Augmenting the role of gas in India's 2030 energy mix and beyond

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Foreword from ASSOCHAM

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Secretary General
ASSOCHAM

India's growing energy demand requires new solutions for production, transportation and energy usage. Considering this, the growth of the natural gas sector is crucial for the country's shift to a cleaner and more sustainable energy future.

India wants to diversify its energy mix, cut carbon emissions and improve energy access. This goal is supported by the increasing significance of natural gas. With the government's push to boost the share of natural gas in India's energy portfolio, the need for top-notch infrastructure is more urgent than ever. India's gas pipeline infrastructure has expanded considerably in recent decades, with over 24,945 km of working pipes.[1] The National Gas Grid, with the objective of increasing inter-regional connectivity and the smooth transport of gas all over the nation along with the development of regional pipelines, is central to facilitating the increased consumption of gas – especially in the power, industrial and transportation sectors.

The government's efforts to expand the number of City Gas Distribution (CGD) geographical areas have resulted in the fast-paced growth of piped natural gas (PNG) for homes and compressed natural gas (CNG) for automobiles in urban and semi-urban towns. This expansion is a part of India's overall vision to bring the percentage of natural gas in its energy basket from 6.2% to 15% by 2030.[2]

India's gas infrastructure is undergoing significant transformation which will be instrumental in its energy future, but several success factors, enablers and building blocks are required for it to grow. Impact of united tariffs on CGD and gas markets, pipeline and LNG terminal bottlenecks, development and maintenance challenges, domestic production and import dependency will all play their specific roles in achieving this vision. With the nation's transition towards cleaner fuels, an integrated gas network will be crucial in providing a secure and affordable source of energy and supporting a gas-based economy.

The India Gas Infrastructure Conference aims to gather leaders from the industry, government and academia to discuss the future of gas infrastructure in India. I hope this report gives stakeholders a chance to discuss new ideas, investments, regulations and the technology that will shape the gas infrastructure in the coming years.

I wish the conference a grand success.

1 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2090844#:~:text=The%20length%20of%20operational%20Natural,and%20operated%20by%20entities%20viz.

2 https://ppac.gov.in/download.php?file=rep_studies/1751629660_Readt%20_Reckoner_FY_2024_25.pdf

Foreword from PwC

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At present, India is at a crucial juncture – faced with the challenge of meeting the surging energy demands of a booming economy while advancing towards its net-zero goals. With more than 80%[3] of the current energy demand derived from coal and oil, the transition to cleaner fuels is not only an environmental need but also a strategic requirement for energy security and affordability. In this situation, natural gas becomes an essential fuel to power the ongoing transition sustainably.

This knowledge paper delivers a perspective on achieving the government's vision of creating a gas-based economy by raising the share of natural gas in the primary energy mix from the current 6.2% to 15% by 2030.[4] It delves into the important growth engines for gas, such as expansion of the CGD networks, emerging market for liquified natural gas in the transport segment and arising role of gas-fired power in stabilising the grid going forward.

However, the path to achieving this vision is filled with obstacles, which include infrastructure bottlenecks, complexities in pricing and geopolitical supply risks. This knowledge paper elucidates these roadblocks and provides a set of strategic policy interventions designed to quicken gas adoption. It scrutinises the need for integrating gas into the GST framework, promoting transparent price discovery, assuring equitable third-party access to the infrastructure and developing strategic gas reserves.

Additionally, this paper explores the impact of decarbonisation on gas itself, along with the role of compressed biogas and the long-term potential of green hydrogen.

We hope you find this report insightful and that it sparks conversations that translate into empowered action.

3 https://ppac.gov.in/download.php?file=rep_studies/1751629660_Readt%20_Reckoner_FY_2024_25.pdf

4 Ibid.

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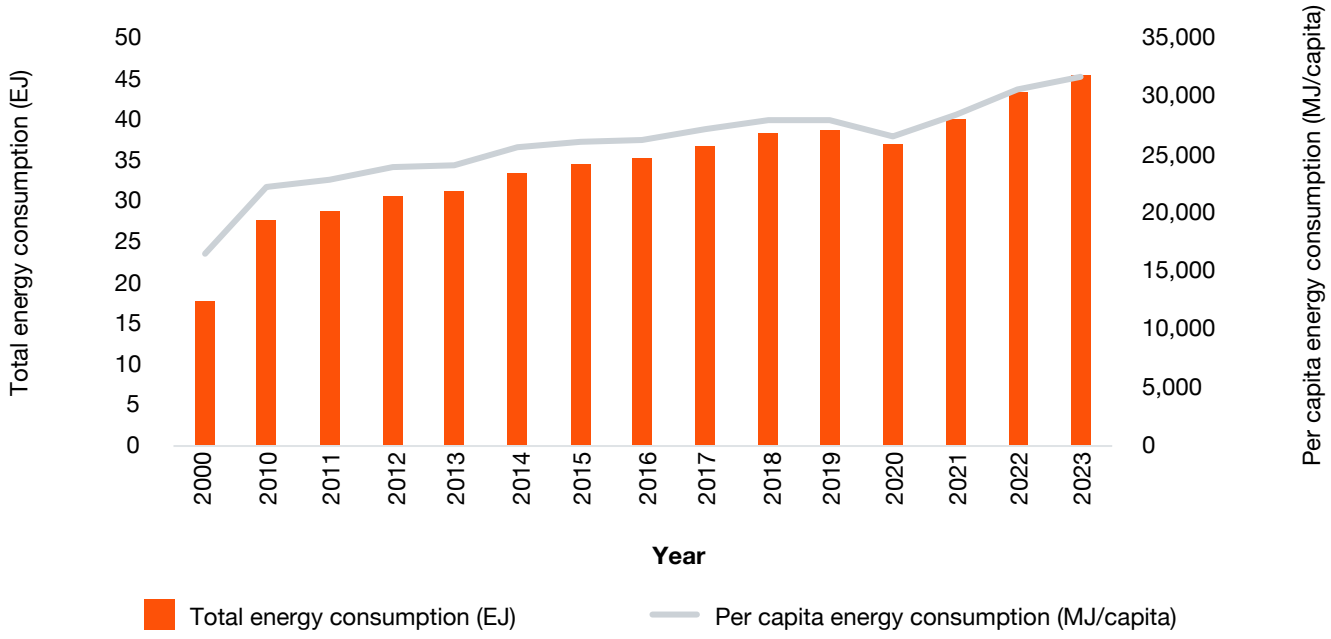
01 Introduction: Importance of gas in the energy basket of India

India is the world's third-largest energy consuming economy after China and the US, owing to improving standards of living, increased urbanisation, growing industrialisation and emerging end-use applications like data centres. Energy usage has doubled since 2000, with over 80% of energy demand still being met by coal, oil and solid biomass.[5]

Figure 1: Total energy consumption – absolute and per capita level



Source: https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=INDIA&fuel=Energy%20supply&indicator=TESbySource

5 https://www.iea.org/data-and-statistics/data-tools/energy-statistics-data-browser?country=INDIA&fuel=Energy%20supply&indicator=TESbySource

At present, the share of natural gas in India's energy mix is 6.2%.[6,7] Recognising its role as a critical bridge fuel in the country's energy transition journey and decarbonisation, the Government of India (GoI) has stated its intent to move towards a gas-based economy by increasing the share of natural gas in India's primary energy basket from the current 6.2% to 15% by 2030.[8]

To aid penetration, GoI has introduced a series of reforms and initiatives like priority allocation of domestically produced gas to homes and transport in city gas distribution (CGD). This will help accelerate the cross-country gas grid set up, pricing and tariff reforms to improve consumption while encouraging infrastructure build up and upstream investments and biogas blending, to name a few.

As the Government pushes through for the next big leap of consumption growth for natural gas in the country, multiple headwinds challenge this ambition. Trade wars and fragmented geopolitics, stalling penetration and slow downstream infrastructure growth, limited to no growth in emerging applications like liquified natural gas (LNG) in transport and bunkering, long pending tax reforms, and underutilised infrastructure pose challenges in the envisaged growth trajectory.

The Government and the regulator, Petroleum and Natural Gas Regulatory Board (PNGRB), have done a commendable job so far of creating the right base. However, the rapid evolution of the business environment and stalling consumption necessitates a relook at the current policy set and strategic targeted steps and trade strategy to weather the unpredictable externalities. By targeting the right growth opportunities and introducing smart policies, the Government can further boost gas consumption beyond its expected trajectory by 2030. In this paper, we explore growth areas such as the potential of LNG for long-haul trucking, greater utilisation of gas-power generation fleet, and accelerated infrastructure development in residential, commercial and transport sectors to drive the additional demand. We also examine the untapped potential of India's compressed biogas (CBG) production in reducing LNG imports by bridging the gap between increasing consumption and marginal domestic production. Finally, we outline policy options to enhance the role of natural gas within the national energy mix in the coming years.

6 https://ppac.gov.in/download.php?file=rep_studies/1751629660_Readt%20_Reckoner_FY_2024_25.pdf

7 https://www.energyinst.org/statistical-review

8 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=1987803

02

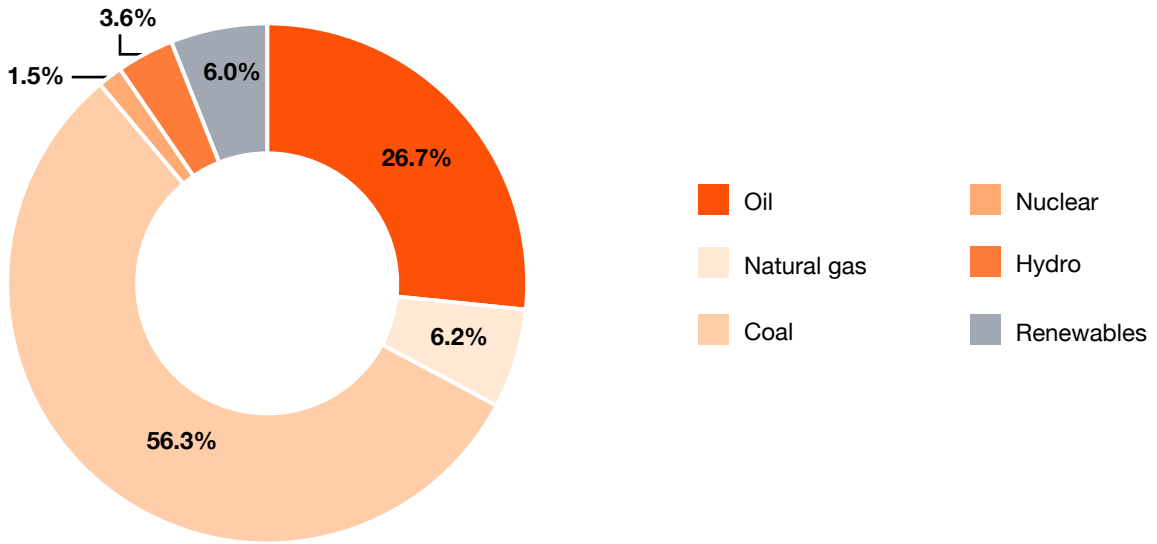
What's next for the gas sector in India: Potential for growth and need for policy interventions

Overview of the gas market in India

India's gas market is in a phase of rapid expansion, driven by the Government's vision to increase the share of natural gas in its energy mix. The market is heavily dependent on imported LNG to meet its rising demand, as domestic production is limited. Key growth drivers include the expansion of CGD networks for homes and vehicles, and its use in the fertiliser and power sectors. To support this, India is aggressively investing in expanding its national gas pipeline grid and building new LNG import terminals.

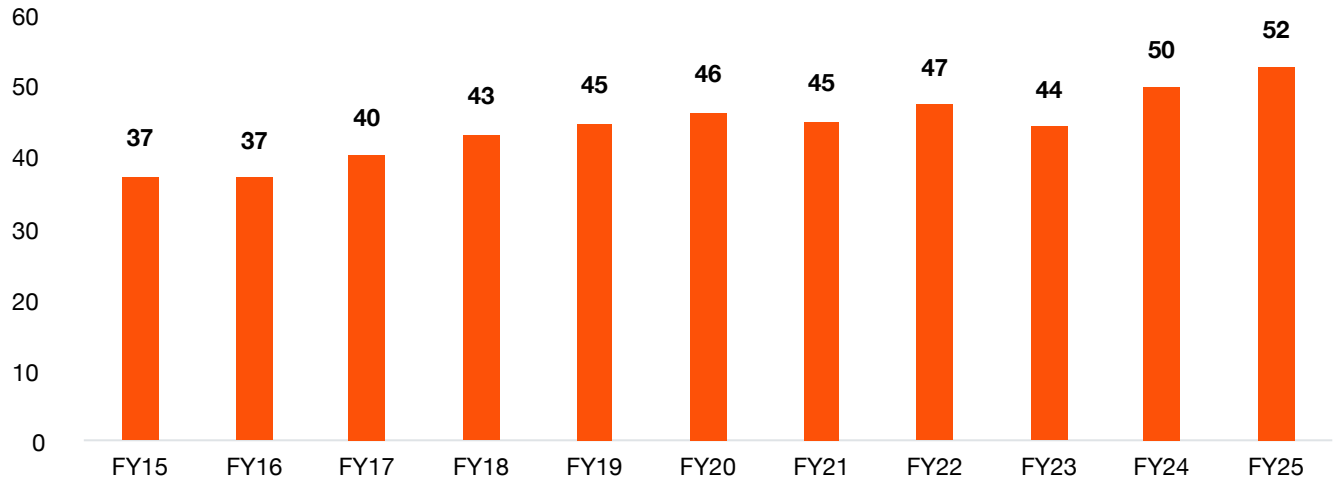
Figure 2: Share of natural gas in India's energy basket

India's energy mix 2024



Source: https://ppac.gov.in/#redyreckonr, India Oil and Gas Ready Reckoner FY2024-25

Figure 3: Historical gas consumption trend in India (MMTPA)

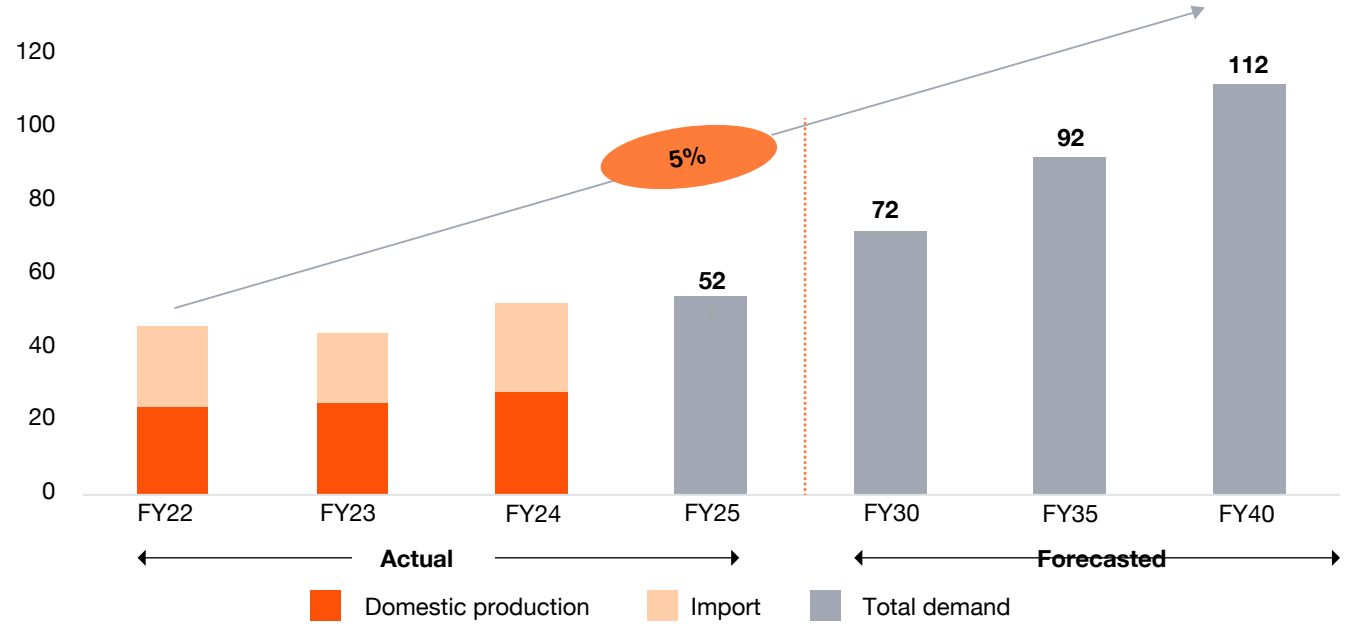


Source: https://ppac.gov.in/natural-gas/consumption

Natural gas demand

India's gas demand is poised for steady growth, influenced by a combination of economic dynamics, policy incentives and environmental goals. Gas consumption is expected to more than double – increasing from 52 MTPA[9] in FY25 to 112 MTPA[10] by FY40 – in line with the country's net zero commitments. Natural gas will act as the bridge fuel as India reduces its coal-based fuel consumption and builds its renewable capacity to meet energy needs.

Figure 4: Natural gas demand outlook (MMTPA)



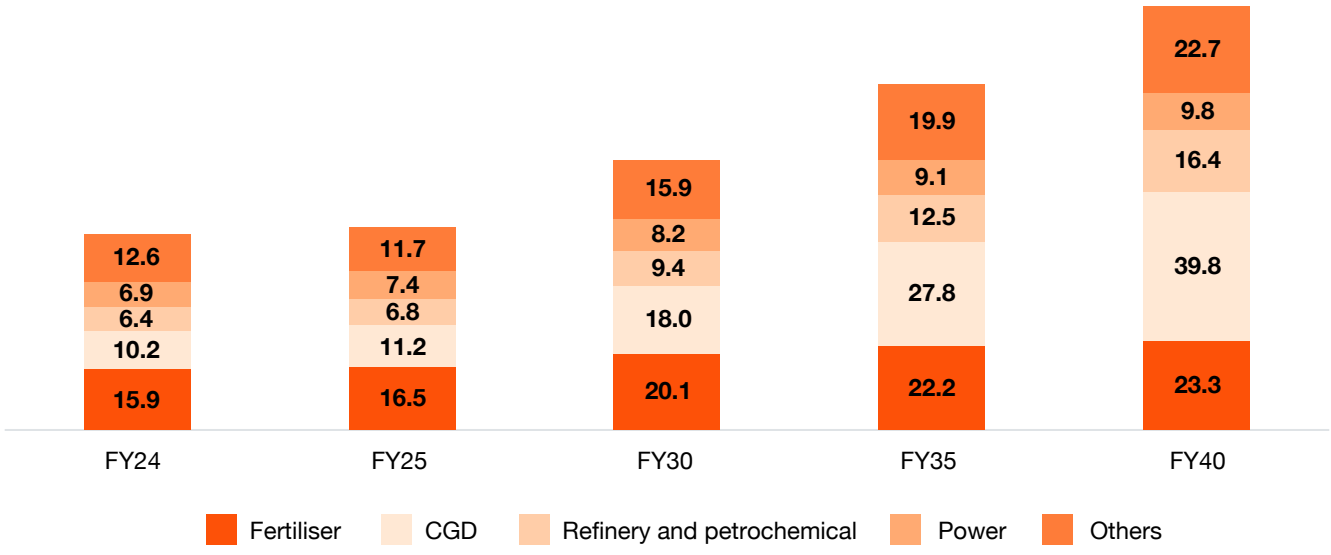
Source: PwC analysis; https://ppac.gov.in/natural-gas/consumption

9 https://ppac.gov.in/natural-gas/consumption
10 PwC analysis

Sectoral trends

Growing demand for natural gas is expected to be driven predominantly by CGD, long-haul transport, oil refining, followed by the power sector. While traditional sectors like fertiliser production and petrochemicals remain significant consumers, this growth is concentrated in these three key areas. This trend is driven by a confluence of environmental regulations, economic advantages and strategic policy decisions by governments worldwide.

Figure 5: Sector-wise gas demand outlook (MMTPA)



Source: PwC analysis; https://ppac.gov.in/natural-gas/sectoral-consumption

Growth segments and enhancing customer conversions

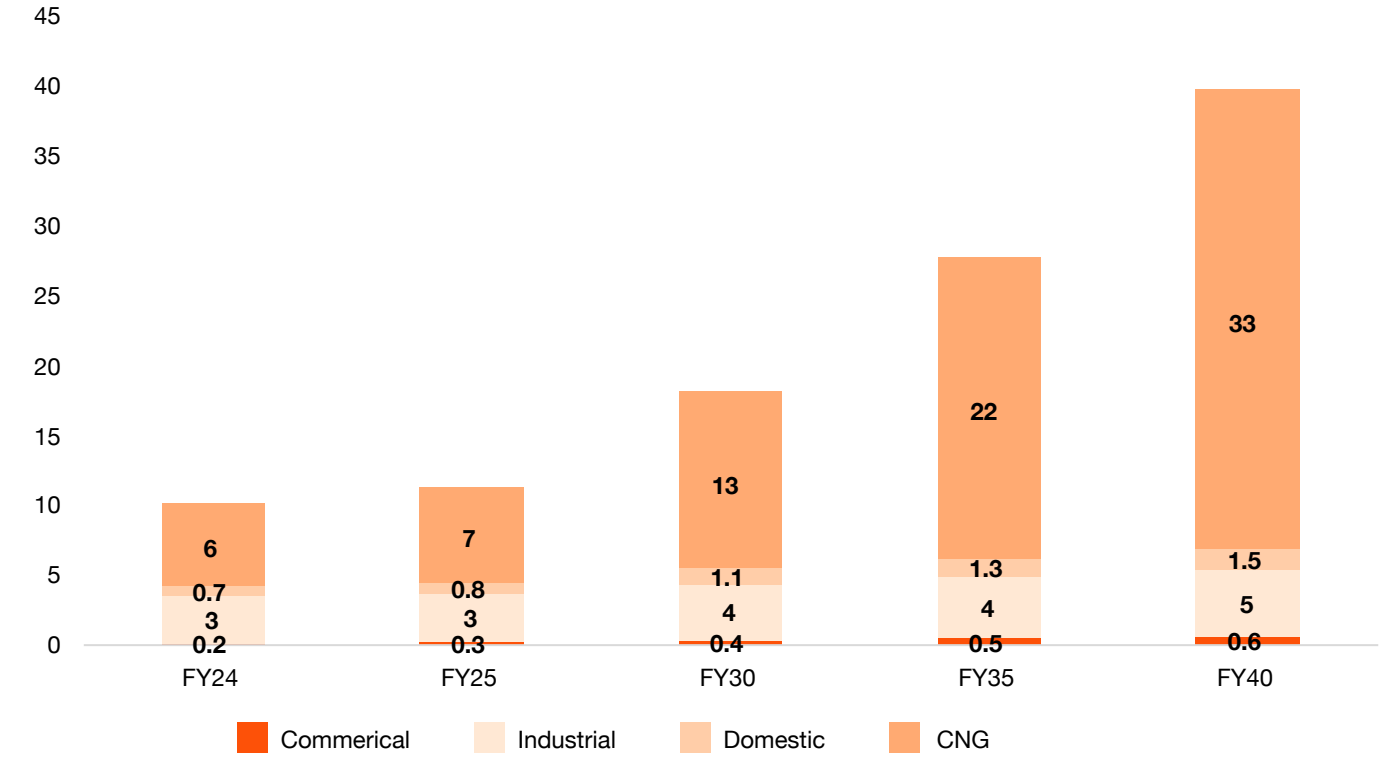
CGD – the primary demand driver

The CGD sector is poised to be the most significant contributor to gas demand growth through 2030. To make natural gas available to the public, the Government has placed strong emphasis on the expansion of CGD networks across the country. The pace of CGD licensing has increased remarkably from the ninth round of CGD bidding, along with growing interest from companies to apply for the same. After the 12/12A CGD bidding round, potential coverage of the population is expected to reach approximately 100% – achieving almost complete coverage of the country's area – except for Andaman and Nicobar and Lakshadweep Islands.[11]

This robust growth of the CGD sector is attributable to the continued expansion of infrastructure, such as CNG filling stations and distribution grid and the use of LNG in transportation.

CNG: Demand in CGD sector will be predominantly driven by CNG contributing **nearly 30% of the total natural gas demand (~33 MTPA) by 2040.**[12] The CGD sector is set for massive infrastructure growth by 2032, as minimum work programme (MWP) targets to increase domestic piped natural gas (PNG) connections tenfold to 120 million, and more than double the number of CNG stations to 17,500.[13] The scale of CNG adoption in India's transport sector is globally significant, with the country's roads home to around 7.7 million CNG-fuelled vehicles in 2024,[14] making it one of the top international markets.

Figure 6: CGD demand split (MMTPA)



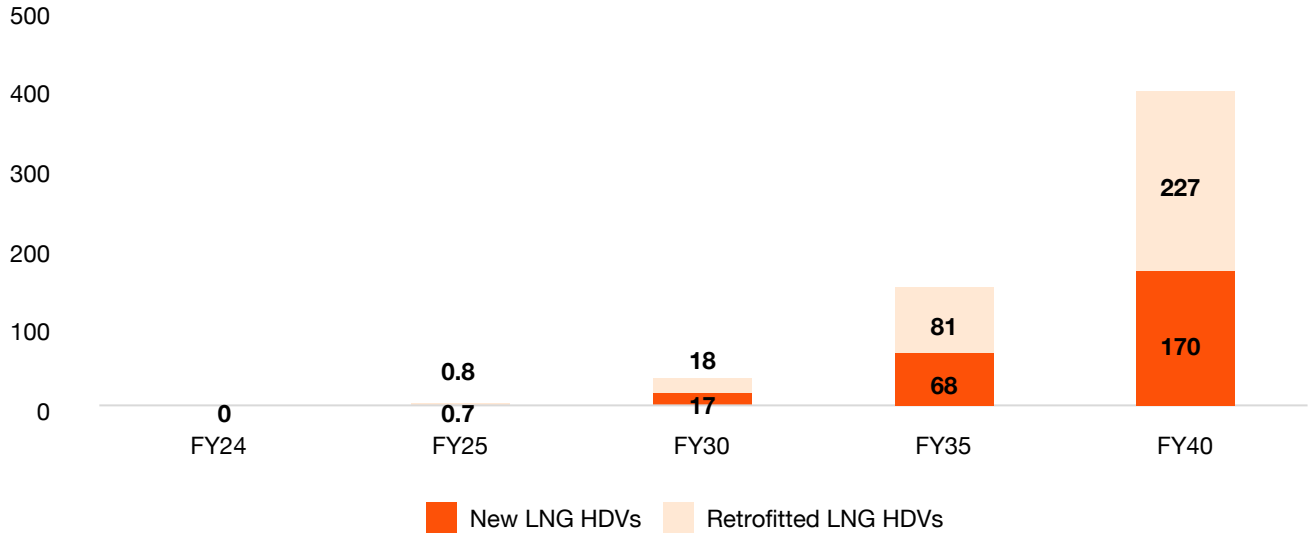
Source: PwC analysis

11 https://pib.gov.in/PressReleaseIframePage.aspx?PRID=2040078
12 PwC analysis
13 https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1987803
14 https://iea.blob.core.windows.net/assets/ef262e8d-239f-4cfc-8f8c-4d75ac887a0f/IndiaGasMarketReport.pdf

LNG in long-haul trucking: At present, the market for LNG as a transportation fuel is at a very nascent stage but holds significant potential. Factors like environmental concerns, government support, LNG infrastructure development and the price competitiveness of LNG are increasing its demand in the market. LNG also offers significant environmental benefits, with lower particulate matter (PM), NOx and SOx emissions.

- **LNG Corridors initiative:** The Government, key players (e.g. IOCL, BPCL, Petronet LNG, GAIL) and many others are actively developing LNG dispensing stations along major national highways like the Golden Quadrilateral. The Ministry of Petroleum and Natural Gas (MoPNG) has mandated the development of 50 LNG stations as part of a long-term goal to create a network of 1,000, with a target to convert **one-third of India's long-haul trucks** to LNG vehicles by 2030, creating a viable ecosystem for LNG trucking.[15]

Figure 7: LNG vehicles forecast (in '000')



Source: PwC analysis

The projected adoption of approximately **400,000 LNG-fuelled trucks by 2040**[16] is poised to become a major new demand driver for natural gas in India, unlocking significant investment opportunities in both refuelling infrastructure and the LNG supply chain.

15 https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1673998

16 PwC analysis, Parivahan data

Oil refining

India has rapidly grown into a global oil refining powerhouse. Between 2006 and 2023, the country more than doubled its refining capabilities,[17] making it the fourth-largest in the world and a major exporter of petroleum products. The country's **refining capacity is projected to reach 309.5 MTPA by 2030.** By **2040,**[18] natural gas consumption in petrochemicals and refineries is expected to reach 16.4 MTPA, growing at the CAGR of 6.5%.[19] With rising demand for petrochemicals, natural gas will remain a key feedstock, driving increased consumption in the sector.

Gas-based power generation – A grid balancing role

While challenged by cheap coal and renewables for baseload power, gas has a new and critical role to play. By the end of 2023, India had 62 gas-based power plants, with a total capacity of ~24 GW.[20] Despite the power sector's relatively modest CAGR for natural gas compared to other sectors, its consumption is still expected to increase, reaching ~10 MTPA by 2040.[21]

Peaking power and grid stability

As India's share of intermittent renewable energy (solar and wind) increases, gas-fired power plants, with their quick ramp-up/ramp-down capabilities, are ideal for balancing the grid and meeting peak demand when renewables are unavailable. This is a shift from a baseload to a flexible, ancillary services role.

17 https://iea.blob.core.windows.net/assets/ef262e8d-239f-4cfc-8f8c-4d75ac887a0f/IndiaGasMarketReport.pdf

18 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2096817

19 PwC analysis

20 https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1911550#:~:text=by%20PIB%20Delhi-,The%20Central%20Electricity%20Authority%20under%20Ministry%20of%20Power%2C%20monitors%2062,ANNEXURE

21 PwC analysis

Trade policy and potential impact of geopolitical tariffs and sanctions

While growth drivers to boost gas demand in India continue to exist, we do live in an increasingly volatile and geopolitically challenged world. With over 50% of India's gas consumption[22] being met through LNG imports, the Indian gas market is highly susceptible to the volatilities of international trade policies, geopolitical conflicts, tariffs and sanctions. These factors represent a primary threat to supply security, price stability and the overall bankability of gas-based projects, thereby directly impacting the viability of India's gas-centric energy transition.

The primary geopolitical threats emanate from:

- **Conflict-driven supply disruptions:** Geopolitical conflicts between Asian and European nations
- **Economic sanctions on producer nations:** Sanctions on major gas producing nations limit India's sourcing options.
- **Chokepoint vulnerability:** A significant portion of India's LNG supply transits through strategic maritime chokepoints like the Strait of Hormuz, making it vulnerable to the regional instability in the region.[23]

The shifting trade landscape is compelling a realignment of India's gas sourcing strategy as follows:

1. Diversification as a strategic imperative

The over-reliance on a single supplier or region is now viewed as a high-risk strategy. India has actively diversified its portfolio, with the US emerging as a major LNG supplier.

2. Contract renegotiation and innovation

Recent geopolitical volatility has underscored the need for more resilient contractual structures. India's renewal of a massive 7.5 MMTPA long-term deal with Qatar Energy LNG by Petronet LNG Ltd is a testament to this, securing supply until 2048.[24] Future contracts are likely to include more flexible terms, such as destination flexibility, hybrid pricing indices (linking to both oil and gas hub prices) and more robust force majeure clauses.

3. Focus on energy security

Energy security is now a core pillar of India's foreign policy. Securing favourable long-term deals, investing in overseas gas assets and building strong government-to-government relationships with producer nations (e.g. UAE, Mozambique, US) will be critical components of mitigating trade and geopolitical risks.

22 https://ppac.gov.in/natural-gas/consumption

23 https://www.eia.gov/todayinenergy/detail.php?id=65504

24 https://www.petronetlng.in/w/petronet-lng-limited-executes-long-term-contract-for-purchase-of-7.5-mmtpa-lng-with-qatarenergy-1#:~:text=Renewal%20of%20this%20agreement%20is,and%2017.5%20MMTPA%20in%202019)

Recommended policy and regulatory interventions to increase gas penetration in these sectors

India's ambition to foster a gas-based economy and significantly increase the share of natural gas in its energy portfolio represents a core strategic objective. However, the realisation of this vision has been historically constrained by persistent headwinds. To address these challenges, a focused policy approach could be instrumental in solidifying the role of natural gas in India's energy landscape by 2030 and beyond.

Integration of natural gas into the Goods and Services Tax (GST) framework

Natural gas should be brought under GST to harmonise the tax structure across competing energy sources such as LPG. This will rectify the current disparate and frequently unfavourable taxation of gas relative to fuels like coal and LPG, establishing a more uniform and equitable competitive environment.

Capex and policy support for use of LNG in heavy-duty transport

The heavy-duty transport sector, traditionally difficult to decarbonise, presents a significant opportunity for natural gas penetration in India. LNG offers a commercially viable and environmentally superior alternative to diesel. Recent government and industry initiatives, notably the planned development of an LNG refuelling corridor along the Golden Quadrilateral and major national highways, are creating the foundational infrastructure necessary to support a national LNG-powered vehicle ecosystem. To build on this momentum and accelerate the transition, the following steps could be taken:

- Adapt the successful NCR model, mandating all new commercial trucks registered to operate across the Golden Corridor must meet stringent emission norms, with LNG being a preferred compliance pathway. The following incentives could be given for faster adoption:
  - **Toll rebates:** Significant discounts on tolls for LNG trucks
  - **Priority lanes:** Dedicated or priority lanes at toll plazas
  - **Phased ban:** Announce a future date after which older, highly polluting diesel trucks (e.g. BS-IV) will not be allowed to ply on these corridors.
- Provide direct subsidies or interest in subvention on loans for the purchase of LNG trucks to make total cost of ownership (TCO) for LNG trucks more feasible.

Redefining the role of gas in the power sector

Gas power plants, despite being cleaner and flexible, struggle to compete with coal for baseload power and are often underutilised, leading to stranded assets. Making it mandatory for State Electricity Regulatory Commissions (SERCs) and DISCOMs to utilise gas-based power to meet a certain percentage of their peaking power and grid balancing (ancillary services) requirements will provide a secure revenue stream for gas power plants, ensuring their financial viability and readiness to support the grid's stability as the share of intermittent renewables grows.

Support for the CBG sector

India's push for CBG was started by the SATAT initiative, with the primary goal to establish **5,000 CBG plants** across India with a production target of **15 million metric tonnes (MMT)** of CBG per annum by 2024-25.[25] Next important step was the mandatory blending of CBG in the CNG and PNG segments. To further support the development of the CBG sector, the following policy initiatives could be taken:

- Provide land-acquisition incentives to set up rural CBG plants.
- Create a transparent national registry to track CBG output and issue green certificates.
- In early CBG obligation phases (CBG sold with natural gas for CNG/PNG), allow compliance waivers/credits to address supply shortfalls.

Enhancing market access

While India has an open access policy in principle, its implementation on pipelines and LNG terminals is inconsistent. New or smaller players often face challenges in securing capacity on pipelines controlled by incumbent players. The process can be opaque, and capacity hoarding can occur. This could be improved by following proposed interventions:

- **Establish a centralised digital platform:** Mandating the use of a single, transparent, electronic platform for all pipeline capacity booking, managed by an independent authority or the PNGRB. This would operate on a 'first-come, first-serve' and non-discriminatory basis.
- **Strengthen secondary capacity markets:** Allow entities that have booked pipeline capacity to trade on an open platform (like an exchange). This will ensure that a booked but unutilised capacity can be efficiently reallocated to those who need it, preventing artificial bottlenecks.

Fostering transparent price discovery

India has the Indian Gas Exchange (IGX), but its traded volumes are a small fraction of the country's total consumption. The market is still dominated by prices determined by long-term, oil-indexed contracts or volatile international spot LNG benchmarks (like Japan Korea Marker). Proposed interventions to address this issue are as follows:

- **Phasing out administered pricing mechanism (APM):** Implementing a clear, time-bound roadmap to phase out APM pricing entirely, as **recommended by the Kirit Parikh Committee.**[26] All domestically produced gas should eventually be sold at prices discovered through a transparent market mechanism (i.e. the gas exchange). This will ensure that the gas flows to sectors where it is valued most, incentivising upstream investment by allowing producers to realise market-based returns.
- **Empowering domestic gas trading hubs:** Driving liquidity on IGX by mandating PSUs to sell a portion of their market-priced gas through the exchange. A liquid gas exchange will provide a visible, real-time price signal based on Indian supply and demand, creating a credible domestic benchmark.

25 https://www.pib.gov.in/PressReleaseIframePage.aspx?PRID=1917439#:~:text=The%20Minister%20also%20shared%20India's,compressed%20biogas%20across%20the%20country

26 https://sansad.in/getFile/annex/219/Au553.pdf?source=pqars

03 Infrastructure as a sector enabler for increased gas penetration

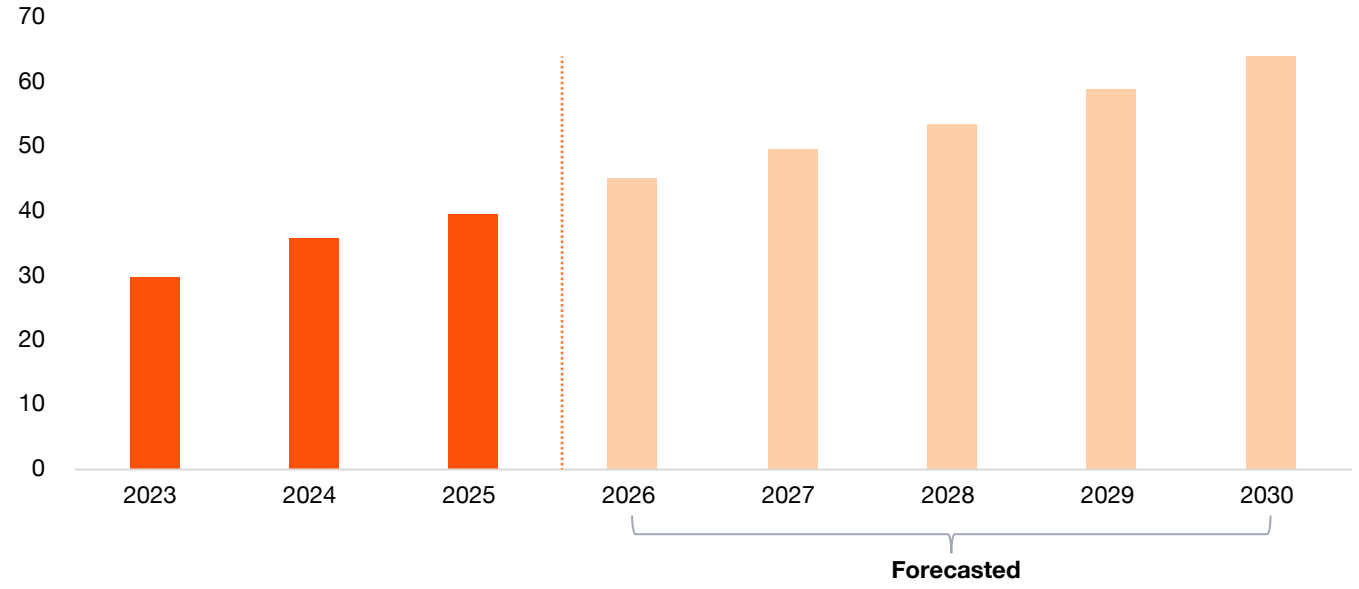
India's aim of reaching 15% share of gas in energy mix by 2030 depends majorly on fast infrastructure development, policy refinements for fair access, strategic resilience and rationalisation of the tariff system. Optimal utilisation of pipelines and LNG terminals, impartial third-party access, strategic reserves of gas, market-led pricing and improved project management together form the pillars for this transformation.

If executed collectively, these measures will not only suffice growing demand of the country, but will also make India a regional gas hub, guaranteeing affordable, reliable and sustainable source of energy for the years ahead.

Accelerating pipeline and LNG terminal development in India

India's mission to become a **gas-based economy** is gaining traction, with natural gas aimed to grow from current **6.3% of the energy mix to 15% by 2030**. Demand is envisaged to grow from **65 bcm/yr in 2023 to 103 bcm/yr by 2030,**[27] indicating nearly 60% growth. This growth makes infrastructure development of pipelines, regasification capacity and last-mile connectivity – a strategic necessity.

Figure 8: LNG import (bcm/yr)



Source: https://www.iea.org/reports/india-gas-market-report/

27 https://www.iea.org/news/indias-natural-gas-demand-set-for-60-rise-by-2030-supported-by-upcoming-global-lng-supply-wave

A prime example of this push is the **Jamnagar–Loni LPG Pipeline (JLPL) expansion by GAIL,** which will double the capacity from 3.25 to 6.5 MMTPA.[28] This 1,415 km pipeline connecting Gujarat's industrial clusters to northern consumption centres showcases the kind of infrastructure support India needs to minimise bottlenecks and promote cleaner fuels.

From an LNG viewpoint, India's imports have **increased by 70% between 2013 and 2023,** and reached 36 bcm in 2024. As growth in domestic production has risen gradually while the demand for natural gas increases, LNG imports are projected to **grow at 11% to 64 bcm by 2030.** This will require additional regasification capacity in the latter half of this decade for India, which is currently the fourth-largest LNG importer globally.[29]

However, **LNG terminals are being largely underutilised**. The Kochi terminal is a prime example, being operated at only 21% in 2024, while most others (except Dahej, Dabhol and Hazira) averaged lower than 30% utilisation over the last decade. This inefficiency – resulting from unsynchronised planning between terminal construction and downstream connectivity – not only causes assets to be stranded but also results in higher tariffs for the end user.[30]

S.no.	Year of commissioning	Operator	Terminal	Present capacity (MMTPA)	Utilisation 2023–24	Historical utilisation 2015–16 to 2022–23
1	2004	PLL	Dahej	17.5	95.10%	98.23%
2	2013	PLL	Kochi	5.0	20.60%	13.14%
3	2005	Hazira LNG Pvt. Ltd.	Hazira	5.2	30.30%	67.17%
4	2013	KLL	Dabhol	5.0	42.7%	57.50%
5	2019	Indian Oil LNG Pvt Ltd.	Ennore	5.0	18.30%	12.00%
6	2020	GSPC LNG Ltd.	Mundra	5.0	14.60%	24.93%
7	2023	Adani Total	Dhamra	5.0	27.40%	-
			Total	**47.7**	**50.50%**	**54.64%**

Source: https://pngrb.gov.in/pdf/CaseStudies/20241231_CSR.pdf

28 https://www.pngrb.gov.in/pdf/ppp/Govt-Authorization/20250723_Jamnagar-GAIL.pdf
29 https://www.iea.org/reports/india-gas-market-report/executive-summary
30 https://pngrb.gov.in/pdf/CaseStudies/20241231_CSR.pdf

To address this, the **PNGRB's LNG Terminal Regulations, 2025** promotes greater transparency, necessitating developers to provide evacuation plans, secure pre-final investment decision (pre-FID) registration and furnish bank guarantees. The purpose is to confirm that projects are demand driven and in sync with pipeline development plans.

The way forward requires integrated planning – ensuring that pipeline authorisations are in line with the terminal capacity and industrial demand clusters. Organised infrastructure development of pipelines, terminals and city gas networks will result in maximum throughput, reduce stranded assets and make sure that country's infrastructure development is in line with its surging gas demand.

Policy measures for equitable third-party access for cross-country pipelines, city gas infrastructure and LNG terminals

India has built over 24,000 km of gas transmission pipeline and seven LNG import terminals. Still, access to infrastructure remains skewed towards major gas corporations in the market. Despite the **PNGRB Act (2006)** directing open access, capacity prioritisation by the owners often sidelines third-parties' interest.[31]

The **LNG Terminal Regulations, 2025** has resulted in removal of the prior 20% short-term common carrier requirement and instead implemented a new set of rules, bolstering regulatory oversight by demanding pre-investment disclosure, comprehensive evacuation plans, public disclosure of tariffs and PNGRB-approved completion schedules.

Operationally, the access inefficiencies continue to remain. There is no provision of a unified booking system, confirmation of slots takes up to 72 hours, and day-ahead and intra-day nominations are still not available. Due to this lack of flexibility, spot traders and city gas distributors are hampered, as the transactions costs become high and occasional shortfalls occur during peak demand.

Comparing with the EU's model, we can identify India's gaps. EU regulations need real-time reporting of the available pipeline capacity on electronic bulletin boards, along with day-ahead and intra-day booking using automated platforms, guaranteeing non-discriminatory allocations. The EU's regulator (ACER) additionally proposes to conduct auction-based capacity allocation and higher degree of cross-border coordination to ensure efficiency.

Recommended reforms for India

- Amend the gas access codes to permit day-ahead and intra-day bookings, lowering the confirmation time down from 72 to 24 hours.
- Set up independent system operators (ISOs) to handle capacity allocation, scheduling and balancing – separate from marketing arms – eliminating conflicts of interest.
- Launch a National Electronic Gas Bulletin Board displaying real-time data on pipeline and terminal capacities, reference tariffs and booking status, which will boost transparency, reduce negotiation-related delays and lower transaction costs.

With implementation of these reforms, India can unlock genuine third-party access, improving competition and accelerating its transition to a gas-based economy.

31 https://pngrb.gov.in/pdf/CaseStudies/20241231_CSR.pdf

Tariff reforms and potential for unbundling of infrastructure and marketing

India's gas sector has been struggling with pricing distortions and concentration of control. Nearly 50% of the gas supply of the country is domestic,[32] while imports are increasing with increasing demand. Still the upstream investments are limited due to the Government-imposed price caps on the deepwater and high pressure/high temperature (HP/HT) production. As per International Energy Agency (IEA), phased extension of full gas pricing freedom in all fields would enhance upstream investment and help in securing long-term supply.

Structure of the market is another challenge as **GAIL administers over 12,400 km of pipelines and markets more than half of domestic gas sold in the country,**[33] resulting in influence over both sales price and transmission tariffs. This integration results in a conflict of interest, which deters competitive pricing.

To counter these issues, IEA recommends **legal unbundling** of infrastructure and marketing by:

- developing an independent **transmission system operator (TSO)** to set tariffs, assign capacity and manage investments with transparency
- isolating **marketing and trading into separate entities,** with independent governance and reporting
- standardising **gas sales agreements (GSAs)** to ensure transparent, arm's-length transactions.

The **PNGRB has also taken steps to simplify the tariff structure** by reducing the previously three distance-based zones into two: Zone 1 (≤300 km) and Zone 2 (>300 km). Domestic PNG and CNG customers would now pay a unified tariff of Zone 1, regardless of their distance from the gas source, while industrial users remain differentiated.[34]

The new **Pipeline Development and Rebate (PDR) model** instructs that the operators with more than 75% utilisation must reinvest half of their net earnings into development of infrastructure, while passing the rest back to consumers as tariff rebates. Similarly, the efficient fuel procurement mandate demands 75% of system-use gas to be sourced via multi-year contracts, which in turn reduces volatility.

By combining **market-driven pricing, tariff rationalisation and unbundling,** India can encourage competition, reduce control concentration and optimise infrastructure utilisation – thereby laying the groundwork to achieve **15% gas share target by 2030.**

32 https://ppac.gov.in/download.php?file=rep_studies/1751629660_Readt%20_Reckoner_FY_2024_25.pdf

33 https://gailcgd.gail.co.in/CGD/entry/aboutus

34 https://pngrb.gov.in/OurRegulation/PNGRB%20Regulations/B.%20Natural%20Gas%20Pipeline/B.4.%20NGPL%20Tariff%20Regulations/20250707-NGPL-Tariff-Post-Third-Amendment.pdf

Need for strategic gas reserves

During the initial period of geopolitical tensions between Asian and European nations in 2022, the vulnerability of gas-importing nations to supply disruption and price volatility was exposed. And for India, this dependency becomes a critical risk.

At present, ONGC, Oil India and GAIL handle nearly **2 bcm of commercial storage,** but this is insufficient for emergencies.[35] A strategic reserve would provide:

- **supply security** during the time of global disruptions or surge in domestic demand
- **stabilisation of price,** which will mitigate volatility for industrial and city gas users
- **regional leverage,** enabling India to supply to neighbouring countries such as Bangladesh, Sri Lanka and Myanmar during tough markets.

GoI has also deputed a feasibility study for a **strategic gas reserve of 4 bcm capacity,** which was modelled on its successful crude oil Strategic Petroleum Reserve (SPR).[36] This proposed reserve will use **underground storage – i.e. depleted wells and salt caverns** – supplemented by above-ground LNG bullet tanks for quick response and seasonal balancing. Sites for Phase 1 are planned in western and northeastern regions of the country, with the first facility targeted to be operational within 3–4 years, at an estimated capex of **USD 1–2 billion.**

Complementing the crude oil reserves, India's gas SPR would not only reinforce the energy security of the country but also strengthen its position as a regional gas hub – an important step towards its clean energy transition.

35 https://iea.blob.core.windows.net/assets/ef262e8d-239f-4cfc-8f8c-4d75ac887a0f/IndiaGasMarketReport.pdf
36 https://www.pib.gov.in/PressReleasePage.aspx?PRID=2113233

Enablers for efficient infrastructure development and project management

To successfully deliver India's ambitious gas infrastructure targets, we do not just need investment but also **world-class project management and regulatory certainty.** Several enablers that can drive efficiency are as follows:

Integrated project management

- **Implementing GIS-enabled route planning and 4D building information modelling (BIM) scheduling** would reduce project timelines while limiting cost overruns.
- **Cloud-based dashboards** would enable real-time tracking of the budgets, milestones and resources, thus improving accountability.

Standardised contracts and special purpose vehicles (SPVs)

- Standard **EPC and public–private partnership (PPP) templates** can lessen procurement delays and bring down risk for investors.
- **SPVs** can isolate the project risk involved, simplify necessary partnerships and streamline financing for large projects like pipelines or LNG terminals.

Digital twin and IoT monitoring

- Digital replicas of assets can support **predictive maintenance and leak detection,** reducing unplanned shutdowns.
- IoT-enabled monitoring can improve safety and reduce downtime.

Regulatory certainty and skill development

- Transparent **tendering and milestone-linked payments** can expedite clearance processes.
- Training for **2,000+ officials** in project finance, contract management and stakeholder engagement can help build necessary institutional capacity.

Coordinated network expansion

India's **city gas network at present spans to 400 districts across 307 geographical areas.** Alignment of this expansion with the trunk pipelines and LNG terminals is necessary to avoid stranded assets and maximise throughput. The IEA estimates **USD 96 billion in infrastructure investment by 2050** under low-price scenarios, which shows the need for robust project governance and financing frameworks.[37]

37 https://iea.blob.core.windows.net/assets/4719e321-6d3d-41a2-bd6b-461ad2f850a8/NetZeroby2050-ARoadmapfortheGlobalEnergySector.pdf

04

Implications of decarbonisation and energy transition on the gas sector

The global push for decarbonisation and energy transition is becoming more important, changing the gas sector significantly. As countries focus on meeting ambitious climate goals, the energy industry is making major changes to cut carbon emissions and encourage sustainable practices. The gas sector is vital in this shift, with stakeholders looking for new strategies to meet global climate goals. However, the industry also faces several challenges. Environmental and regulatory pressures are increasing as governments and consumers seek lower emissions and cleaner energy options. Methane emissions from natural gas operations are a major concern, requiring better monitoring and reduction methods. Additionally, the industry deals with market volatility caused by geopolitical tensions and economic downturns, as seen during the COVID-19 pandemic. Geopolitical risks and infrastructure issues add more complexity – often needing large investments to update and protect gas pipelines, LNG terminals and storage facilities against climate threats. To navigate this challenging environment, the gas industry must keep innovating, plan strategically for future changes, and promote collaboration among stakeholders to achieve sustainable growth and resilience. As a result, traditional gas operations are being reassessed to adopt greener practices and technologies that would help in creating a lower carbon future.

The role of natural gas as a bridge fuel towards energy transition

Natural gas is often seen as a 'bridge fuel' in the global energy transition – i.e. it offers a cleaner alternative for coal and oil, while renewable energy sources continue to develop. When burned, natural gas emits roughly 50% less carbon dioxide than coal and 30% less than oil for the same energy output.[38] This lower emission profile makes it a viable choice for countries looking to lower their carbon footprint without sacrificing energy reliability. Its adaptable properties make it ideal for balancing intermittent renewable sources like solar and wind, ensuring grid stability during supply fluctuations.

Beyond its cleaner combustion, natural gas benefits from existing infrastructure and technological improvements that boost its efficiency. Combined cycle power plants, which reuse waste heat to generate extra electricity, can achieve thermal efficiencies over 60%. Innovations like carbon capture and storage (CCS) and the creation of blue hydrogen from natural gas are further reducing its environmental impact. These technologies allow natural gas to assist in decarbonisation efforts in hard-to-decarbonise sectors like heavy industry and transport, ensuring it remains relevant in a low-carbon future. Currently, India gets about 6.3% of its energy from natural gas and aims to increase this share to 15% by 2030.[39] This vision is backed by policies like expanding CGD networks, promoting biogas blending and developing LNG infrastructure.

Some challenges such as methane emissions during production and transportation can undermine its environmental advantages, highlighting the need for effective monitoring and reduction technologies. Moreover, long-term dependence on natural gas might delay progress in renewable energy infrastructure, emphasising the need for careful planning to manage its role effectively. By investing in cleaner operational methods and renewable technologies, the gas industry can support global sustainability goals while remaining a key player in the energy transition.

Operational decarbonisation – Key levers to reduce emission footprint in current gas operations

While natural gas emits less CO_2 than coal or oil, it still produces substantial greenhouse gases throughout its entire value chain – i.e. upstream production, gas processing, pipelines and storage, LNG and city distribution. These emissions result from fuel combustion, flaring, venting and methane leaks. To reduce these emissions, the gas sector can take two main paths: switch to lower-carbon fuels or decarbonise its existing operations. Fuel switching often requires significant capital and long lead times, while many operational decarbonisation measures can be implemented more quickly and at lower costs using existing technologies.

38 World Energy Outlook Special report by IEA

39 https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1844630

Operational decarbonisation involves implementing targeted strategies to reduce emissions from different operations across the value chain. Key levers in this effort include reducing methane leaks and modernising and upgrading infrastructure.

Key levers to reduce the emission footprint:

1. Methane emissions reduction

- **Leak detection and repair (LDAR):** Deploying optical gas imaging cameras, aerial surveys (aircraft-based gas mapping LiDAR), satellites and continuous sensors to detect leaks quickly and prioritise super-emitters for rapid repair
- **Eliminating routine flaring and venting**: Installing vapor recovery units (VRUs) on tanks, connecting associated gas to gathering systems and, when flaring is unavoidable, keeping flares lit and tuned and replacing open flares with enclosed or low-emission units to maximise destruction efficiency and reduce unburned methane
- **Methane capturing and utilisation:** Capturing methane for reinjection into pipelines during maintenance operations or converting it into LNG or hydrogen to turn waste into value

2. Modernisation and infrastructural upgrades

- **Replacing leak-prone assets:** Accelerating replacement of cast iron and bare steel distribution mains and services; installing modern coated steel or polyethylene (PE) pipe and replacing high-bleed equipment with no or low-bleed equipment. Using inline inspection (smart pigs), advanced coatings and composite repairs; improving cathodic protection to prevent corrosion and leaks
- **Upgrading LNG and processing plants:** Adding boil-off gas reliquefication, electric drives, high-efficiency turbines, and cold-energy recovery; optimising dehydration and sulphur removal
- **Automating and digitalising:** Integrating smart systems for predictive maintenance and emissions tracking to prevent failures and optimise performance. Installing continuous methane sensors, automated flare monitoring and robust telemetry to enable measurement-based monitoring, reporting, verification (MRV)

Diversification and business model transformation – potential of biogas and LNG in transport, green hydrogen and environmental, social and governance (ESG)/sustainability drivers

Diversification and business model transformation in the gas sector mean broadening beyond conventional natural gas sales and reshaping how value is created. Diversification adds low-carbon gases and new energy services to the portfolio, while business model transformation shifts from purely selling gases to offering integrated solutions: renewable energy, infrastructure-as-a-service and certified low-carbon products. This change is driven by climate policies, investor expectations, customer demand for cleaner energy and the need to manage long-term transition risk. Companies that diversify early can protect revenue, lower financing risks and build new capabilities that remain relevant in a net-zero energy system.

- Biogas/biomethane: Biogas is produced from organic waste (landfills, agricultural residues, manure, wastewater). Upgrading biogas removes CO_2 and impurities to produce biomethane with pipeline-quality specifications. Biomethane can be injected into existing gas grids or used as a transport fuel, delivering immediate lifecycle emissions cuts by avoiding methane emissions from waste. It uses existing infrastructure and helps decarbonise heating, industry and heavy vehicles. Success depends on securing reliable feedstocks, building or partnering for digesters and upgrading plants, and locking in long-term offtake with utilities, fleets or industrial users. Certification and tracking of environmental attributes help monetise the premium, while quality control (for H2S, moisture, siloxanes) and sustainability standards are key to scaling. The GoI has introduced the **CBG Blending Obligation (CBO).** CBO will be voluntary till FY 2024–25 and the blending obligation would become mandatory from FY 2025–26. CBO shall be kept as 1%, 3% and 4% of the total CNG/PNG consumption for FY 2025–26, 2026–27 and 2027–28 respectively. From 2028–29 onwards, CBO will be 5%.[30]
- LNG in transport: It focuses on fuelling deep-sea ships and heavy-duty trucks, supported by bunkering terminals and refuelling stations. LNG reduces local air pollutants (SOx, NOx, particulates) and can lower greenhouse gases compared to oil-based fuels. It offers immediate compliance benefits under tightening marine and road emissions rules. Near-term opportunities include deploying engines that reduce slip (e.g. high-pressure direct injection) and managing boil-off gas efficiently. Over time, operators can blend or switch to bio-LNG or e-LNG to deepen decarbonisation.
- Green hydrogen: Produced by electrolysis using renewable electricity, green hydrogen and has near-zero operational emissions. It can replace fossil-based hydrogen in refining and ammonia, enable low-carbon steel via direct-reduced iron, support power peaking and long-duration storage, and fuel heavy transport. The PNGRB has granted initial approval for 5% v/v blending of green hydrogen into the PNG supply. This blending ratio is planned to be gradually increased in phases, ultimately reaching 20%. Integrating green hydrogen with natural gas helps significantly lower carbon emissions while preserving the overall energy content of the gas mixture.[41] Gas companies can develop hydrogen hubs near

40 https://www.pib.gov.in/PressReleasePage.aspx?PRID=1979705#:~:text=CBO%20will%20be%20voluntary%20till,promoting%20biofuels

41 https://pngrb.gov.in/pdf/CaseStudies/20250619_CSR_Report.pdf

strong renewables and aim for long-term agreement with offtakers, repurpose or build pipelines and storage, and use ammonia or synthetic methane as carriers for export. Costs are falling with scale, cheap renewables and incentives, but projects still require bankable offtake, reliable certification of origin and careful integration with the power system.

- ESG and sustainability drivers: These drivers shape access to customers and capital. Lenders, insurers and large buyers increasingly require measurable cuts in methane intensity, zero routine flaring and credible Scope 1–3 targets. Companies are responding by adopting measurement-based monitoring, reporting and verification, certifying gas as responsibly sourced or low-methane, and linking executive pay to emissions and safety performance. Strong community engagement, supply chain standards, and transparent disclosures help lower financing costs, win contracts, and build trust while accelerating the sector's transition.

Impact of electrification: EV, BESS

The energy transition and emergence of electrification, driven by electric vehicles (EVs) and battery energy storage systems (BESS), is creating a new competitive dynamic within India's energy landscape. Rather than a threat, it highlights the unique value proposition of gas as a practical, scalable and indispensable partner – one that co-exists with electrification options in the country's transition.

Sector/ application	Natural gas	Electrification/BESS	Strategic outlook
Urban and light commercial transport	**CNG:** Delivers an immediate, affordable and scalable solution to urban air pollution. Leverages a vast and rapidly expanding refuelling network, offering a proven TCO advantage that makes clean mobility accessible to the masses today.	**EVs:** Faces significant hurdles of high upfront vehicle cost for consumers, range anxiety, long refuelling times, and need for massive, costly upgrades to the electricity grid to support widespread charging.	**CNG will remain the workhorse clean fuel for India's urban mobility** transition well into the 2030s, co-existing with EVs. Reliability and affordability of CNG ensures its role as the primary alternative to liquid fuels for the foreseeable future.
Long-haul trucking	**LNG:** Offers the power, range and quick refuelling necessary for heavy-duty logistics, providing a clear TCO advantage over diesel without compromising on performance. It is the only market-ready technology to decarbonise this critical economic backbone.	**Electric/hydrogen trucks:** Constrained by prohibitive battery weight (reducing cargo capacity), non-existent hydrogen refuelling corridors and unproven economics. These are experimental technologies still in the R&D phase in the Indian context.	**LNG is set to become the dominant clean fuel for long-haul transport through 2040.** It creates the critical 'green corridors' that future technologies like hydrogen may one day utilise, cementing gas infrastructure as a long-term national asset.
Power grid balancing and peaking power	**Gas-fired power plants:** Offer flexible, dispatchable power to complement intermittent renewables; quicker ramp-up/ down than coal plants	**BESS:** Technically superior for grid balancing; zero emissions when charged by renewables; plummeting costs and strong policy support (i.e. policy linked incentives [PLI]).	**Gas power is not a competitor but an enabler of renewables:** Provides firm, dispatchable capacity that guarantees the reliability of a renewable-heavy grid. This role will become more critical as India's renewable capacity grows.
Domestic cooking	**PNG:** PNG offers convenient, safe and reliable solution for the domestic cooking with continuous piped supply. It replaces traditional cylinders providing a significant lifestyle upgrade.	**Induction cooktops:** Inductions are still considered secondary cooking devices in most Indian households. Acceptance of induction cooktops as primary stove is highly unlikely in the near future because of its dependency on reliable power supply, which is still a challenge in many areas.	**PNG seems to have a clear advantage over induction cooktops** because of its convenience and reliability. PNG is projected to have a strong growth trajectory and will become the stable demand anchor for the domestic sector.

05 Way forward

India's aim to improve the share of natural gas to 15% of the energy mix needs a major acceleration in the infrastructure development, creation of demand and market reforms. This transition will be driven by strategic policy, targeted investments and innovation in the private sector. A collective roadmap for the key stakeholders is necessary in order to navigate the roadblocks and capitalise on the opportunities ahead.

For the Government and regulators

Make a unified and market-driven policy framework by incorporating natural gas into the GST regime and phasing out the APM to ensure a level playing field.

Perform strategic interventions to power demand by providing policy support for LNG in heavy duty vehicles, directing the use of gas-based power for balancing the grid and peaking power needs and building a supportive ecosystem for CBG growth.

Improve energy security and transparency by developing a strategic gas reserve, legally decoupling the infrastructure and marketing arms, and mandating a clear digital platform for booking of pipeline and terminal capacity.

For gas sector companies

Adopt digital transformation and project management excellency by embracing technologies such as GIS mapping, IoT monitoring and digital twins to improve operational safety and efficiency.

Diversify business models to be in line with the energy transition and be equipped for the future integration of green hydrogen.

Prioritise operational decarbonisation and ESG performance by renovating the infrastructure to lower methane emission, hence improving access to capital and strengthening social license to operate.

For financial institutions and investors

Financial institutions must identify and invest in promising large-scale infrastructure projects, including cross-country pipelines, LNG infrastructure and CGD networks, to build out the national gas grid.

They would need to prioritise investments in projects with strong ESG credentials and technology upgrades that support decarbonisation, as these are critical for long-term risk mitigation and sustainable returns.

Further, we recommend that these institutions develop innovative financial instruments and risk mitigation strategies to manage challenges associated with price volatility, geopolitical risks and the capital-intensive nature of the gas sector.

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