassing traditional energy sources like coal and gas.

ISA's achievements were a focal point during the assembly, as Joshi commended the alliance for completing 21 out of 27 solar demonstration projects across various nations. He also announced the dedication of 11 new demonstration projects and the inauguration of 7 STAR-C centres, which aim to enhance institutional capacities in ISA member states.

A prominent highlight of ISA's ongoing efforts includes the launch of the Solar Data Portal, a platform providing real-time data on solar resources, investment opportunities, and project performance globally. "This portal is transforming how governments and investors interact with solar projects, fostering transparency and action-oriented insights," Joshi remarked. The Global Solar Facility, another key initiative, is geared toward unlocking capital f ects in underserved regions, particularly in Africa, with a pilot underway in the Democratic Republic of Congo and financial backing from India and partners like Bloomberg.

Innovation Centre, fostering research and development in clean energy technologies. ISA's global events, including the International Solar Festival and CEO Caucus, further amplify its role, with upcoming sessions at COP29 under a dedicated Solar Hub pavilion to encourage wider international cooperation.

"The path ahead is clear, and the time for action is now," Joshi stated, urging countries, organizations, and private sectors to unite under the ISA's goals. "As President of the International Solar Alliance, I take immense pride in the progress we have made together. The achievements of 2024 have set the stage for even greater advancements in the years to come."

In closing, Joshi reiterated the ISA's guiding principle of unity, likening member countries to "the diverse fingers of a hand" that, when joined together, form a fist symbolizing collective strength.

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