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Green Urea Mission in India: Policy, Implementation, and Challenges

A case study on India's Green Urea Mission, analyzing policy frameworks, subsidies, and challenges to large-scale adoption.

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Abstract

The International Forum for Environment, Sustainability, and Technology (iFOREST), hosted a stakeholder gathering on the advantages of 'Green Urea' for the economy and environment in a low-carbon future, at India Habitat Centre, Delhi on July 30th, 2024. The report emphasizes the immediate necessity of a Green Urea Mission to update urea production and maximize consumption. The Green Urea Mission in India is a crucial effort focused on improving sustainable farming methods by using environmentally friendly fertilizers. This study examines the policies, implementation approaches, and obstacles encountered in achieving widespread adoption of the mission. It starts by looking at current fertilizer policies and analyzing how green urea fits within the country's sustainability objectives. The research focuses on the existing production techniques and the shift towards eco-friendly urea, stressing the importance of technology and financial tools like subsidies.

Despite its potential, the mission encounters significant challenges, such as high production costs, infrastructure limitations, and environmental concerns related to traditional farming practices. Through case studies of successful global implementations and pilot projects within India, the paper identifies best practices and lessons learned. It concludes with policy recommendations aimed at enhancing financial incentives for farmers, strengthening research and development efforts, and promoting public-private partnerships. This comprehensive analysis underscores the importance of the Green Urea Mission in fostering sustainable agriculture and mitigating environmental impacts in India.

Introduction

The use of chemical fertilizers has helped India overcome periodic famines and move towards food sufficiency. Chemical fertilizers, along with high-yielding seed varieties, mechanized agricultural practices, irrigation equipment, and pesticides introduced by the Green Revolution in the 1960s, have played a critical role in increasing farm outputs, securing the food supply, and delivering surplus production for exports. India produces adequate essential food grains, such as wheat and rice, to supply its enormous population's needs while also being the world's top rice exporter.

Given that agriculture is a pillar of the Indian economy, the usage of fertilisers has an indirect impact on livelihoods besides agricultural production. The Indian government has acknowledged the need for change in the fertiliser sector, specifically urea manufacturing. The New Urea Policy (NUP-2015) was created to increase domestic urea production, encourage energy efficiency, and rationalise subsidy burdens. Under this approach, urea manufacturing facilities are encouraged to produce above their cost variables, resulting in a more sustainable production model. [1]

The Green Urea Mission seeks an upgrade from conventional urea generated from natural gas to green urea made from green hydrogen. This transition is projected to minimise reliance on imported natural gas while considerably reducing greenhouse gas emissions. The aim is consistent with the larger National Green Hydrogen goal, which seeks a 30% increase in nitrogen use efficiency (NUE), a 30% reduction in urea consumption, and a 30% increase in non-chemical farming by 2050.[2]

Literature Review

Green urea production is gaining popularity as an environmentally conscious alternative to traditional urea production. The environmental effect of urea manufacturing is an excellent

[1] What is New Urea Policy (NUP) 2015? -
[2] Report Release & Meeting: Green Urea Economic and Environmental Benefits of a Low-Carbon Future

example of one of many global businesses that must be decarbonised to mitigate climate change and accomplish sustainability. The **existing method produces 910 kg of CO_2 per tonne of urea**, emphasising the necessity for decarbonisation.[3] Green urea offers the potential for increasing agricultural yields while lowering environmental concerns such as groundwater contamination. Studies show that green urea coated with organic ingredients, such as chitosan, outperforms conventional urea in dissolving tests and promotes more effective vegetative growth among plants. [4]

Three major issues with the current fertiliser policy: domestic manufacturers are not adequately compensated, the fiscal burden of urea subsidies has steadily increased over time, although yields have plateaued, and the large price gap between urea and other fertilisers has encouraged overuse, resulting in severe soil degradation. There is a need for urea pricing deregulation. [5]

Islanded green ammonia production for fertiliser manufacturing in India exemplifies the potential to shift towards import substitution and socioeconomic advantages. There are high chances that urea, which will be manufactured using green ammonia, could become cheaper compared to other traditional alternative options before 2030, based on carbon pricing and fossil fuel subsidy removal as inducements. Given the scale and importance of the demand for nitrogenous fertiliser and that high-emitting coal gasification has been revisited as a method of production, India is an excellent example of where financial support to transition to green production would have a high return on investment: achieving many of the sustainable development goals, providing high-quality jobs in substantial numbers, and developing an industry that has a huge potential for growth due to green ammonia's foreseen use in the power sector and international shipping. [6]

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[3] Mao, Chengliang, Jaewon Byun, Hamish W. MacLeod, Christos T. Maravelias and Geoffrey A. Ozin. “Green urea production for sustainable agriculture.” Joule (2024): n. Pag.

[4] Yahya, N. (2018). Efficacy of Green Urea for Sustainable Agriculture. In: Green Urea . Green Energy and Technology. Springer, Singapore.

[5] Kaur, Rajwinder. “Agricultural Subsidies in India Boon or Curse.” IOSR Journal of Humanities and Social Science 2, no. 4 (2012): 40–46.

[6] Nayak-Luke, Richard Michael, Luke Hatton, Zac Cesaro and René Bañares-Alcántara. “Assessing the viability of decarbonising India's nitrogenous fertiliser consumption.” *Journal of Cleaner Production* (2022): n. Pag.

Data Methodology

The research methodology adopted for this project employs a rigorous blend of qualitative and quantitative approaches, strategically integrating insights from authoritative sources to examine the Green Urea Mission as proposed in the iForest report. Qualitative analysis is conducted through a thorough examination of reports published by Niti Aayog, Ministry of New and Renewable Energy, and Department of Fertilizers among others. Surveys conducted by international and national institutions and organizations, academic papers, articles, and journals were also reviewed facilitating the identification of research gaps. These documents provide detailed data on indices, their computation, and the status of women in the respective countries. Complementing the qualitative aspect, the quantitative dimension utilizes empirical data obtained from official government sources and reputable studies. By incorporating diverse forms of evidence, the study aims to offer a comprehensive and well-supported analysis of the Green Urea Mission.

Policy Framework

Overview of fertiliser policies in India

1. **New Urea Policy (NUP) 2015**

Introduced in May 2015, the New Urea Policy aims to maximise indigenous urea production by reducing import dependency enhancing self-sufficiency and promoting energy efficiency by encouraging the adoption of advanced technologies to lower carbon footprints in urea production. The government subsidizes approximately 70% of urea costs, with the Maximum Retail Price (MRP) set at around **₹5,000 per tonne against an average production cost of ₹18,000 per tonne**. The policy also includes a concession scheme where the difference between production costs and selling prices is covered by subsidies, ensuring that urea remains affordable for farmers. [7]

2. **Neem Coated Urea Policy**

[7] What is New Urea Policy (NUP) 2015? -

In 2015, the government mandated that at least 75% of domestically produced urea must be neem-coated, a practice aimed at improving soil health as Neem coating reduces excessive use of urea and prevents its diversion for non-agricultural uses. It increases farmer income by promoting sustainable farming practices and reducing input costs. This policy has been effective in ensuring that urea is used primarily for agricultural purposes and not diverted for industrial applications.[8]

3. Urea Subsidy Scheme

The Urea Subsidy Scheme ensures that farmers can purchase urea at a fixed price of ₹242 per 45 kg bag, significantly lower than its actual cost (₹2200). The government has committed substantial funds to maintain this subsidy- ₹3.68 lakh crore was allocated for the subsidy from 2022-23 to 2024-25. This approach helps moderate farmers' input costs despite rising global fertiliser prices due to geopolitical factors. [9]

4. Atmanirbhar Bharat

The Indian government aims to achieve complete self-sufficiency in urea by the end of 2025. This initiative is part of a broader strategy to reduce import dependency, as India is currently one of the largest importers of urea globally. The establishment of new nano urea plants is underway, with eight new facilities expected to begin production by November 2025. The introduction of **Urea Gold**, a sulphur-coated variant, aims to enhance soil health while being more cost-effective for farmers. [10]

National Green Hydrogen Mission

This forms a step forward towards making India an energy-independent nation, and de-carbonizing critical sectors, as the Government approved the National Green Hydrogen Mission on January 4, 2023, with an initial outlay of ₹19,744 crore.[11] The Mission shall drive demand creation, production, utilisation, and export of Green Hydrogen and mobilise more than ₹8 lakh crore

[8] Neem Coated Urea
[9] https://www.pib.gov.in/PressReleseDetail.aspx?PRID=1935893&reg=3&lang=1
[10] Prime Minister dedicates to the Nation the Hindustan Urvarak & Rasayan Ltd (HURL) Sindri Fertiliser Plant.
[11] economic survey 2022-23: highlights

investment by 2030. It shall ensure that the production capacity of at least 5 MMT (Million Metric Tonne) per annum of Green hydrogen is in place. It shall cause a cumulative reduction of over ₹1 lakh crore of imports of fossil fuel and create employment for more than 6 lakh people. Renewable energy capacity by adding about 125 GW (Giga Watt) is relatively impressive in numbers; on the environmental side, nearly 50 MMT of the annual GHG emissions are reduced.

Financial incentives to focus indigenisation of electrolysers and Green Hydrogen production. Regions to be identified for large-scale mass production and consumption of Hydrogen to be developed as Green Hydrogen Hubs. Building an enabling policy framework for the creation of the Green Hydrogen Ecosystem. Framework for Public-Private Partnerships to be established in R&D Skill Development Program. [12]

Most large economies including India have made commitments to a net zero target. Transition to Green Hydrogen and Green Ammonia is one of the major requirements for reducing emissions, especially in the hard-to-abate sectors. The government of India has considered several policy measures to make the transition from fossil fuel or fossil fuel-based feedstocks to Green Hydrogen / Green Ammonia both as energy carriers and as chemical feedstock for different sectors.

Implementation Strategies

Current Urea Production Method

The chemical fertilisers used in India fall into two categories: nitrogenous and phosphatic & potash (P&K) fertilisers. Urea is the major nitrogenous fertilizer. P&K fertilizers are Di-ammonium Phosphate (DAP), Muriate of Potassium (MOP) and a combination of nitrogen, phosphorus, potassium, and sulphur known as NPKS. Hydrogen and nitrogen gases react at high temperatures and pressures to produce ammonia (NH_3), an intermediary needed in fertilizer production. Generally, fossil fuels including coal, natural gas, or naphtha are reformed for hydrogen. They provide the fuel needed as well to provide the heat of the reactions. Since air contains the necessary

[12] Harnessing GREEN HYDROGEN

amount of nitrogen used in the process, it is introduced into the secondary reformer. One of the products of the reforming reactions is the CO_2 gas. In the urea synthesis process, this CO_2 produced by the reformers is utilized in the subsequent step. Urea is manufactured through the Bosch–Meiser process, where ammonia reacts with CO_2. Gas is an essential feedstock and fuel in the production of urea and constitutes about 70-80% of the cost of production, depending on feedstock prices and the efficiency of production units. Falling production from domestic gas has triggered an exponential increase in the consumption of imported liquefied natural gas (LNG), or regasified LNG, within the fertiliser sector in India. [13]

Urea, a fossil fuel-based product, is an essential source of GHG and N_2O produced in the fields as a result of urea application is a highly potent GHG with a Global Warming Potential (GWP) about 300 times greater than that of CO_2. N_2O is now the leading ozone-depleting substance released through human activity. This implies that a third part of the urea applied to fields leaks into the environment, amidst heavy environmental and financial costs associated with increased use of urea, aside from soil degradation. High environmental and monetary costs notwithstanding, increased use has yet to result in higher yields.

India's heavy dependence on urea exposes it to energy security and diplomacy vulnerabilities. This year, **84% of urea was produced with the help of imported natural gas and about 21% of urea used was imported directly**. In such a scenario, a standing committee report placed in February flagged this dependence on imports as a major issue where the Department of Fertilizers needs to address the deficit and work for greater self-reliance in urea production. [14]

Transitioning to Green Urea Production

Green ammonia blending can go a long way in reducing the natural gas consumption for the sector as an entirety and, in effect, improve energy efficiency. This can automatically create space within the subsidy expenditure to support the adoption of green ammonia. Not only this but most of the

[13] India’s proposed urea self-sufficiency plan: Green hydrogen can be an enabler - Renewable Watch
[14] STANDING COMMITTEE ON CHEMICALS AND FERTILIZERS (2023-24) (SEVENTEENTH LOK SABHA) MINISTRY OF CHEMICALS AND FERTILIZERS (DEPARTM

natural gas is imported, meaning that a transition toward domestic use of green ammonia will help safeguard the energy needs of the sector against both economic as well as political shocks. The potential for producing renewably from water-based Green Hydrogen technologies from Solid Oxide Electrolyser Cell (SOEC), Proton Exchange Membrane (PEM) and Alkaline Water Electrolysis (AWE), and Anion Exchange Membrane Water Electrolyser (AEM).[15] For urea production, there are two ways to introduce green hydrogen: it can be introduced at the suction of the synthesis compressor and is then blended with syngas[16] or it is blended as green ammonia in the urea production step.

Proposed goals for the Green Urea Mission are:

1. Achieve a reduction of 30% in urea use within nitrogenous fertilizers by 2050.
2. Non-chemical agriculture land is to be enhanced by 30% and nitrogen use efficiency is to be improved by 30%.
3. The project is likely to significantly reduce greenhouse gas emissions and water pollution that are a part of the conventional process of producing (Grey) Urea.

In the conventional process of producing (Grey) Urea, the CO_2 evolved in the production of Ammonia is collected and made to react with Ammonia under given conditions to form Urea.[17]

Because the entire steam methane reforming (SMR[18]) process is suppressed during the production of Green Urea and H_2 is not produced from NG, this source of CO_2 is no longer available. Further, since this tender for decarbonization also assumes that renewable electricity is being consumed, even the captive power plant no longer generates CO_2. The reduction in Urea consumption will significantly decrease nitrate pollution of groundwater and surface water bodies, along with improved soil health and agricultural productivity.

[15] Economic Feasibility of Green Ammonia Use in India's Fertiliser Sector

[16] Syngas is a combustible gas mixture of carbon monoxide and hydrogen that is used to produce fuels and chemicals.

[17] Report Release & Meeting: Green Urea Economic and Environmental Benefits of a Low-Carbon Future

[18] SMR is a chemical process that produces hydrogen from natural gas or other methane sources.

Challenges to large-scale adoption

Important constraints for the expansion of green hydrogen in India include, on the supply side, the cost of production and delivery, and, on the demand side, Indian players' readiness to consume green hydrogen in traditional industrial processes.

1. Economic Challenges

   1.1. Electrolyzer Costs: The initial capital investment for electrolysis technology, which is essential for producing green hydrogen, is substantial. Current costs for electrolyzers are high, and reducing these costs is crucial for making green hydrogen economically viable.

   1.2. Subsidy Dependence: The Indian government currently heavily subsidises urea, accounting for about 85-90% of production costs. Transitioning to green urea may initially require maintaining these subsidies until production costs decrease, which could strain government finances.

   1.3. Low Domestic Demand: The current market demand for green hydrogen is lukewarm. Without a robust domestic market, scaling up production may be challenging, hindering the overall adoption of green urea.

2. Infrastructural Challenges

   2.1. Hydrogen Hubs: Developing regions as hydrogen hubs requires significant investment in infrastructure to support large-scale production and distribution of green hydrogen. This includes storage facilities and transportation networks.

   2.2. Integration with Existing Plants: Existing urea manufacturing facilities will need modifications to switch from grey to green ammonia. This integration process can be complex and costly, requiring careful planning and execution.

3. Technological Challenges

   3.1. Emerging Technology: Green hydrogen production is still an emerging technology with limited global standards and certification schemes. This lack of maturity can lead to uncertainties in quality and reliability.

   3.2. Efficiency Issues: Current **nitrogen use efficiency (NUE) in India is only about 35%**, compared to over 50% in North America. Improving NUE is essential before a large-scale shift to green urea can be effectively realized.

4. Policy and Regulatory Challenges

   4.1. Policy Alignment: The Green Urea Mission needs to be effectively integrated with the National Green Hydrogen Mission. Coordinated policies are essential for providing the necessary support and incentives for both sectors.

   4.2. Long-term Commitment: Achieving the ambitious targets set by the Green Urea Mission (e.g., reducing urea consumption by 50% over two decades) will require sustained government commitment and action over many years.

Case Studies

Successful Implementation of Green Urea Initiatives Globally

Green urea is gaining traction in Europe as part of efforts to decarbonize fertilizer production. Innovations like the **CONFETI project** aim to create eco-friendly urea using renewable energy and CO_2 capture techniques. Additionally, companies like Stamicarbon are exploring green ammonia production, which could influence urea's future viability. The European Union's (EU) focus on sustainable agriculture aligns with these advancements, promoting lower-carbon fertilizers to meet climate goals. The **EU Hydrogen Strategy** looks to harness the tremendous business opportunities associated with the production of decarbonised hydrogen. Global interest will mean new opportunities for EU companies, which are being stimulated by the proposals adopted by the Commission. [19]

There are currently two projects under development in Australia that plan to merge green hydrogen into fertiliser production processes. **Project Haber** is a proposed ammonia or granulated urea manufacturing facility with a planned capacity of 1.4 MTPA (million tonnes per annum) of urea. Although natural gas is the primary feedstock for the project, in reality, it is the integration of an 'on-site 10 MW electrolyser capable of producing approximately 1,825 tonnes per annum of renewables-based hydrogen, or approximately two per cent of the total hydrogen feedstock for the plant'. The **Yuri Renewable Hydrogen to Ammonia Project**, Australia, 'will construct a 10 MW electrolyser to produce renewables-based hydrogen to replace a portion of the hydrogen produced through the SMR process at Yara Fertilisers' existing liquid ammonia plant'. [20]

Pilot projects in India

Several technology providers are attempting to push the envelope for green ammonia technology. Nanjing Kapsom Energy Limited is a company which designs, engineers and constructs chemical plants. They have successfully developed the **World's First Green Ammonia Plant** in Bikaner, Rajasthan. The containerized unit produces hydrogen through an alkaline electrolyzer and generates nitrogen gas and ammonia is its end product.

Currently, the country's production of Green Hydrogen is very small. Under R&D projects supported by the Ministry of New and Renewable Energy a Green Hydrogen production plant based on solar energy and electrolysis has been established in Gurugram, Haryana, and a 6 kg/hour Green Hydrogen production plant based on biomass gasification has been established at IISc Bangalore, Karnataka. Further, some pilot projects have been set up in the country for the production of Green Hydrogen such as a Green Hydrogen manufacturing pilot plant at Jorhat,

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[19] EHB initiative to provide insights on infrastructure development by 2030.

[20] Milani, Dia, Ali Kiani, Nawshad Haque, Sarabjit Giddey and Paul H. M. Feron. "Green pathways for urea synthesis: A review from Australia's perspective." Sustainable Chemistry for Climate Action (2022): n. pag.

Assam by Oil India Limited and Kawas, Gujarat by National Thermal Power Corporation (NTPC) Limited. The government of India has not provided subsidies for these pilot projects. Recently, one company has set up its manufacturing facility for Polymer Electrolyte Membrane electrolysers in Bengaluru. [21]

Notably, the Final Investment Decision (FID) has been achieved by the **AM Green Ammonia project**, for a one million tonnes per annum of green ammonia facility at an existing urea plant in Kakinada, Andhra Pradesh. The facility is expected to start production in the second half of 2026 and is likely to produce 5 MTPA of green ammonia by 2030. This production is expected to supplement low-cost green molecules derived from renewable energy sources for decarbonizing industries like fertilisers, power generation, and chemicals.

Policy Recommendations

1. Reducing the **cost of green hydrogen assets** through affordable capital or grants will ultimately lower the overall cost of green ammonia. Investing in these measures by the government will result in subsidies being decreased, leading to revenue expenditure. For instance, producing white hydrogen in India costs roughly ₹378/kg, which is almost twice as much as producing grey hydrogen. Roughly 50-70% of the production expenses for green hydrogen come from continuous renewable electricity. The remaining expenses are for the electrolyser. Reaching the ₹168/kg milestone, green hydrogen will enable the expansion of a green energy ecosystem in India.[22]

2. While the production costs of green hydrogen are relatively low, significant expenses arise from the necessary infrastructure for conversion, storage, and transport. To make green hydrogen and its derivatives more competitive, it is essential to **minimize these infrastructure costs**. This will help lower delivery costs and stimulate demand for green products.

[21] Several pilot projects undertaken in the country for production of Green Hydrogen - Union Power & NRE Minister
[22] Green Hydrogen: Enabling Measures Roadmap for Adoption in India

3. Stakeholders should **re-channel subsidies** currently allocated to high-emission energy sources. By doing so, they can ensure that basic energy needs are met while making green energy options more economically viable for consumers.

4. The Green Urea Mission should be **integrated with the National Green Hydrogen Mission**. This alignment aims to set ambitious targets for reducing urea dependency and enhancing nitrogen use efficiency, ultimately leading to a significant decrease in environmental costs associated with urea production. A national roadmap is essential to outline specific timelines, investment aspirations, and the overall vision for green hydrogen utilization in urea production, enhancing investor confidence and ensuring collaborative efforts across the value chain.

5. The government should **provide direct subsidies** for the establishment of green hydrogen production facilities specifically for use in urea manufacturing. This financial support can help offset initial capital costs and encourage investment in renewable energy technologies. Implementing **tax credits** for companies that produce green hydrogen can incentivize the adoption of cleaner technologies in the fertilizer sector.

6. The government should **prioritize the establishment of dedicated green hydrogen hubs** across key agricultural regions. These hubs will serve as centres for producing green hydrogen, which can be utilized in urea production facilities.

7. To effectively implement this mission, it is crucial to **provide grants or tax breaks for companies engaged in research and development (R&D)** focused on efficient green hydrogen production methods and improved urea manufacturing processes. Tax breaks can improve the financial viability of companies investing in sustainable technologies, allowing them to compete more effectively in the market.

8. Reducing the **subsidy gap** between conventional and green urea, combined with providing farmers sufficient time and resources to adapt, is crucial for the success of the Green Urea Mission.

9. Set specific, measurable **targets for each urea manufacturing unit** to reduce carbon emissions by a defined percentage over a specified timeline. Introduce a tiered penalty system based on the degree of non-compliance with the established targets.

10. The government should set an **MSP for green urea** to provide financial security to farmers during the transition phase. This would ensure that farmers receive a fair price while the market stabilizes, thereby incentivizing them to adopt green urea.

11. Farmers need to be informed about the economic and environmental advantages of using green urea. **Training programs** should highlight how green urea enhances soil health and crop yields, thereby contributing to long-term agricultural sustainability. By fostering awareness, creating demand, and ensuring a smooth transition in the supply chain, India can significantly reduce its reliance on traditional fertilizers while enhancing agricultural productivity sustainably.

12. Collaborate with nations like Australia that have made significant progress in green hydrogen and sustainable fertiliser technologies. This **partnership** can facilitate technology transfer and investment opportunities, enhancing local capabilities in green urea production.

13. Actively seek funding from **international climate funds** and grants provided by multilateral organizations such as the UN or World Bank. These funds can support infrastructure development, research, and pilot projects within the Green Urea Mission.

14. Create **dedicated zones or industrial clusters** for green urea manufacturing. Such clusters can streamline supply chains, reduce production costs through economies of scale, and foster innovation among local enterprises.

15. Establish a **robust logistics network** to ensure the efficient distribution of green urea across agricultural regions. This network should prioritize minimizing the carbon footprint associated with transportation by utilizing electric vehicles or biofuels.

16. Implement policies that **simplify access** to land, permits, and financing for green urea producers. This is especially crucial for new entrants looking to innovate within the sector.

17. Create a **body responsible for monitoring the progress** of the Green Urea Mission. This task force should track emissions reductions, assess adoption rates among farmers, and evaluate the overall impact on agricultural productivity. Implement regular reporting on progress towards mission goals, ensuring transparency and accountability.

18. Employ **data analytics** to refine policies related to subsidy structures and production processes. This can help identify bottlenecks in production and distribution, allowing for timely interventions. Create mechanisms for feedback from farmers and producers to continuously improve policy effectiveness based on real-world experiences.

Conclusion

India has the potential to become a leading exporter of green hydrogen products due to its strong manufacturing base and abundant supply of affordable renewable resources. Nevertheless, the significant expense of green hydrogen currently versus grey hydrogen is expected to impede India's shift towards becoming a dominant player in the global green hydrogen industry. Policy intervention is needed for both supply and demand. Offering incentives for demand without setting the bar too high can help lower the hurdles to establishing a market initially, which can be eliminated as the market evolves. A simultaneous effort is required on the supply side to develop the necessary infrastructure for the widespread production of green hydrogen. This can be combined with the incentives for electrolysers and fuel cells in production-linking, along with a mandate for industry and private sectors to adopt these technologies. The Urea industry is not included in the National Green Hydrogen Mission's (NHGM) priority list, despite being the second largest user of hydrogen after oil refineries. Urea is the ideal choice for NGHM because the technology for creating Green Urea from Green Hydrogen is available and well-developed. With adequate policy support, industry engagement, market promotion, and growing investor interest, India might become a cost-effective, zero-carbon manufacturing hub, while also meeting its objectives of economic growth, employment generation, and enhanced public health.