

5. Green Ammonia- Environment

'Green' growth on inland waterways. India is leveraging the SIGHT programme and its \$500 billion investment potential to become a global leader in Green Ammonia, a carbon-neutral derivative of hydrogen. While challenges like high production costs and infrastructure gaps remain, its role in decarbonizing the fertilizer and shipping sectors makes it central to India's 2070 Net-Zero roadmap.

1. Understanding Green Ammonia

Definition- Ammonia (NH_3) produced by reacting Green Hydrogen (generated via water electrolysis using renewable energy) with Nitrogen (separated from the air).

The "Double Green" Advantage- Unlike conventional "Grey Ammonia" which relies on Natural Gas (SMR process), Green Ammonia is nearly carbon-neutral.

Global Context- Mechanisms like the EU's H2Global and South Korea's Clean Hydrogen Portfolio Standard are currently the primary drivers of the global market.

India's Competitive Edge- India's green ammonia auctions under the SECI SIGHT programme are recognized globally for their massive scale and cost-competitiveness.

2. Benefits of Green Ammonia

Benefit Category	Impact on India
Fertilizer Decarbonization	Transitioning the fertilizer sector (huge ammonia consumer) from gas-based to green-based imports significantly cuts national emissions.
Energy Carrier	Ammonia is significantly easier to liquefy, store, and transport than pure hydrogen, making it the preferred medium for long-distance energy trade.
Strategic Autonomy	Drastically reduces the massive import bill for natural gas and finished fertilizers, strengthening energy security.
Industrial Versatility	Acts as a clean fuel for the marine/shipping industry, zero-carbon power generation, and chemical manufacturing.
Export Potential	Positions India as a global "Green Fuel Hub" for nations in Europe and East Asia seeking to meet net-zero targets.

3. Critical Challenges to Adoption

Economic Viability- Currently, the production cost of green ammonia remains higher than conventional ammonia derived from fossil fuels.

Technological Maturity- While the Haber-Bosch process is old, scaling up high-capacity electrolyzers to match industrial demand is still an evolving challenge.

Infrastructure Gaps- India lacks the specialized storage tanks, dedicated pipelines, and bunkering facilities at ports required for large-scale ammonia handling.

Grid Complexity- Since India's base-load power still relies heavily on coal, ensuring a 24/7 "Round-the-Clock" (RTC) renewable supply for electrolyzers is difficult.

Global Competition- Countries with high solar/wind potential (like Australia, Chile, and Middle Eastern nations) are competing for the same export markets.

4. Government Initiatives & Policy Framework

National Green Hydrogen Mission (NGHM)- The overarching framework that identifies ammonia as the primary derivative for industrial decarbonization.

SIGHT Programme-

1. Outlay- ₹17,490 crore.
2. Focus- Direct incentives for domestic electrolyzer manufacturing and green hydrogen production.

SECI Auctions- Implementing transparent, competitive bidding to discover the lowest prices for green ammonia, currently reaching historic lows.

Pilot Projects– Live testing of green ammonia integration in fertilizer plants and as a fuel in shipping vessels.

International Diplomacy– Engaging in bilateral agreements for technology transfer and securing long-term "off-take" agreements with global buyers.

5. Conclusion and Way Forward

India's success in the green ammonia landscape is rooted in its low renewable energy costs and robust logistics. However, to maintain its lead toward the 2070 Net-Zero goal, the following steps are essential–

Regulatory Stability– Providing long-term policy certainty to attract the projected \$500 billion in investments.

Blended Finance– Using "Green Bonds" and risk-safeguards to lower the cost of capital for high-risk early projects.

Certification Frameworks– Establishing a robust "Green Rating" system to ensure Indian ammonia meets strict international carbon-intensity standards for export.

Safety Standards– Developing stringent safety protocols for handling and transporting large volumes of toxic and pressurized ammonia.

Source- <https://www.thehindubusinessline.com/economy/logistics/green-growth-on-inland-waterways/article70663840.ece/amp/>

