

PNGRB's Role in Hydrogen Ecosystem: A Comprehensive Outlook

The Petroleum and Natural Gas Regulatory Board (PNGRB), established under the PNGRB Act of 2006, enacted by Parliament in the 57th Year of the Republic of India, regulates the refining, processing, storage, transportation, distribution, marketing, and sale of petroleum products and natural gas, excluding the production of crude oil and natural gas. Its mandate is to safeguard consumer interests, ensure the availability of uninterrupted supplies, foster competitive markets, and address related regulatory matters.

Since its inception, PNGRB has authorized over 35,000 kilometres (km) of natural gas pipelines, with 25,000 km operational, and the remainder set for commissioning in the next 2-3 years. In addition, PNGRB has approved City Gas Distribution (CGD) networks in 307 geographical areas (GAs), in which natural gas steel pipeline network is projected to expand from 20,000 to 50,000 km by 2032. This infrastructure positions PNGRB as a cornerstone in India's clean energy transition, particularly in integrating hydrogen into the energy framework.

PNGRB is expected to play a key role in regulating the transportation of hydrogen through pipelines. It may oversee the retrofitting of existing pipelines or the creation of new pipelines for hydrogen transportation, ensuring that safety and operational guidelines are adapted for hydrogen's unique properties.

Hydrogen: The Fuel of the Future

As Francesco La Camera, Director of the International Renewable Energy Agency (IRENA), has noted, "Rapid green hydrogen scale-up lies on a systemic innovation approach beyond technology, which means we need innovative regulatory and policy frameworks, finance, and business models." This moment is critical for hydrogen, especially given its complex history. Despite early setbacks and hydrogen-related disasters, the gas has remained integral in industries like petroleum refining. In the 1970s, hydrogen gained attention for fuel cell vehicles (FCVs), yet it never truly disappeared. By the 2010s, hydrogen was rediscovered as a potential driver for decarbonization. Today, hydrogen is once again at the centre of a global conversation, with some advocating for its role in decarbonizing the gas industry, while others view it as a potential smokescreen for the fossil fuel sector to extend its life. This duality underscores hydrogen's significance in the future of energy.

Countries such as **Japan**, the **European Union (EU)**, the **US**,

and **Australia** are leading the charge in hydrogen adoption. Japan's **Basic Hydrogen Strategy** aims to integrate hydrogen across transportation, energy storage, and industrial sectors. The EU's Hydrogen Strategy for a Climate-Neutral Europe envisions scaling up green hydrogen production and establishing a trans-European hydrogen network by 2050. Similarly, the US has launched initiatives like the **Hydrogen Shot** to decarbonize industries and transportation by reducing the cost of clean hydrogen by 80% to \$1 per kilogram in one decade, while Australia positions itself as a hydrogen export leader to meet the growing demand in Asia.

In India's scenario, transition toward a hydrogen economy is crucial for addressing climate change and fulfilling its Paris Agreement commitments. As India experiences rapid economic growth, energy demand is rising, making the reduction of reliance on imported fossil fuels a key priority for energy security. Green hydrogen, produced using renewable energy, presents a sustainable solution to meet India's energy needs and decarbonization goals.

Hydrogen demand is growing in critical sectors such as fertilizers, refineries, and ammonia production, all undergoing a shift from fossil fuels to renewable energy. India's **National Green Hydrogen Mission** plays a pivotal role in facilitating this transition. However, efficiently transporting green hydrogen from supply-rich regions (with abundant renewable energy) to industrial demand centres is essential. This can be achieved by using existing natural gas pipelines or dedicated hydrogen pipelines, though challenges related to infrastructure optimization, safety standards, and regulatory frameworks must be addressed.

A practical pathway which seems to accelerate hydrogen



Pilot project on Green Hydrogen Blending by Gujarat Gas in NTPC Kawas Township, Surat, Gujarat





Hydrogen generation unit at NTPC Kawas Township, Surat, Gujarat

adoption is blending hydrogen with natural gas in existing infrastructure, which can be retrofitted at a lower cost. Low-level blending (**5-20% v/v**) of hydrogen with natural gas can significantly reduce carbon emissions, providing an incremental solution that allows industries and consumers to gradually transition to cleaner energy. This approach paves the way for the global shift toward sustainability and will facilitate the transition towards pure hydrogen (100% hydrogen with no natural gas blended) transmission.

As India looks to integrate hydrogen into its energy landscape, blending hydrogen with natural gas becomes a vital component of its decarbonization strategy. In the initial stages, hydrogen can be transported through rail or road using compressed or liquefied trailers. Over time, a network must be developed and retrofit existing infrastructure where feasible. Material compatibility and safety standards will remain top priorities in these efforts. International studies suggest that blending hydrogen up to **10-20%** by volume is feasible, but India must assess local conditions to determine the optimal ratio, ensuring the integrity of pipeline materials, given that India's existing natural gas infrastructure comprises various grades of steel such as X52, X60, X70, and X80, all requiring extensive testing to ensure compatibility with hydrogen.

PNGRB's Initiatives for Hydrogen Integration

PNGRB is spearheading efforts to facilitate hydrogen transmission through pipelines in India, focusing on developing infrastructure, ensuring regulatory compliance, and authorizing pilot projects to assess the feasibility and safety of hydrogen integration with natural gas.

A. Comprehensive Studies

1. **Hydrogen Pathways Study:** In collaboration with the World Bank and ICF India, PNGRB completed a study

in 2024, titled *Pathways for Hydrogen Transmission through Natural Gas Pipelines and City Gas Distribution Networks*¹. This study evaluates hydrogen demand-supply dynamics, infrastructure compatibility for various blending levels, and compares global best practices. Key tasks included:

- Mapping demand-supply of low carbon hydrogen with respect to pipeline supply infrastructure.
- Technical and commercial assessments of pipeline sector.
- Assessment of Policy and Regulatory Framework, including international experience.
- Developing a roadmap to integrate hydrogen into pipelines aligned with India's National Green Hydrogen Mission.

2. **Roadmap Development:** PNGRB, together with ICF, is creating a roadmap, expected to be completed at the end of the current financial year, for hydrogen blending in existing natural gas infrastructure, as well as development of dedicated 100% hydrogen pipelines, focusing on regulatory frameworks, safety standards, and technical specifications, including action plans and funding identification.

B. Pilot Projects on Hydrogen Blending

PNGRB has approved several pilot projects to test hydrogen blending with natural gas. These projects are vital for assessing the technical feasibility, infrastructure readiness, and hydrogen's impact on existing pipelines. Key pilot projects include:

1. **Indore, Madhya Pradesh:** GAIL (India) Limited and Aavantika Gas Limited conducted a pilot project on hydrogen blending with natural gas, starting with 2% v/v hydrogen into natural gas directly at the City Gate Station (CGS) in the steel pipeline catering to all segments



Hydrogen pressure regulation skid at City Gate Station of Indore GA of Aavantika Gas

¹ https://pngrb.gov.in/pdf/press-note/ICF_20241017.pdf - ICF presentation at PNGRB Oct 2024 stakeholder interaction





Hydrogen storage cascades with hydrogen pressure regulation skid at City Gate Station of Indore GA of Aavantika Gas

of the CGD network, i.e. Domestic piped natural gas (PNG), compressed natural gas (CNG), and Commercial & Industrial (C&I) consumers. Later, the blending ratio increased up to 5% in the MDPE² CGD network (excluding CNG), catering to domestic PNG, and C&I customers only.

2. **NTPC Kawas, Gujarat:** Gujarat Gas Limited (GGL) is conducting a pilot project on hydrogen blending with natural gas up to 5% v/v in the MDPE PNG distribution network of NTPC Kawas township, Surat, Gujarat. The blending percentage has now been increased from 5% to 8% v/v.
3. **Jorhat, Assam:** PNGRB granted approval to Assam Gas Company Limited (AGCL) for hydrogen blending with natural gas up to 2% v/v in the MDPE network of domestic households located within the premises of Base Pumping Station of Oil India Limited (OIL) at Jorhat, Assam. The project is yet to be commissioned.
4. **Ahmedabad, Gujarat:** Adani Total Gas Limited (ATGL) is conducting a pilot project to blend hydrogen up to 5% in the MDPE network.
5. **Gorakhpur, Uttar Pradesh:** PNGRB granted approval to Torrent Gas Limited for blending hydrogen up to 2% in the CGD network, which will be catering to all segments, i.e., Domestic PNG, CNG, and C&I consumers. The project is yet to be commissioned.

C. Regulatory and Policy Framework

Under National Green Hydrogen Mission, Ministry of Petroleum and Natural Gas (MoPNG) will play a key role in promoting the adoption of green hydrogen in refineries and CGD, involving both public sector entities and private sector participation. Additionally, MoPNG will facilitate development of necessary regulatory framework to support this transition through PNGRB. The latter's role is crucial in enabling the regulatory infrastructure needed for the effective integration of green hydrogen into the sector.

PNGRB is in the process of amending regulations to accommodate standards related to hydrogen and establish a robust regulatory framework for hydrogen infrastructure. Notable regulatory updates include:

- PNGRB is working with Ministry of New and Renewable Energy (MNRE) to review proposed hydrogen standards for inclusion in CGD and natural gas pipeline regulations. PNGRB has amended its Technical Standards and Specifications (T4S) to include standards for hydrogen blends, such as AGA Report No. 8 (compressibility factors for hydrogen-natural gas blends) and IS 15677 (protocols for metering hydrogen blends).
- PNGRB is in the process of preparing a draft typical guideline for hydrogen blending with natural gas, which is under deliberation of the PNGRB CGD T4S technical committee.
- PNGRB is in talks with GAIL (India) Limited to set up a state-of-the-art testing facility at its Vijapur, Madhya Pradesh plant, to assess pipeline compatibility with hydrogen. Furthermore, PNGRB is actively engaging with industry stakeholders such as IOCL, BPCL, HPCL³ and OIL to explore opportunities for collaboration in the development of a joint testing facility.

D. Formation of Hydrogen Cell

To streamline efforts, PNGRB has established a **dedicated Hydrogen Cell** tasked with overseeing the regulatory and infrastructure requirements for hydrogen transmission in India.

Way Forward for PNGRB

Facilitating the establishment of hydrogen ecosystem

Currently, hydrogen does not come under the purview of PNGRB as per the existing provisions of the PNGRB Act, 2006. However, the study on 'Pathways for Hydrogen Transmission through Natural Gas Pipelines and CGD Networks', conducted by PNGRB in association with the World Bank and ICF, outlined a comprehensive way forward for PNGRB to facilitate hydrogen blending with natural gas. Based on the study, several potential initiatives and tasks that PNGRB may undertake in this direction were identified, including:

- **Amendment in the PNGRB Act, 2006:** This Act needs to be amended to include provisions for hydrogen-blended natural gas and pure hydrogen.
- **Development of testing facility for hydrogen blending with natural gas:** PNGRB is planning to facilitate the establishment of a state-of-the-art testing facility with various stakeholders to evaluate the suitability

² Medium Density Polyethylene (MDPE)

³ IOCL (Indian Oil Corporation Ltd.), BPCL (Bharat Petroleum Corporation Ltd.), HPCL (Hindustan Petroleum Corporation Ltd.)



of existing pipeline infrastructure for transporting hydrogen blended with natural gas. The facility is to include various test beds, comprising closed-loop pipeline networks with sections made from different grades of steel and aged pipeline sections that were once part of operational natural gas networks. These sections will help simulate the conditions of pipelines currently in service. Testing is to be conducted in a time-accelerated manner to replicate long-term operational scenarios. The primary objective is to assess the feasibility of repurposing existing natural gas pipelines for the transmission of hydrogen-blended natural gas and pure hydrogen, ensuring safety, reliability, and efficiency in the transition to a hydrogen-based energy system.

● **Amendment in Existing Regulations:**

- a) **Access Code & Authorization Regulations** – Amendment in these regulations is required to incorporate hydrogen into the gas mix, with corresponding regulations enforced for the transportation of hydrogen-blended natural gas.
- b) **Tariff Regulations** – Amendment in tariff regulations is required to update the tariff structures to account for the additional costs involved in transporting hydrogen blends.
- c) **Capacity Determination** – Amendment in these regulations will be required to address the specifics of hydrogen-blended natural gas for ensuring accurate capacity determination of the pipeline carrying hydrogen-blended natural gas.
- d) **T4S/IMS/ERDMP Regulations** – Safety standards specific to hydrogen-blended natural gas to be adopted in the Regulations.

- **Introduction of New Regulations:** Notification of new regulations related to Technical & Safety, Access Code, Authorization, Tariff, and Capacity Determination, etc., will be required for dedicated hydrogen transmission pipelines post inclusion of provisions for pure hydrogen in PNGRB Act, 2006. This will facilitate in enforcing PNGRB regulations on dedicated hydrogen pipelines, which will be transporting pure hydrogen from supply sources to demand centers.

Furthermore, PNGRB is to focus on the development of regulatory framework for 100% hydrogen pipelines enabling more localized and efficient hydrogen transportation across hydrogen hubs. PNGRB aims to assess and ensure the technical compatibility of these segments before expanding to broader areas. This approach is crucial for reducing costs and addressing infrastructure challenges.

Conclusion

PNGRB is at the forefront of India's hydrogen transition by facilitating the development of infrastructure for hydrogen transportation through pipelines, driving regulatory reforms, pilot projects, and international collaborations. By enabling hydrogen blending in existing pipelines and preparing for dedicated hydrogen networks, PNGRB is laying the foundation for a **sustainable and resilient energy ecosystem**.

For further information, please contact:
e-technical@pngrb.gov.in

Authors: Farhan Akhter & Ambikesh Tiwari



Farhan Akhter is an Assistant Consultant at the Hydrogen Cell (PNGRB). He, along with the Hydrogen Cell team, oversees operations related to integrating hydrogen into natural gas infrastructure. This includes collaborating with various stakeholders to support pilot projects and testing facilities, conducting pipeline compatibility studies, and contributing to the development of regulatory frameworks crucial for the successful adoption of hydrogen as a clean energy source.

Farhan completed his Bachelor of Engineering in Electronics and Instrumentation in 2023 from RV College of Engineering, and is also a Cisco Certified Networking Associate (CCNA). He started his career as a Systems Reliability Engineer, gaining expertise in hyper-virtualization and server technologies. Later, he worked as a Graduate Engineer Trainee (GET) in the petroleum and EV retail outlet sector, with the engineering division on dispenser operations, and with the instrumentation team, before joining PNGRB.



Ambikesh Tiwari, Assistant Consultant at the Hydrogen Cell, PNGRB, has a Bachelor's in Applied Petroleum Engineering from UPES Dehradun. He brings knowledge and experience in regulatory

compliance, project management, and strategic planning within the City Gas Distribution (CGD) sector.

In his current role at the Hydrogen Cell, he plays a pivotal role in evaluating and approving pilot projects on hydrogen blending, contributing to the advancement of sustainable energy initiatives. Additionally, he oversees the adherence of CGD operators nationwide to PNGRB's T4S, IMS, and ERDMP regulations, ensuring the safe and efficient functioning of gas distribution networks.

