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Pathways for Hydrogen Transmission/Distribution and Future Roadmap: PNGRB perspective

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Key Initiatives By PNGRB (1/2)

Hydrogen Blending Pilots

- Pilot Projects in Madhya Pradesh, Gujarat, Assam, and Uttar Pradesh are exploring hydrogen blends of 2–8% in low-pressure CGD networks.

Adoption of MNRE Standards

- 1st set of recommendations has been reviewed and relevant standards have been adopted.
- 2nd set of Recommended standards are under review in the Technical committee.

Study on Pathways for Transmission of H2 in NG Pipeline & CGD Network

- Study has been conducted by PNGRB in association with World Bank through ICF.
- Two stakeholder interactions have been conducted in Mar'24 & Oct'24 respectively to discuss the outcomes of the study.
- Final report has been submitted by ICF.

Key Initiatives By PNGRB (2/2)

Amendment to the PNGRB Act, 2006

- PNGRB has proposed amendment to the PNGRB Act, 2006 for the inclusion of Hydrogen transmission through pipelines.

Technical Committee

- PNGRB has constituted a Technical Committee for formulation of guideline/regulations for pure Hydrogen transmission pipelines.

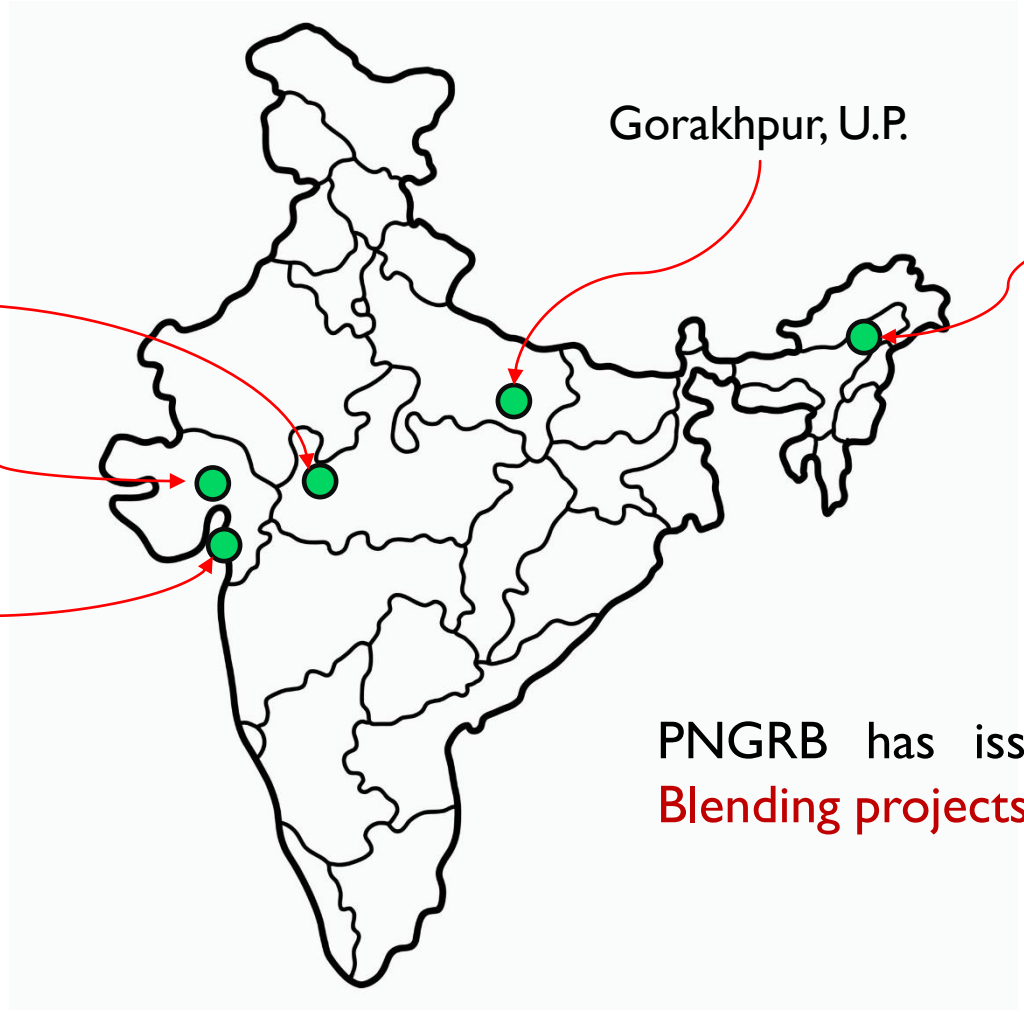
Guidelines for Hydrogen Blending

- Draft typical guidelines for hydrogen blending with natural gas is in discussion within the Technical Committee.

Hydrogen Roadmap

- ICF has been engaged for charting the detailed roadmap for the Hydrogen transmission and distribution.

H2 Blending Pilot Project Studies



PNGRB has issued permission for pilot Blending projects for 5 Geographical Areas

HYDROGEN BLENDING PILOT PROJECT STUDIES

	1st Pilot Study	Ongoing Pilot Project				
Entity	**Avantika Gas, Indore GA**	**Gujarat Gas Limited–NTPC, Kawas**	**Avantika Gas Limited, Indore GA**	**Assam Gas Company, Jorhat Assam**	**Adani Total Gas Limited – Ahmedabad**	**Torrent Gas Limited – Gorakhpur**
Pilot Study Area	Indore, MP (Blending in Entire Charge Area)	NTPC Kawas Township	Indore, MP (Blending in Entire Charge Area)	Household in Base Pumping Station of M/s OIL in Jorhat, Assam	Domestic Households and commercial customers in Shantigram area of Ahmedabad	Blending in entire CGD network of Gorakhpur GA
Customers Serviced	Domestic PNG, CNG, Industrial, Commercial	Domestic PNG (within the township)	Domestic PNG, Industrial, Commercial	Domestic PNG (within the township)	Domestic PNG, Commercial	Domestic PNG, Industrial, Commercial & CNG
Injection	Inside GAIL premises Into Steel Line, upstream of CGS	Injection into MDPE Pipeline	Injection into MDPE PNG network at AGL Motherstation	Injection into MDPE Pipeline	Injection into MDPE pipeline	Injection in Steel Pipeline at CGS
Blending Percentage	2% (v/v)	8% (v/v)	5% (v/v)	2% (v/v)	5% (v/v)	2% (v/v)
Proposal Clearance	23.06.2021	03.11.2023	23.10.2022	31.03.2023	30.05.2024	29.11.2024
Present Status	**COMPLETED (**No adverse reports)	**Injection Started (Jan 2023)** Study Ongoing	**Injection Started (March 2023). Injection stopped By PNGRB due to NCs observed at site**	**Injection yet to start**	**Injection Started (June 2024)** Study Ongoing	**Injection yet to start**

Adoption of MNRE referred standards

- 18 standards referred by MNRE in the first set of recommendations for adoption in PNGRB Regulations, the status is as under :

S no.	Summary	
1	6 nos.	Already covered in PNGRB regulations
2	9 nos.	Not recommended for adoptions as alternate provisions exist
3	2 nos. of standards (i.e., AGA Report No.8 & IS 15677)	Adopted in PNGRB T4S for CGD regulations vide Gazette dated 25.04.2024.
4	1 no. (ASME B31.12)	May be adopted for Hydrogen Pipelines in PNGRB Regulation subsequent to the inclusion of Hydrogen in PNGRB Act 2006.

- 2nd set of 58 recommended standards are under review by the Technical committee for PNGRB T4S CGD Regulations.

Pathways for Hydrogen transmission in natural gas pipelines and City Gas Distribution networks

PNGRB in collaboration with the World Bank, has initiated a study to develop pathways for Hydrogen transmission in natural gas pipelines and City Gas Distribution networks.

The study is structured around the following tasks:

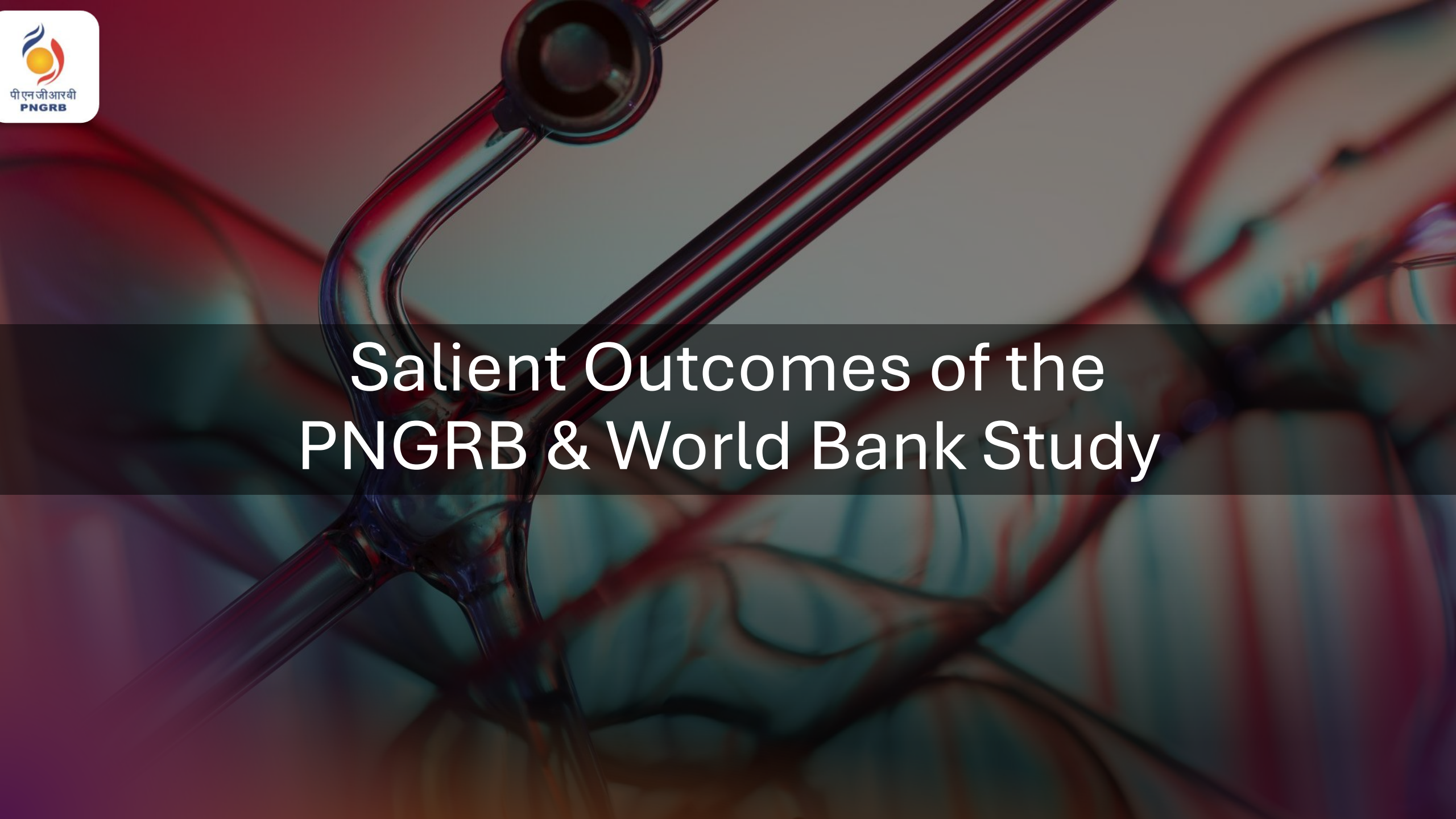
Task 1:
Mapping demand supply with respect to supply infrastructure

Task 2:
Technical Assessment in Pipeline Sector

Task 3:
Commercial Assessment of Pipeline Sector

Task 4:
Policy and Regulatory Framework

Task 5:
Roadmap for Transmission of Hydrogen Infrastructure (Pipeline)



Salient Outcomes of the PNGRB & World Bank Study

Technical Assessment

Blending Limit In Various Components

S.NO.	Element	Blending Limit (without modifications)	Blending Limit (with modifications)	Key Remarks/Retro fitment Solution
1	Compressor	2%-5%	15%-20%	Swapping gas turbines or internal combustion engines with electric motors
2	Electrically Driven Compressor	15%-20%	-	-
3	Valve	10%	-	Required new equipment
4	Gas Filter	10%		Required new equipment
5	Fuel Filter	10%		Required new equipment
6	Odorant	15%	-	
7	Insulation Joint	10%-20%	-	
8	Volumetric Meters	10%		Required new equipment
9	Process gas chromatograph	<=0.2%	10%-20%	Replace helium cylinders with Argon Cylinder

Blending Limit In Various Components

S.NO.	Element	Blending Limit (without modifications)	Blending Limit (with modifications)	Key Remarks/Retro fitment Solution
10	Gas Meters	10% - 50%		
11	Gas Turbine	1%-2%	15%-20%	Modifications to increase limit to 15% - 20%
12	Feedstock/Reformer	2%	-	Lower efficiency. Requires deblending solution
13	Burner/Gas Stove	10%	20%-100%	
14	CNG Vehicle fuel Tank	2%		Requires deblending solution
15	Domestic Appliances	20%		
16	Transmission pipeline (Steel)	5%-10%	-	-
17	Distribution pipeline (PE)	25%-100%	-	-
18	Condensing and Steam Boilers	5%-10%	20%-100%	

Blending Limit In Various Components

01

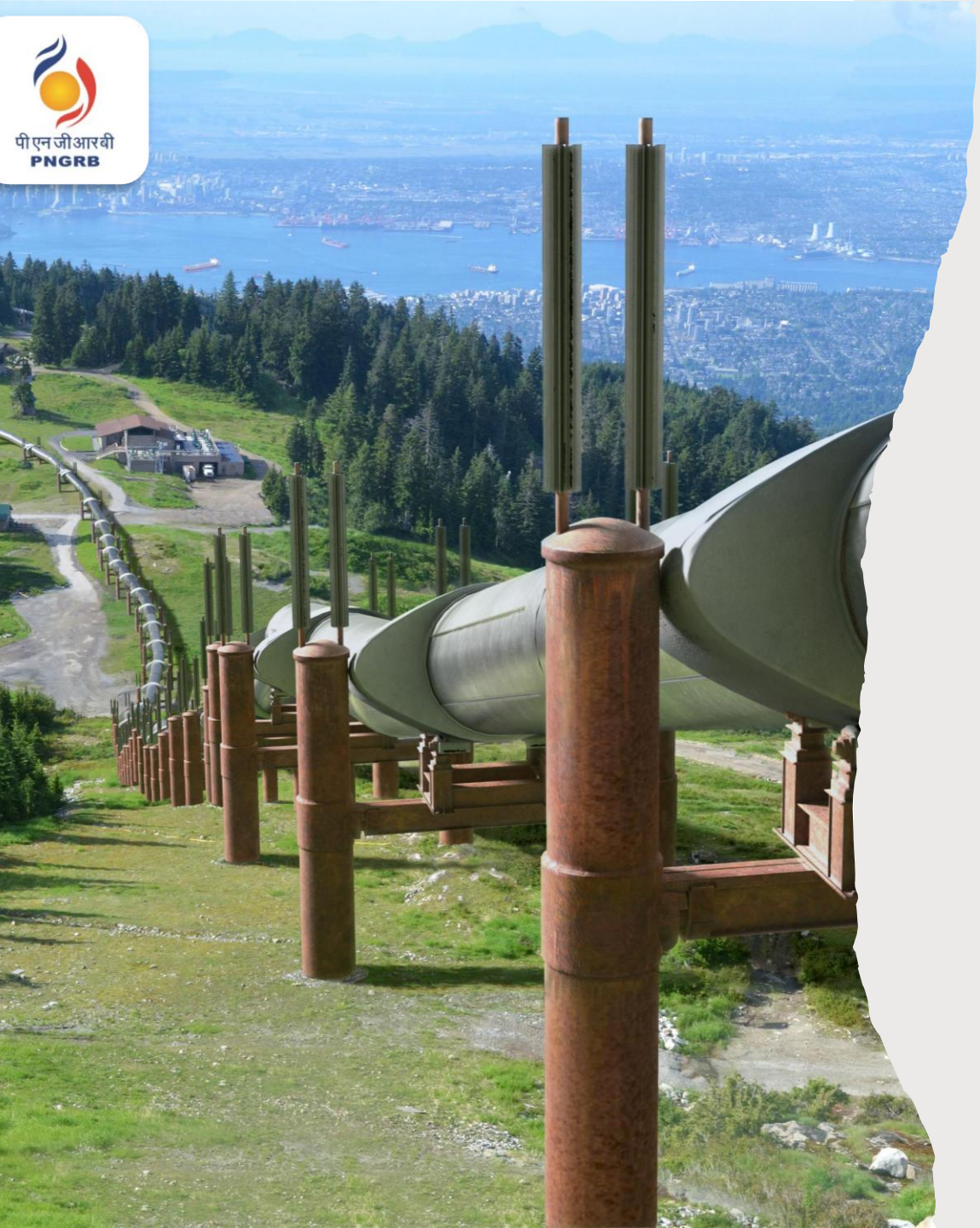
From 2% - 10% blending with minimal adjustment

02

From 10% - 20% blending requires case-specific analysis and involves modifications

03

Exceeding 20% presents significant challenges



Hydrogen Blending with Natural Gas

Safety and Feasibility Studies:

- International studies (Europe, USA, Australia) suggest blending hydrogen up to 10-20% by volume is feasible without major changes to infrastructure.
- Indian-specific studies are needed to evaluate material compatibility and determine the optimal blending ratio.

Material Compatibility:

- **Impact on Pipelines:** Hydrogen affects pipeline materials, especially steel and polyethylene.
- **Key Concerns:** Increased fatigue crack growth, reduced fracture resistance.
- India must prioritize research to assess long-term material performance.

Regulatory and Policy Framework

Amendment to PNGRB Act:

- Provisions of the PNGRB Act must be updated to regulate hydrogen pipelines.

Amending Existing Regulations:

- **Access Code & Authorization Updates:** Regulations must recognize hydrogen in the gas mix.
- **Tariff Adjustments:** Tariff regulations should account for the additional costs of transporting hydrogen blends.
- **IMS/ERDMP/T4S Regulations:** New safety and material standards specific to hydrogen blending are required.

Policy Incentives:

- Incentivize hydrogen blending through subsidies, tax incentives, and funding for R&D.

Technology and Infrastructure Development

R&D Focus:

- **Advanced Materials:** Develop and test materials that can withstand hydrogen’s effects (embrittlement, permeability).
- **Hydrogen Separation:** Technologies to separate hydrogen from blended natural gas (though de-blending is currently costly).

Infrastructure Upgrades:

- **Pipeline Retrofitting:** Older pipelines must be retrofitted or replaced with hydrogen-compatible materials (coatings, liners).
- **Compression and Storage:** Higher compression power is required due to hydrogen's low density, and storage facilities must be adapted to prevent leaks.
- **End-User Equipment:** Some appliances may require retrofitting or replacement for hydrogen compatibility.

Education and Stakeholder Engagement

Training and Capacity Building

- **Industry Training:** Programs to upskill existing gas industry workers in hydrogen safety, technology, and operations.
- **Public Awareness:** Educate the public on hydrogen's benefits and safety to gain acceptance.

Stakeholder Collaboration

- Collaboration between industry, academia, and government is essential for driving research, development, and innovation in hydrogen technology.

International Partnerships

- Engage in international collaborations (e.g., with UK, Netherlands, Germany, USA) to exchange knowledge, align standards, and access advanced technologies.

PNGRB Team Led by Chairperson, visits Future Grid Facility in UK

DNV

Roadmap Development For PNGRB By ICF

S.NO.	List of projects for H2 Roadmap development	Objective
1	Setting-up of Test Beds	Perform physicals tests to simulate gas conditions for different hydrogen blends (including pure H2)
2	Pilot Projects	Execute pilot projects to test pipelines for H2 Transport
3	Safety and technical standards review and development	Review and enhance existing technical and safety standards for H2 Testing and transportation
4	Pipeline identification for H2 blended NG Transportation	Identify and Assess potential pipelines suitable for H2 Blended NG transport.
5	H2 Blending Framework	Develop and validate business models for financing hydrogen blending (including pure H2) Identify commercial scale NG infrastructure zones
6	Commercial pipeline development	Develop new pipelines designed for 100% hydrogen including all necessary equipment.
7	Capacity Building	To introduce and Scale-up relevant H2 internal capabilities (Technical, Management) in PNGRB
8	End User	Impact of Blending on end-users(Detailed Review)
9	De-blending	Technologies available and cost implications

Thank You