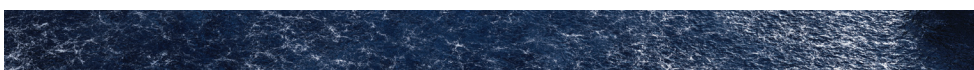
Volume 2

India Forward

Transformative Perspectives

S&P Global



India is demonstrating strong resilience as it confronts unpredictable global market movement and geopolitical risk. As a leader on the global stage, it is a country worthy of everyone's attention.

That is why last year we launched the S&P Global India Research Chapter, an initiative that brings together experts from across S&P Global and Crisil.

The Chapter has gone on to publish insightful research about the opportunities, risks and potential that will shape India's journey toward becoming the world's third-largest economy by 2030.

This year, the India Research Chapter is releasing, 'India Forward: Transformative Perspectives'.

The journal compiles our best and latest thinking on strategic issues impacting businesses, investors, policy makers, and markets. Our research is designed to help stakeholders make informed decisions that have the potential to unlock tremendous value.

As we continue to discover new perspectives about the country and market, we are committed to sharing them with you.

Thank you to the teams responsible for this research. And thank you for your interest in these issues.

Regards,

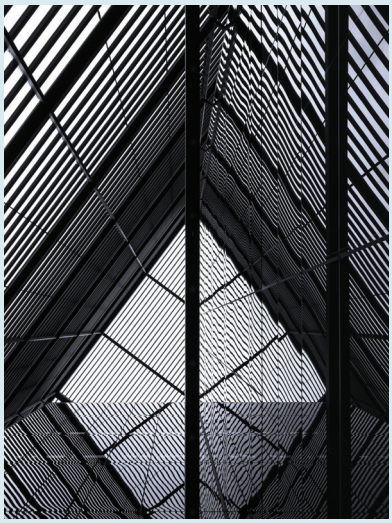
Martina

Martina L. Cheung

President & CEO, S&P Global

India Forward

Transformative Perspectives



India is poised to maximize opportunities as the global trade and cooperation environment evolves. It has grown visibly in size, scale and international impact over the past three decades and is on track to become the world's third-largest economy by fiscal 2030-31.

India's core sectors have grown in sync with the dynamism of demography and an evolving structural context of the economy. These core sectors intersect the promise of new growth in manufacturing and continued gains from agriculture and services. As the economy grows, the call on core sectors to deliver for an aspirational population will increase.

Beyond the near-term, changes in global trade policy would catalyze supply-chain diversification, to the benefit of India. An analysis of S&P Global Market Intelligence's Strategic Opportunity Index (SOI®) over time indicates that India has made notable progress in enhancing its competitiveness and making its manufacturing sector more attractive to global investors.

Energy will be a key thread that will enable the performance and viability of all sectors in India. Cross-cutting themes will span security and reliability, in the larger framework of a more market-oriented and globally integrated economy.

Analysis by S&P Global Commodity Insights elucidates that India's burgeoning biofuel industry is at the forefront of efforts to transform Indian energy sector, balancing growth needs with a shift to sustainable energy sources amid rising environmental concerns. S&P Global Mobility notes that the transport sector, which is a significant source of emissions and a mainstay of increasing urbanization, is a key area where biofuels can have an immediate impact.

At S&P Global and Crisil, we assess the intersection of sectors that will form the backbone of future growth and quality of life in India. As India tactfully navigates geopolitical reordering, a mix of domestic interventions and global partnerships will enable India to meet key objectives for itself and for the world.

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India's manufacturing opportunity amid global trade uncertainty

Beyond near-term challenges, rising trade protectionism may catalyze supply-chain diversification, benefiting India

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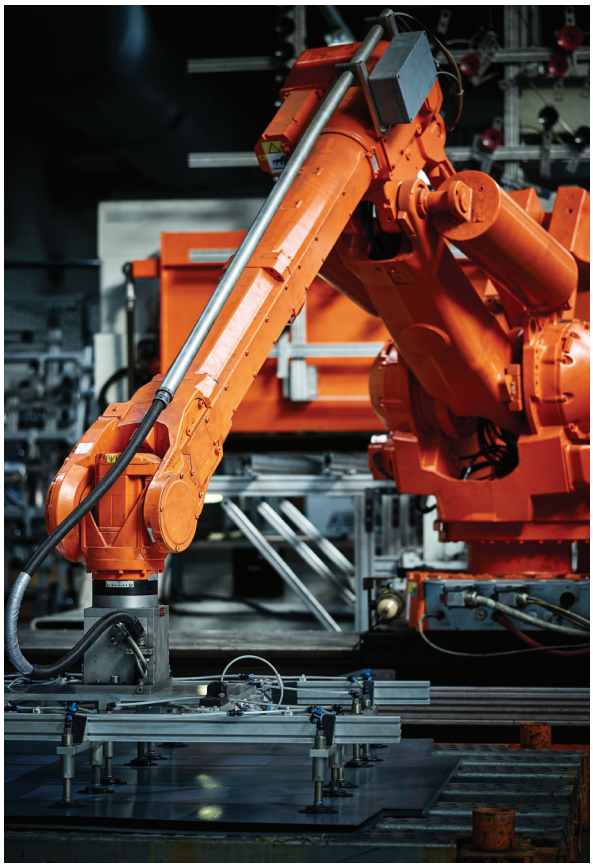


Highlights

India remains the world's fastest-growing large economy despite a slowdown in real GDP growth in fiscal 2024-25. It has moderate dependence on external trade for growth, which cushions it somewhat from ongoing shifts in global trade and tariff policies, though it is not immune to the rising trade protectionism.

While manufacturing value added accounts for a modest 17.2% of the country's real gross domestic product (GDP), the government has implemented targeted policy interventions to build domestic manufacturing capacity and strengthen India's role in global supply chains.

High-frequency HSBC Purchasing Managers' Index® (PMI) data — compiled by S&P Global Market Intelligence — highlights the domestic manufacturing sector's resilience to recent global headwinds compared with other major economies.

An analysis of S&P Global Market Intelligence's Strategic Opportunity Index® (SOI) over time indicates that India has made notable progress in enhancing its competitiveness and making its manufacturing sector more attractive to investors.

Beyond the near-term impact, therefore, India can benefit from the increasing trade protectionism, which may catalyze supply-chain diversification.

Rewiring of global trade is a silver lining for India's manufacturing sector

India is not immune to the ongoing shift in global trade and tariff policies towards protectionism despite a moderate dependence on external trade for growth.

The country faces higher tariffs on exports to the United States (US), its largest export partner. The broader spillovers of heightened global trade and financial uncertainty may be more damaging to its growth in the near term. Private corporate investment may be particularly vulnerable to prolonged policy uncertainty.

Beyond the initial negative impact, however, S&P Global Market Intelligence notes that increasing trade protectionism may catalyze supply-chain diversification, benefiting India. The threat of higher US tariffs on several Asian economies, including mainland China, Vietnam, Taiwan, Thailand and Bangladesh, could be leveraged to India's advantage to accelerate its manufacturing growth and increase its share in global exports.

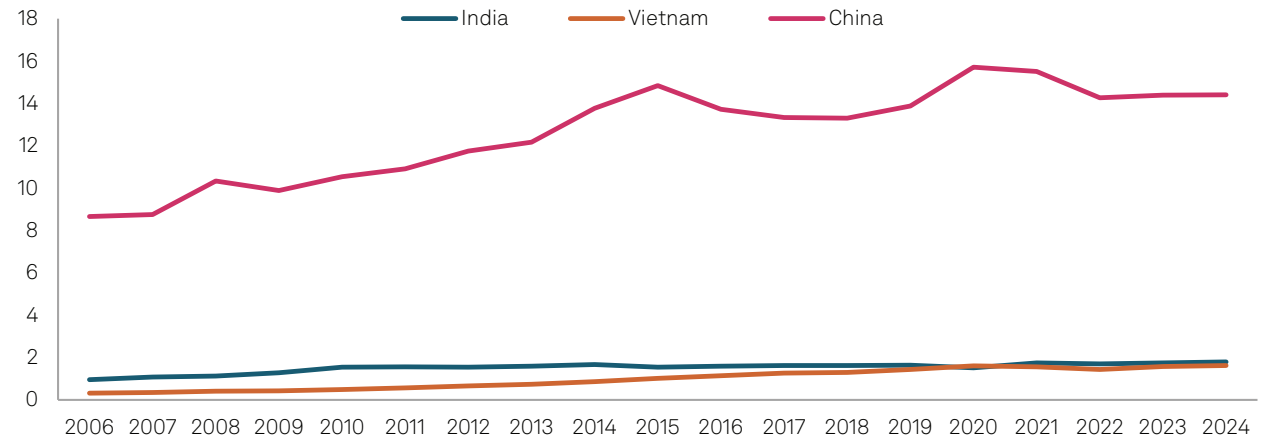
Manufacturing value added accounts for a modest 17.2% of India's real GDP (latest government estimate for fiscal 2024-25), against the government target of 25%.

India's share in global manufacturing exports has remained largely flat over the past decade, reaching only 1.8% in 2024. In contrast, its share in global service exports increased from 2.9% in 2014 to 4.3% in 2024.

Further, the country's share in global foreign direct investment (FDI) inflows has declined after a post-pandemic spike, from a high of 6.5% for FY2020-21 down to 2.1% in FY2023-24.

India's share of global manufacturing exports remains low, even as its goods exports more than doubled between 2009 and 2023 in US$ terms

% of total world merchandise exports



As of April, 2025.
Source: World Trade Organization.
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That said, the government has implemented targeted policy interventions to build domestic manufacturing capacity and strengthen India's role in global supply chains. In particular, the Production Linked Incentive schemes introduced since March 2020 have contributed to growth and boosted exports in several manufacturing segments, including electronics, pharmaceuticals and automobiles. Notably, mobile phone exports, valued at zero in 2016, soared to $20.4 billion in 2024, growing 44% from 2023 alone, after Apple shifted part of its mobile phone manufacturing from China to India.

The private sector also remains optimistic about growth opportunities in India's manufacturing sector. High-frequency HSBC PMI data — compiled by S&P Global Market Intelligence — highlights the domestic manufacturing sector's resilience to recent global headwinds compared with other major economies. The country's headline manufacturing PMI readings over the past 12 months substantially exceeded global averages, supported by buoyant demand, increased hiring and inventory buildup.

Global Manufacturing PMI Output Index

	India	US	Eurozone	UK	China	Japan
Apr-24	63.0	51.1	47.3	49.4	53.1	47.8
May-24	61.1	53.0	49.3	53.4	54.3	49.9
Jun-24	61.9	52.1	46.1	53.3	54.6	50.4
Jul-24	61.7	50.5	45.6	54.9	50.2	49.7
Aug-24	60.3	48.2	45.8	54.4	50.7	51.3
Sep-24	59.8	47.9	44.9	53.6	50.2	49.7
Oct-24	60.4	49.2	45.8	50.3	51.8	49.4
Nov-24	59.1	47.9	45.1	48.3	53.2	49.2
Dec-24	59.0	47.7	44.3	45.9	50.5	49.4
Jan-25	60.1	51.8	47.1	49.2	51.2	47.3
Feb-25	58.1	54.5	48.9	47.3	51.6	48.4
Mar-25	61.7	48.6	50.5	45.3	51.8	46.6

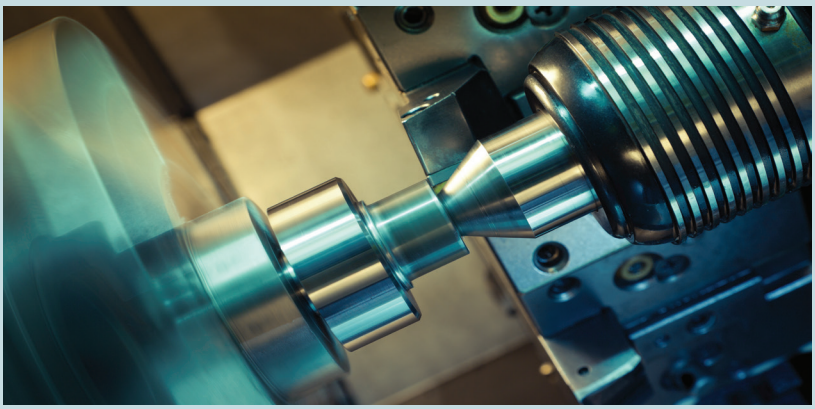
sa, >50 = growth since previous month
Sources: HSBC, Caixin, HCOB, au Jibun Bank, S&P Global Market Intelligence

Below 50.0 | Between 50.0 and 55.0 | Above 55.0

Market competitiveness insights from SOI

An analysis of S&P Global Market Intelligence's SOI® over time indicates that India has made notable progress in enhancing its competitiveness and making its manufacturing sector more attractive to investors.

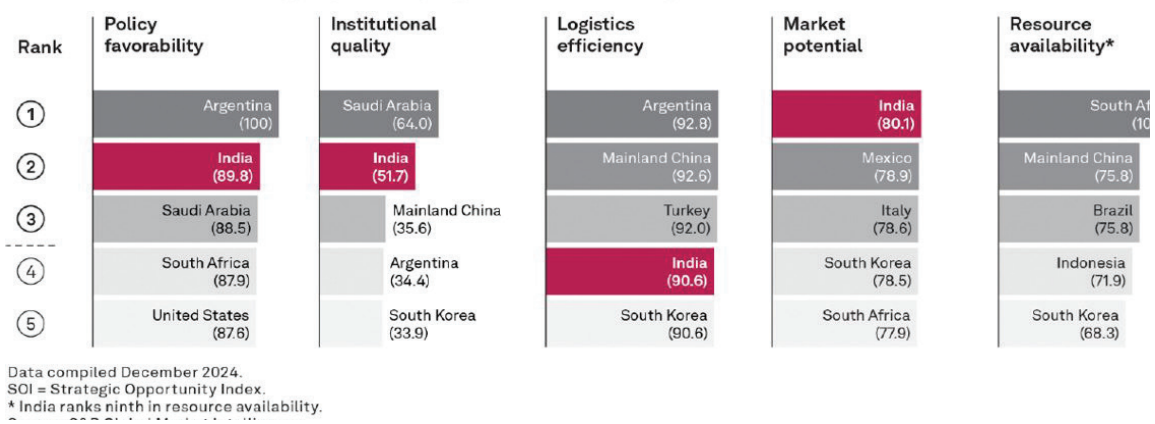
That said, India continues to lag in the resource availability momentum score (69.4 out of 100), which looks at the cost and availability of two key inputs: labor and finance. This is primarily due to the relatively low score of the labor component (50 out of 100), as the availability of labor with the required skills for value-added manufacturing remains a significant challenge that hinders India's competitiveness. The targeted skill development initiatives (e.g., for semiconductors and solar photovoltaic cell manufacturing) underway may take some time to translate into an improvement in the score.



Measuring India's strategic opportunity over time

The SOI measures a market's potential to generate opportunity for enterprise and looks at the broad drivers of competitiveness over time. When available data over the past 10 years is considered, compared with other markets in the G20, India's SOI momentum scores indicate notable improvement in policy favorability (89.9 out of 100), market potential (80.1 out of 100) and logistics efficiency (90.6 out of 100). These scores measure how much improvement markets have made towards setting policy direction that supports new enterprise, the market's openness and attractiveness to business activity, and the effectiveness and reliability of the logistics and supply-chain infrastructure, respectively. Nevertheless, there is significant opportunity for continued improvement in logistics efficiency, considering the country's SOI score in 2024 (49.3 out of 100). For additional analysis of India's logistics efficiency, refer to 'Make In India' Manufacturing Push Hinges on Logistics Investments, Volume 3, India Look Forward journal.

SOI momentum score: Mapping India's progress in market competitiveness

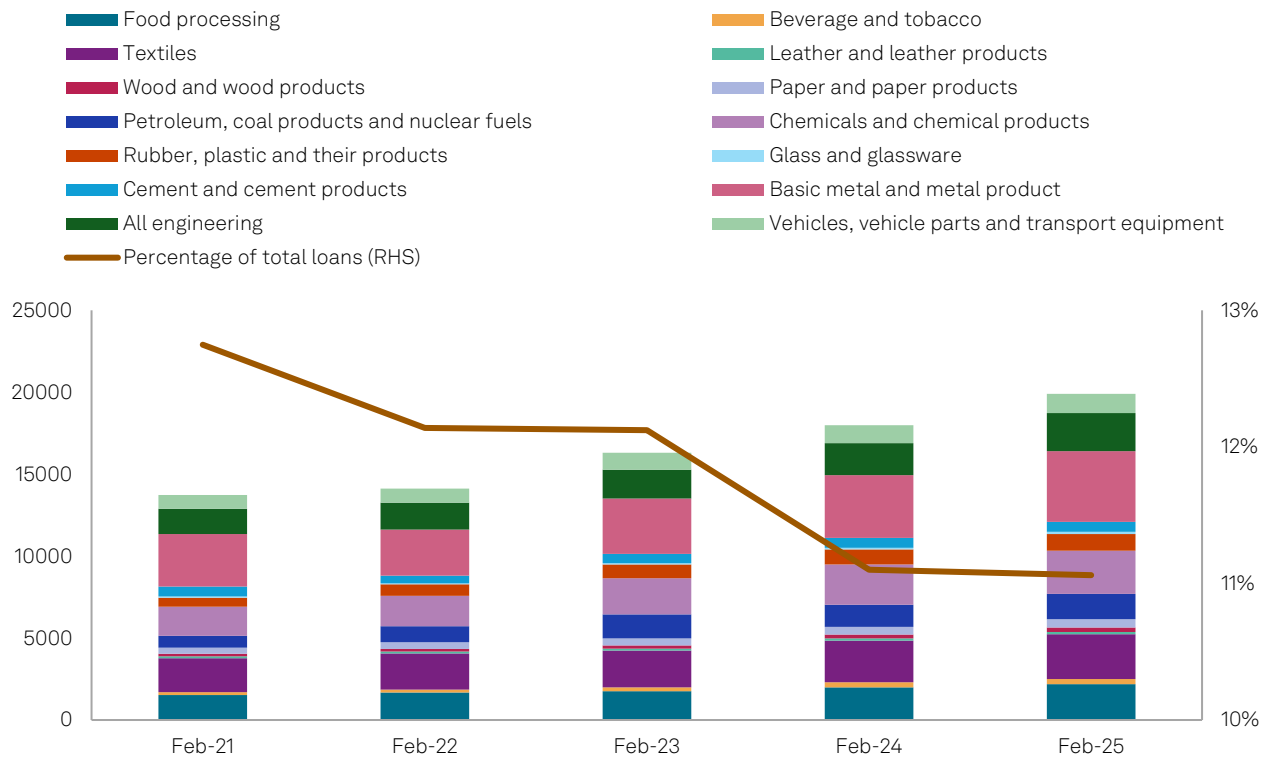


Data compiled December 2024.
SOI = Strategic Opportunity Index.
* India ranks ninth in resource availability.

In contrast, with a score of 89.6 out of 100, finance emerges as an area of strength for India's competitiveness. The score reflects the improved financial position of lenders over the past seven years, following regulatory measures to improve banks' asset quality and the recapitalization of public sector banks. However, much of the financing resources have gone to household lending and the services sector (their share of total loans rose 5 and 3 percentage points, respectively, between 2021 and 2025), with manufacturing's share of total loans falling from 12.7% to 11.1% over the same period.

There are tentative signs of faster manufacturing lending growth in early 2025, at roughly the same pace as total loans. Although the uncertainty stemming from US trade policies will likely reduce the appetite for loans, growth in the manufacturing sector is expected to be supported by high finance resource availability following the inclusion of Indian government bonds in global indices in 2024.

Lending to manufacturing sector, billion rupees



As of April 14, 2025
Source: S&P Global Market Intelligence.

Opportunities in the wider context — benchmarking

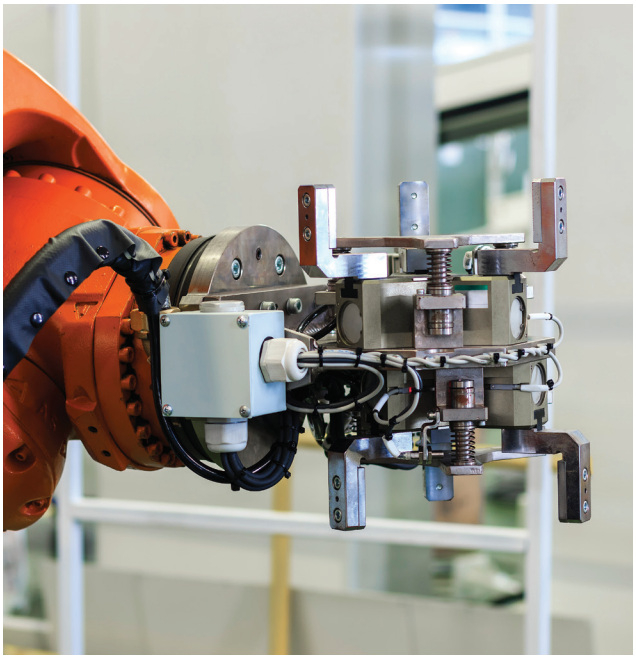
India's 2024 SOI scorecard

Pillar	Score	Sub-pillar	Score	Component	Score
Policy favorability	69.0	Policy environment	77.5	Policies	77.5
		Regulatory governance	65.0	Regulations	65.0
		Tax environment	61.6	Taxes	61.6
Institutional quality	64.3	Institutional strength	53.5	Quality	68.3
				Capacity	8.9
		Judicial independence	60.9	Fairness	60.9
		Financial stability	78.6	Banking	81.7
				Sovereign	75.5
Logistics efficiency	49.3	Supply-chain disruption	70.3	Friction	70.3
		Resilience	28.2	Resilience	28.2
Market potential	63.5	Attractiveness	54.5	Economy	72.1
				Demographics	50.2
				Market size	41.1
		Openness	66.2	Trade	66.2
		Innovation	31.6	Talent	31.6
Resource availability	69.8	Finance	89.6	Cost	86.5
				Availability	92.8
		Labor	50.0	Cost	51.5
				Availability	48.3

Resource availability remains a challenge, where the momentum score suggests India has the most room for improvement to drive competitiveness in manufacturing.

While the labor score represents an area for improvement, there is reason to be optimistic. Over the past year, India's manufacturing PMI data indicated positive employment trends. The PMI consistently registered above the neutral mark of 50, reflecting ongoing job creation as manufacturers increased hiring to meet rising production demand. Robust order books and optimism about future demand underpinned workforce expansion, although rising input costs occasionally tempered recruitment enthusiasm. Rates of job creation have generally been moderate compared with output and sales growth, as firms have often relied on existing capacity or productivity gains.

The range of tools available to the authorities will also strengthen financial availability and provide an opportunity to boost domestic manufacturing capabilities. One prominent feature of the Indian banking



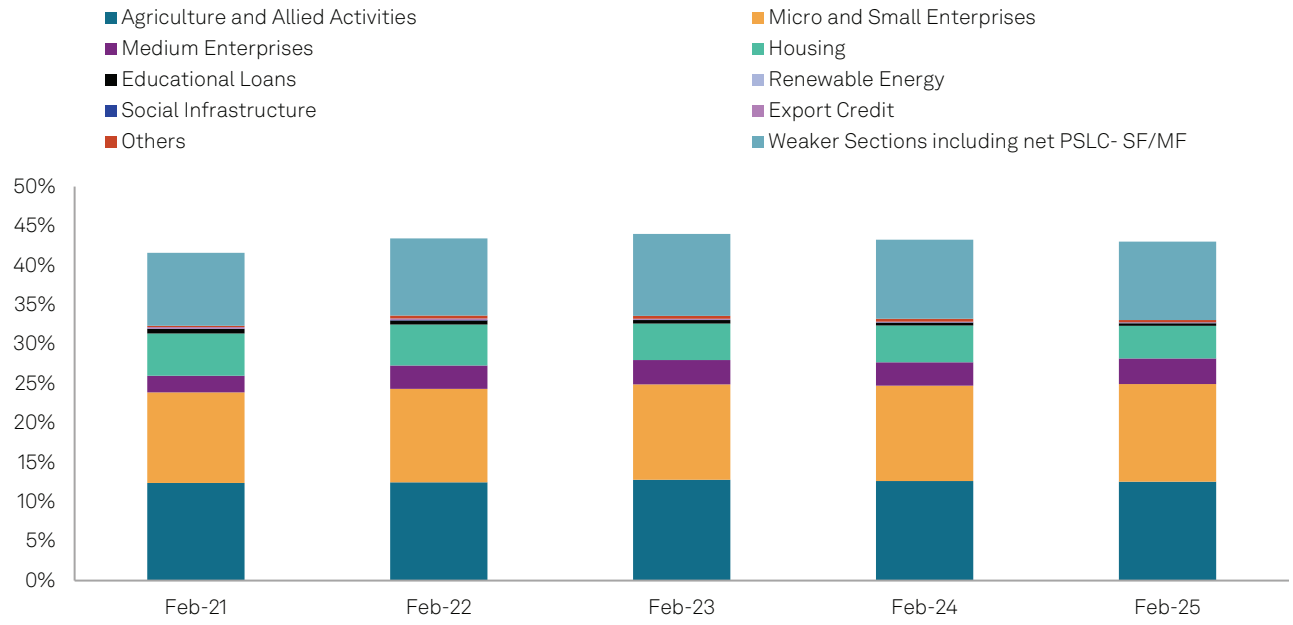
sector is the use of priority sector lending (PSL). In the past, the Reserve Bank of India (RBI) had shown flexibility and adjusted PSL in accordance with the contemporary economic climate and gap in the industry.

After expanding the PSL criteria for renewable energy in April 2025, the RBI could consider delivering more liquidity to manufacturers in the defense and semiconductor space in the same manner.

Another way to attract more lending to these manufacturing segments is to change the risk-weight of loans, which the RBI has been actively doing to reduce risks. The central bank can include key development industries in the "specified categories" and provide a lower risk-weight to reduce capital needs.

Both measures will require scrutiny and monitoring to ensure lending standards are maintained and credit risks do not rise significantly as a result.

Priority sector lending, percent of total loans



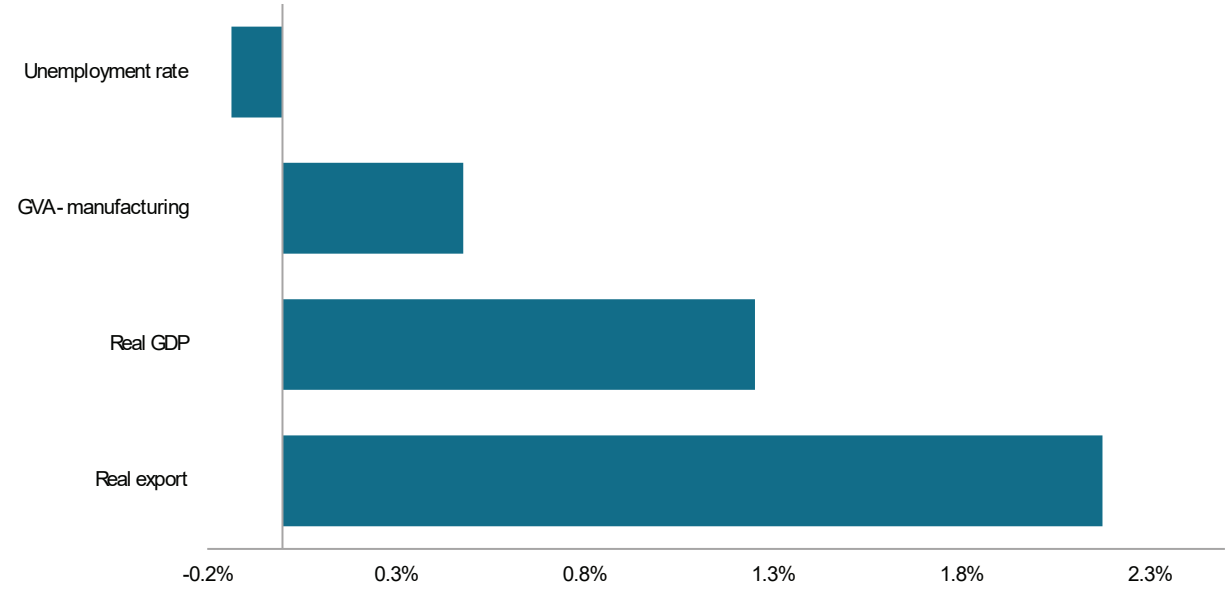
As of April 14, 2025.
Source: S&P Global Market Intelligence.

Looking forward: Fostering a competitive manufacturing environment

Although the Indian manufacturing sector faces notable challenges, the resilience demonstrated by key indicators, such as HSBC PMI data and SOI scores, suggests a positive momentum. As economies adapt to evolving trade dynamics and tariff challenges, India can capitalize on this momentum for accelerated manufacturing growth and greater global supply-chain integration. A strategic shift towards local sourcing, proximity to end-markets, and enhanced regional integration should attract additional investment to the sector, accelerating India's technological advancement and manufacturing competitiveness and creating additional high-quality manufacturing jobs.

A positive shift for India's macroeconomic landscape

Deviation from baseline, Q4 2035



As of April 2025.
Source: S&P Global Market Intelligence.

An S&P Global Market Intelligence Global Link Model scenario analysis shows that despite the initial negative impact of rising US import tariffs and global policy uncertainty, the effects of further manufacturing reshoring and trade regionalization strategies on India could be positive over time. They could add about 1.3 percentage points to India's real GDP by end of fiscal 2034-35, compared with our baseline forecast. S&P Global Market Intelligence projects the country's real GDP growth to average 5.7% over the next decade.

Companies are expected to relocate their operations to regions that offer competitive advantages, with India emerging as a key destination. Further, improvements in logistics efficiency, labor market deregulation and financial resource availability would create a favorable environment for manufacturing investment. This, in turn, would lead to increased economic efficiency, greater manufacturing output, higher manufacturing employment and stronger economic growth overall.

The PMI for India is a crucial tool to track economic performance during uncertain times, such as the tariff concerns emerging in early 2025. Providing a near-real-time snapshot of output, new orders, exports, employment and inflation, the PMI helps assess how India's manufacturing sector responds to global trade disruptions and domestic challenges. By capturing these dynamics, the PMI informs policy responses — such as trade adjustments or monetary measures — and signals to global investors India's ability to navigate tariff-driven uncertainty while maintaining growth.
The SOI is a tool to assess the state of a market and its potential to generate opportunity for enterprise. The SOI covers more than 90 markets from a macro perspective, measuring and benchmarking broadly across themes such as economics, banking, policy direction and supply chains. The SOI measures the fundamental drivers of opportunity across time and looks to where the momentum is likely to continue going forward.

Balancing India's biofuels equation

Bioethanol production and blending on course to meet target, but structured push needed to spur adoption of bio-CNG in the country

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Highlights

India's burgeoning biofuel[1] industry is at the forefront of the country's efforts to transform its energy sector, balancing growth needs with a shift to sustainable energy sources amid rising environmental concerns.

The transport sector, which is a significant source of emissions and a major consumer of imported fuels, is a key area where biofuels can have an immediate impact.

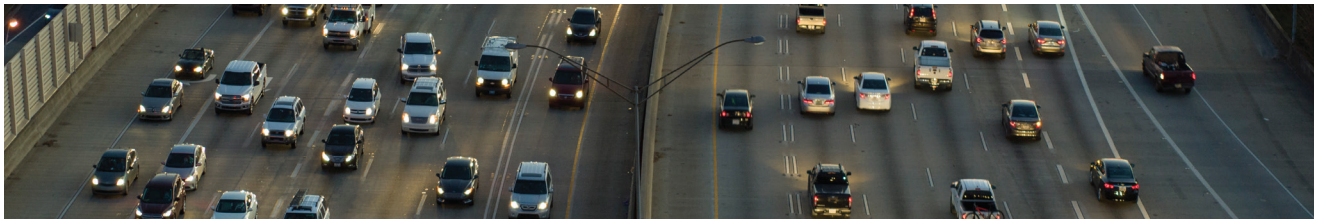
Here, rather than focus solely on battery electric vehicles and hybrids, India is prioritising a 'multi-fuel mix' strategy.

Original equipment manufacturers in India are actively exploring and developing biofuel technologies.

Bioethanol production has taken off and India is on track to achieve its 20% blending target.

Scaling up of bio-compressed natural gas production and distribution, and Its adoption in the transport sector, however, face multiple challenges and require a structured push.

[1] *Biofuel is a fuel produced from organic material such as crops (for bioethanol) or organic waste (for biogas).*



India's transport landscape

India's transport landscape is complex and distinctive, shaped by increasing energy demands and pressing environmental concerns amid rapid economic growth.

Recognising its unique circumstances, India is focusing on alternative energy sources to create a cleaner, self-reliant transport future. Adoption of biofuels is a part of this push.

Bioethanol and bio-compressed natural gas (bio-CNG)[2] have emerged as critical components of the strategy, which acknowledges the need to wean the country away from its reliance on fossil fuels, with oil imports accounting for about 88% of import demand and gas imports for close to 50%.

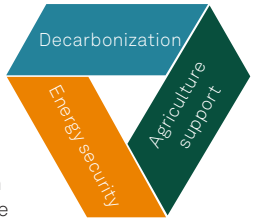
Biofuels offer a triple-win solution to the country's growing need for sustainable energy sources amid rising environmental concerns—by addressing energy security, reducing greenhouse gas (GHG) emissions and enhancing income opportunities for the agricultural sector.

By reducing dependence on crude oil and liquefied natural gas (LNG) imports, biofuels can also conserve valuable foreign exchange and enhance economic resilience and self-reliance.

India is charting its own course here: prioritising a 'multi-fuel mix' strategy rather than focusing solely on battery electric vehicles (BEVs) and hybrids.

India's Interlinked Biofuel Goals

Reduce carbon emissions
Biofuel using agriculture residues and waste creates a renewable energy source.



Energy security
Increase energy security Biofuel production will reduce reliance on imports for energy supplies.

Boost farm incomes
Higher demand for biofuel will positively impact the farming community in India.

While Indian original equipment manufacturers (OEMs) are investing in BEVs and hybrids to align with the global shift towards electric mobility, they remain mindful of the challenges and practical realities of the Indian market.

In the milieu, Indian car manufacturers are proactively diversifying their offerings (e.g., providing flex-fuel vehicles) to cater to the evolving market needs. With strong leadership, industry engagement, and collaborative efforts from OEMs and oil marketing companies (OMCs), the country is on track to achieve a 20% bioethanol blending target in fiscal 2025-26, according to S&P Global Mobility. This serves as a valuable lesson for scaling up bio-CNG adoption in the transport sector.

Flex-fuel vehicles are also a strategically important option, with the potential to reduce India's reliance on gasoline. This multifaceted approach is essential for decreasing import dependence and fostering a sustainable automotive ecosystem.

CNG, with the support of the government and over 50 city gas distribution (CGD) companies, has established a strong presence, achieving a penetration rate of about 18% in the passenger car segment. The ongoing expansion of CNG refuelling infrastructure provides consumers with a cost-effective alternative.

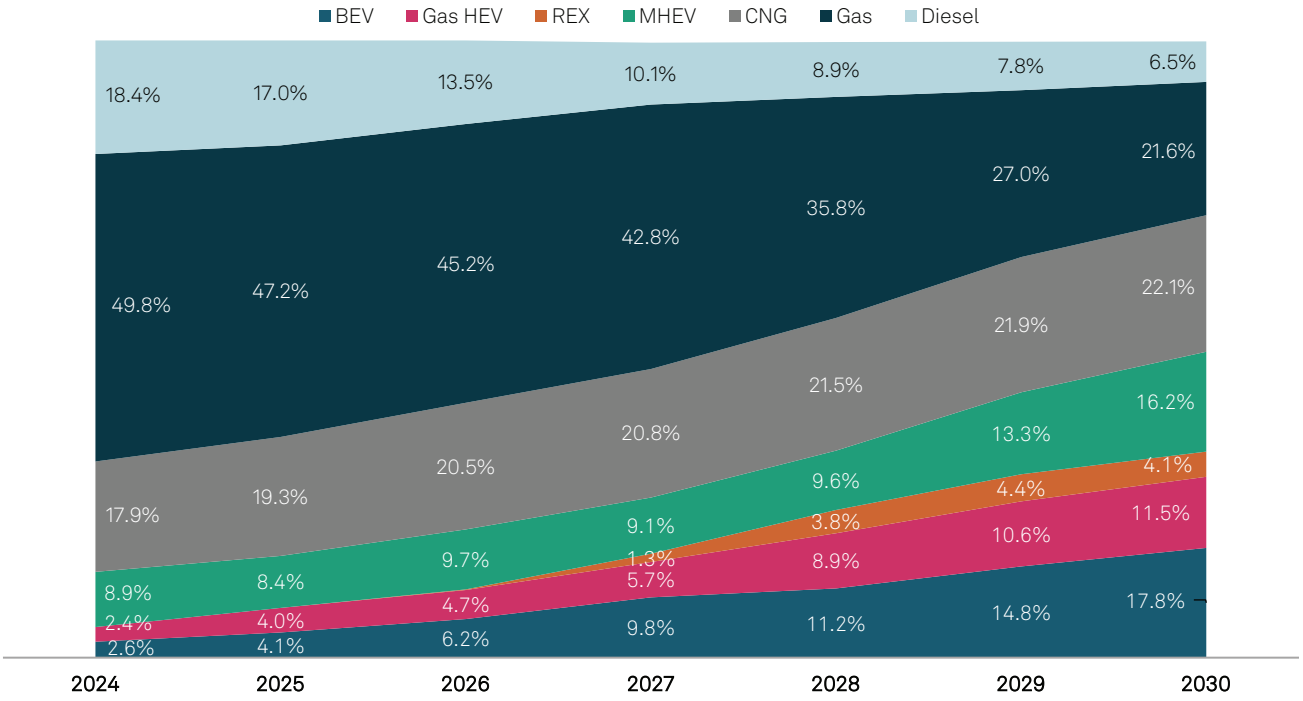
Alongside the rapid growth of the CNG vehicle parc, the government's emphasis on promoting bio-CNG has become increasingly important to offset the decline in domestic gas production and the rising share of imported LNG.

OEMs in India are actively exploring and developing biofuel technologies. Recent developments include:

- Research and development of engines compatible with higher ethanol blends
- Production of flex-fuel vehicles that can run on varying blends of gasoline and ethanol
- Collaboration with bio-CNG producers to ensure compatibility and optimise vehicle performance

[2]*Bio-CNG typically refers to compressed biogas (CBG) used either in pure form or blended with conventional CNG to offer a cleaner, renewable fuel alternative.*

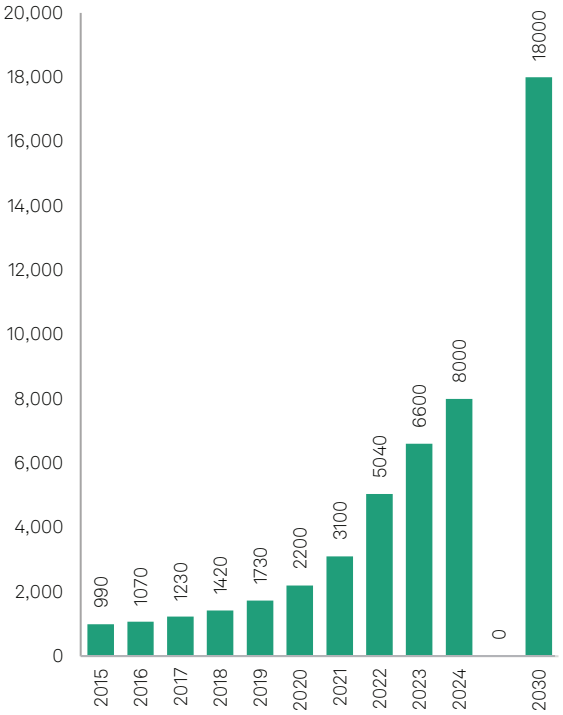
India PV: Multi-Fuel mix Powertrain Strategy



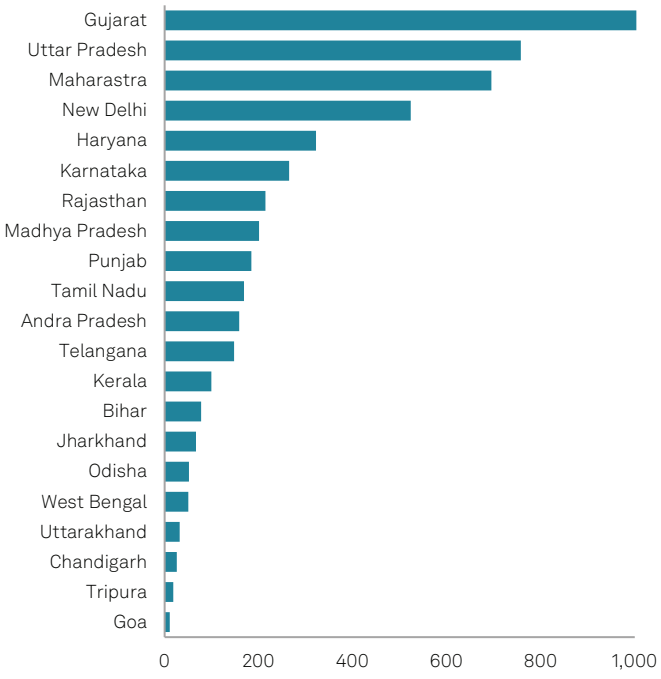
India: CNG Fuel emerging as perfect transition fuel for high mileage users

CNG stations reach increasing, More launches, More headroom for CNG cars (lower CO_2 emissions)

CNG Stations



CNG stations statewise 2024 and CNG penetration in %



Role of bio-CNG as a multi-sector fuel

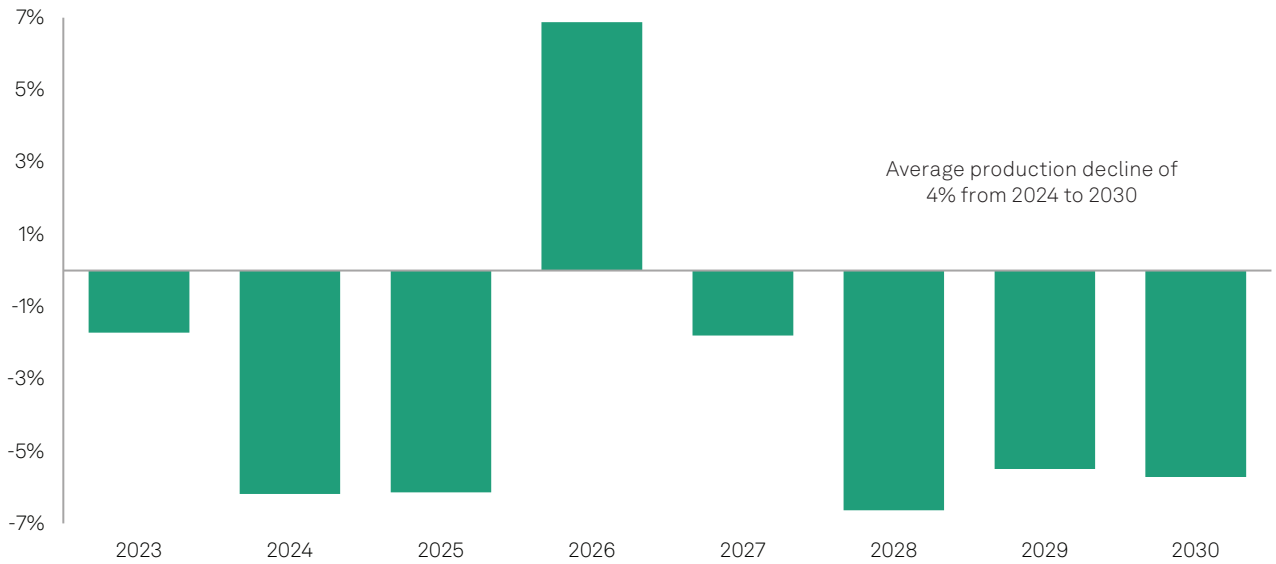
Tapping biogas potential – a domestic resource is essential to secure supply security and check the gas import bill

Gas demand across sectors such as city gas, power, industries and fertilisers is met by a diversified portfolio of gas, broadly classified into domestic gas and LNG.

Domestic gas in India is primarily sourced from two main categories: Administered Price Mechanism (APM) gas from legacy fields operated by public sector companies with regulated pricing, and newer onshore and deepwater gas with market-linked pricing.

APM gas is the cheapest option currently and is allocated on a priority basis to the CGD, fertiliser and power sectors. That said, APM gas allocation is expected to decline in the near-to-medium term due to persistent challenges with current gas sources, according to S&P Global Commodity Insights. Additionally, APM gas volumes are decreasing (see figure below), and prices are expected to rise with market liberalisation, making it costlier to fulfil demand from city gas and other gas consumers. Similarly, deepwater gas has limited availability, and the lack of significant new discoveries will eventually lead to a diminished market size. More importantly, this will compel CGD companies to optimise costs or enlarge their gas portfolio with alternative sources, such as compressed biogas (CBG) and LNG.

India: Year-over-year trends in APM gas production until 2030 (MMcf/d)



Data compiled Jan. 14, 2025.
In 2023, APM comprised of about 70% of total domestic gas production.
Source: S&P Global Commodity Insights.

While LNG remains crucial due to its scale and availability, CBG offers a unique advantage as a domestic resource that can reduce dependence on imports and be directly incorporated into existing natural gas infrastructure. Although CBG cannot currently match the scale of LNG, its potential lies in enhancing energy security and supporting sustainability goals.

For CGD companies, sourcing LNG is not a challenge owing to existing aggregators such as GAIL and Indian Oil Corporation Limited (IOCL). However, there are more barriers to CBG adoption, and scaling up its production is necessary to fully capitalise on its benefits. Notably, IOCL has estimated a CBG potential of approximately 62 million ton (89 billion cubic metres per year). Yet, with 94 operational CBG plants, the total supply amounts to only 36,274 ton[3], a fraction of this vast potential.

'Sweet spots' for biogas

The Indian government provides substantial support through Central Financial Assistance (CFA), which reduces capital expenditure on biogas plants. This includes a scheme to support and subsidise the construction of pipelines connecting bio-CNG plants with CGD networks. Besides, it has other schemes such as Market Development Assistance (MDA) to manage the offtake of fermented organic manure produced from these plants. The assistance, targeting both CGD and CBG sectors, enables better integration of CBG into urban infrastructure, facilitating market access and scalability for producers.

Furthermore, to increase CBG uptake in transport and industries, the government introduced the Sustainable Alternative Towards Affordable Transportation (SATAT) scheme, which pegs CBG prices to CNG retail prices. The government has also introduced a regulatory mandate for CGD companies to start blending CBG by fiscal 2025-26 (April 2025 onwards), starting with a requirement to have up to 1% of each CGD company's total transport (CNG)/ residential consumption fulfilled by CBG.

Still, scaling up bio-CNG production and distribution faces challenges

Sustainable supplies of feedstock: The Indian government recognised the potential of converting waste to wealth and launched the SATAT initiative in 2018, aiming to produce 15 million ton of CBG by fiscal 2023-24 by establishing 5,000 CBG plants. With over 50% of its land area being arable and having one of the largest livestock populations, India has the potential to supply the required feedstock for biofuel generation. However, sourcing, segregating and storing feedstock pose challenges for producers due to its seasonal availability and price uncertainty. The varying production costs, driven by feedstock sourcing challenges and pricing, hinder scalability of and investment in CBG plants.

CBG production struggles to achieve the SATAT target by 2024

Note: 100 CBG plants commissioned by fiscal 2024-25 YTD, and 0.03 million ton of CBG sold in fiscal year 2025
Source: SATAT website

[3]*Until January 2025 of the fiscal year. India's fiscal year runs from April to March.*

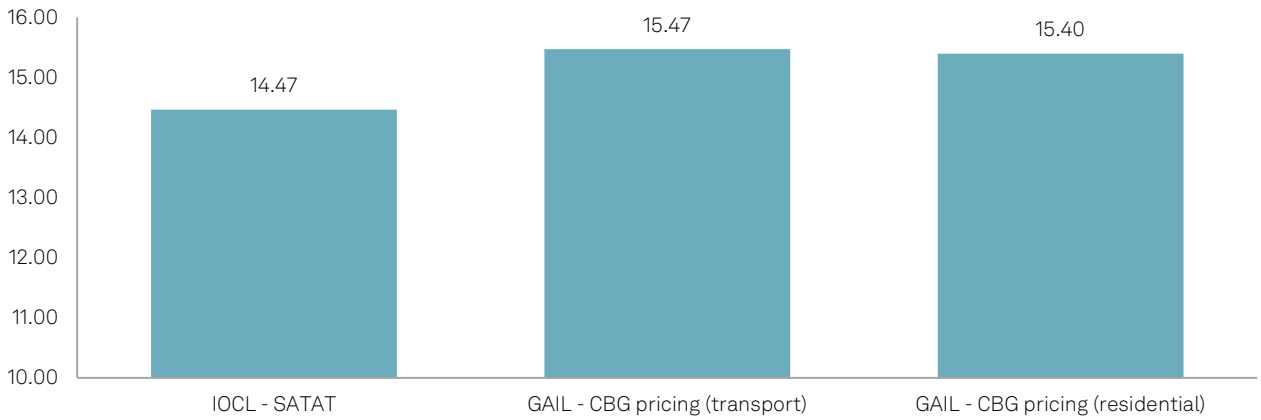
Pricing mechanisms: In India, domestically produced gas was historically benchmarked to international oil products. However, the government has intervened to regulate gas prices despite its eventual goal of moving towards liberalised markets. For example, APM gas is currently linked to 10% of the Indian crude basket[4], with a cap of $6.75/MMBtu for legacy fields, and deepwater gas prices are set twice in a fiscal year with a ceiling price cap. Under the SATAT scheme, CBG prices across the country are pegged to tranches of CNG retail prices. For example, if CNG retails at INR 75 per kg (approximately $17.5 per MMBtu), the corresponding CBG price is INR 62 per kg (approximately $14.5 per MMBtu) (see table below). However, CNG prices are set by individual city gas companies based on their supply mix, and prices vary widely across the country ($16-23 per MMBtu). As a result, the price mechanism only works for certain feedstocks in specific geographies. On average, feedstock accounts for 26% of the total cost, and in some cases, using more expensive feedstock is not viable due to the CNG indexation linkage.

Current CBG procurement prices across India under the SATAT scheme

	CNG retail prices (INR/kg)	Procurement prices for CBG (excluding GST) (INR/kg)	Procurement prices for CBG (including 5% GST) (INR/kg)
1	Up to 70	54	56.70
2	70.01-75	55.25	58.01
3	75.01-80	59.06	62.01
4	80.01-85	62.86	66.00
5	85.01-90	66.67	70.00
6	90.01-95	70.48	74.00
7	95.01-100	74.29	78.00

Expanding CBG marketing to sectors beyond city gas will drive further growth. However, a more robust and flexible pricing mechanism than the CNG linkage is required to accelerate CBG adoption. The existing linkage of biogas (compressed to create CBG or bio-CNG) prices to CNG retail prices results in regional variations, hindering market competitiveness and sector growth.

India: Current CBG price regimes, including 5% GST ($/MMBtu)



Data compiled January 14, 2025.
GST = Goods and Services Tax.
SATAT price is the rate at which CBG producers sell to IOCL for automotive and industrial fuel. GAIL-CBG pricing is the cost of supplying biogas or CBG blended with domestic gas at a uniform price for transport and residential use.
Source: S&P Global Commodity Insights.

[4]*Derived basket comprising sour grade (Oman and Dubai) and sweet grade (Dated Brent) crude oil.*

Investments and project progress: Biogas needs to attract more investment. Despite government support, the sector has made slow progress. As a result, the target of establishing numerous plants to tap biogas potential has not been met.

Boosting bio-CNG; measures required to accelerate growth

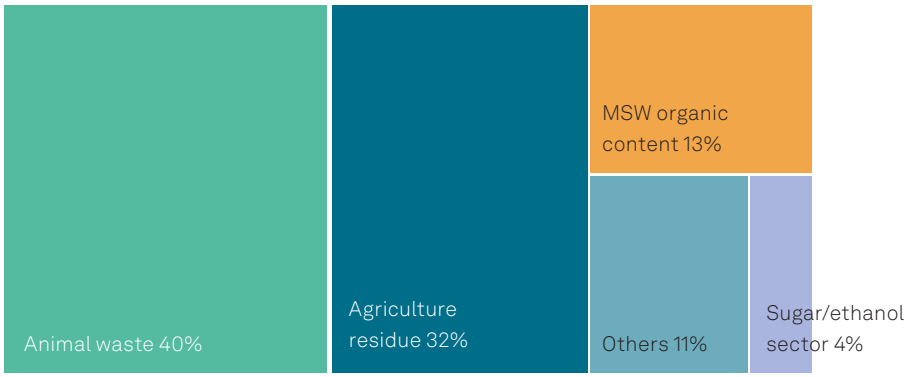
Enhancing efficiency of the feedstock supply chain

India, with its vast agricultural landscape and large population, generates substantial organic waste from various sources, making it an ideal candidate for bio-CNG development. Among other feedstocks for bio-CNG production, such as organic municipal waste and animal waste, agricultural residues, including paddy and wheat residues, are the major ones. Utilising agricultural residues also addresses the critical issue of wasteful burning of crop residues in fields. This could prevent up to 3 billion ton of carbon emissions, according to the United Nation's Food and Agriculture Organization, while improving air quality. Building infrastructure to enhance the use of agricultural residues for biofuels will create additional income opportunities for farmers.

Measures to support sustainable feedstock supplies:

- **Assuring availability:** Mapping and monitoring of agricultural residues as feedstock to ensure its long-term supplies. Long-term supply contracts can also help mitigate risks related to feedstock supply and cost
- **Regional integration:** Establishing a regional ecosystem for feedstock collection from the farm gate, storage, and bio-CNG production units, further connected to bio-CNG offtake networks, for reduced cost curves. The offtake of bio-manure is a critical component that needs to be assured to complete the value chain
- **Technology and process improvements:** Ensuring uninterrupted supplies for feedstock collection and processing equipment, along with efficient technical knowhow to sustain and improve bio-CNG production yields

Agricultural residues are the key bio-CNG feedstock
Potential Feedstock Availability for Bio-CNG



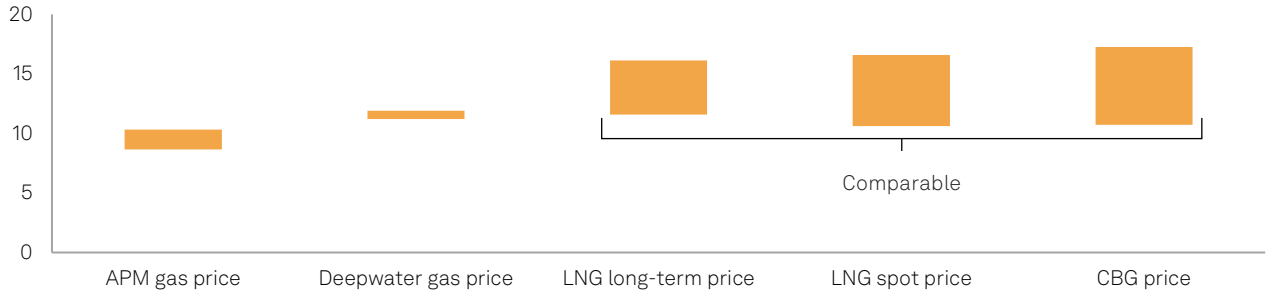
Source: Centre for Science and Environment report

Revising biogas pricing mechanisms

An S&P Global Commodity Insights' analysis (see figure below) of the price ranges for various gas supply options for city gas companies indicates that CBG prices ($10.7–$17.3/MMBtu) are closely aligned with import prices of LNG, particularly spot LNG ($10.6–$16.6/MMBtu), during the 2025-30 timeframe. This makes a compelling case to index CBG prices to LNG import prices, and the transition to this proposed pricing regime is expected to have minimal impact on the profit margins of city gas companies.

Additionally, volatility in LNG prices could be mitigated through the value of carbon credits, providing a steady incentive for CBG adoption. Currently, a national carbon offset mechanism is being developed. Several linkage options can be explored to make this transition feasible. For instance, the government could regulate CBG prices by setting premiums or discounts relative to LNG import prices. Once the market is sufficiently large, premiums or discounts can be determined by the market. One possible approach is to link CBG prices to India's average LNG landed price over the past three months. Alternatively, prices for the upcoming month could be set based on a weighted formula, such as 110% or 120% of the average LNG import price between the 26th of the previous month and the 25th of the current month—an approach similar to that currently used for APM gas.

India: Price ranges for various gases utilised by city gas companies at the gate – 2025 to 2030 ($/MMBtu)



Data compiled January 21, 2025.
The prices reflect the landed cost at the gate for city gas companies, inclusive of taxes, transmission and regasification charges.
As APM consists of a major share of CNG retail price (which is then used to determine the CBG price as per the SATAT scheme), we have assumed an escalation referenced to the APM price rise for the CBG price post 2025.
Source: S&P Global Commodity Insights.

Linking CBG prices to LNG import prices uniformly across the country can provide producers with the flexibility to reach all gas-demand sectors, ensuring economic viability, particularly as feedstock costs and regional variances come into play. This approach can help bridge the gap until a mature market develops.

Indexing CBG prices to LNG import prices can also offer greater stability and predictability. The government can regulate CBG prices by setting premiums or discounts relative to LNG import prices until market forces take over.

Incentivising investments

The CBG sector's progress has been slow despite government support. It needs to attract more investment. With an estimated production capacity of 88 Bcm per year, CBG has the potential to serve a large number of gas consumers. Our analysis suggests that CBG prices can compete with LNG import prices, particularly spot prices. Adopting a price indexation mechanism linked to LNG import prices for CBG could attract investment and foster growth of biogas consumption across all sectors, especially transport. In addition to the current policies, the government can adopt several strategies to boost investment in and adoption of CBG. These include introducing segmented pricing, with lower rates for transport and domestic gas and higher rates for commercial use, as is the case for APM gas. Offering carbon credit incentives to producers and CGD firms, similar to the European Union model, could enhance competitiveness and make CBG a viable option for hard-to-abate sectors.

Along with supportive policy frameworks, indirect enablers such as low-priced biofuels (as in the US and Brazil) and lower tax rates or tax exemptions for bio-CNG and flex-fuel vehicles can boost production and

consumption of biofuels, making them more competitive than conventional fuels.

Looking forward

India's commitment to net-zero emissions requires a multi-faceted approach, where biofuels play a crucial role alongside BEVs and hybrids. While bioethanol blending has gained momentum, scaling up bio-CNG production will necessitate addressing feedstock constraints, pricing inefficiencies and investment bottlenecks. Strategic policy interventions, supply chain optimisation and industry collaboration are essential to unlock bio-CNG's full potential. A well-structured framework, combined with targeted incentives, can position bio-CNG as a viable and competitive alternative, driving India towards a self-reliant and sustainable energy future.

Spotlight: Policy and investment outlook for oil exploration and production in India

Recent regulatory changes present an opportunity as India looks to enhance crude oil exploration and development to achieve self-sufficiency

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Highlights

The Oilfields (Regulation and Development) Amendment Bill, 2024 and other anticipated regulatory changes come at an opportune time for India amid increasing global uncertainty.

The government and its national oil companies are both looking to ensure growth while improving revenue prospects.

Meanwhile, with exploration activity dwindling around the world, many producers are looking at India, which presents an investment opportunity as a major growth market.

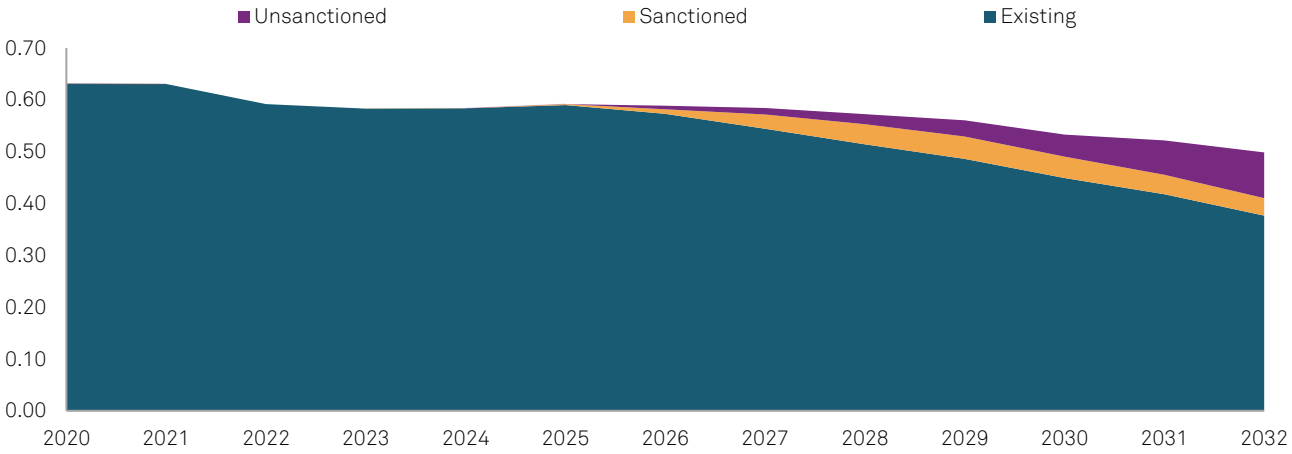
Energy security meets revenue security

The global narrative in energy markets is shifting closer to what India has always pursued – an 'all-of-the-above' approach.

The government and its state-owned national oil companies (NOCs) alike are looking to plug mismatches in supply and revenue.

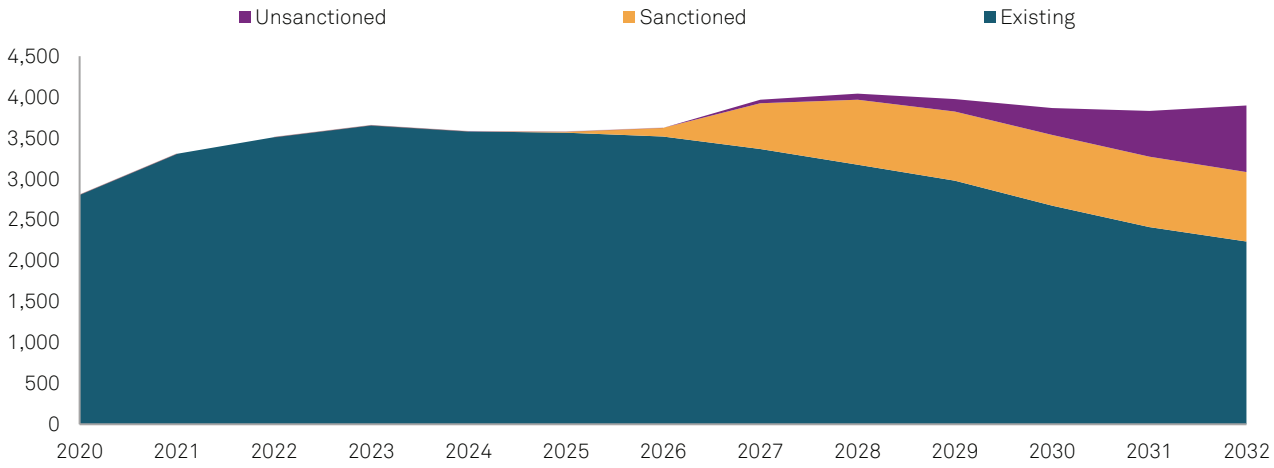
S&P Global Commodity Insights notes that India has a consistent decline in liquids production, while its gas markets are expected to grow significantly.

India oil production outlook



Data compiled April 2025.
MMbbl/d = million barrels per day.
Source: Upstream Content, a product of S&P Global Commodity Insights.

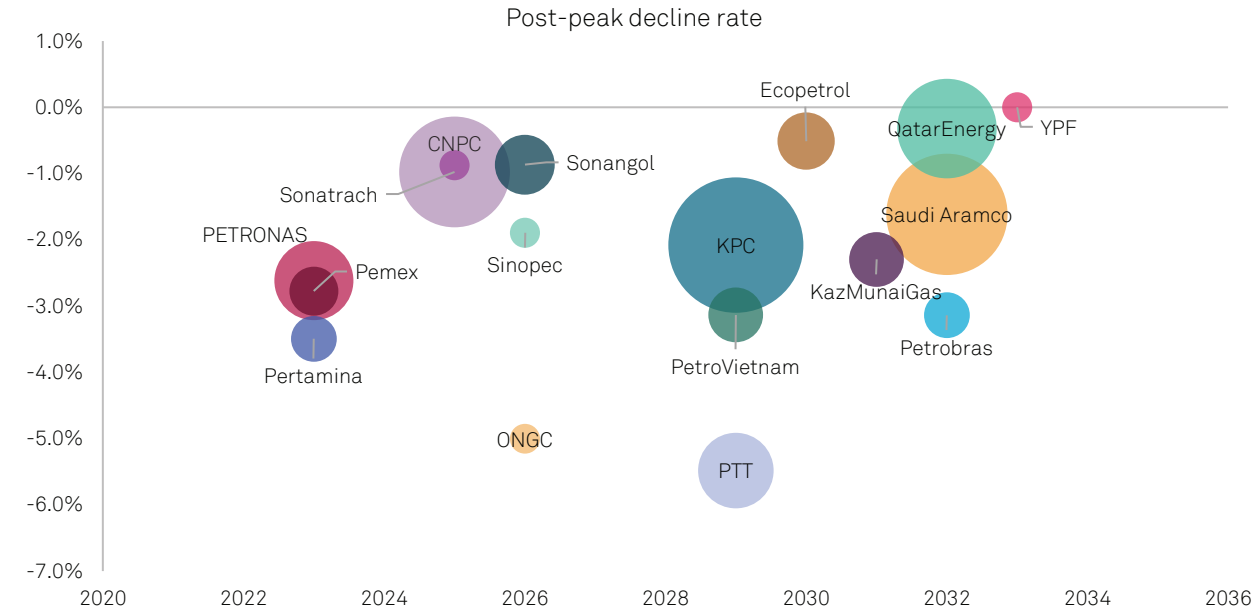
India gas production outlook



Data compiled April 2025.
MMcf/d = million cubic feet per day.
Source: Upstream Content, a product of S&P Global Commodity Insights.

In the milieu, India is set to pursue a path where energy security meets revenue security. A path that helps realize the common objective of the government and the state-owned national oil companies (NOCs) to ensure growth while improving revenue prospects. Renewables and power generation have environmental credentials, but do not support government revenue buoyancy in the same way as the petroleum sector.

NOC peak production, post-peak decline (2024), and NOC revenues as share of GDP



Offshore exploration: An investment opportunity in India

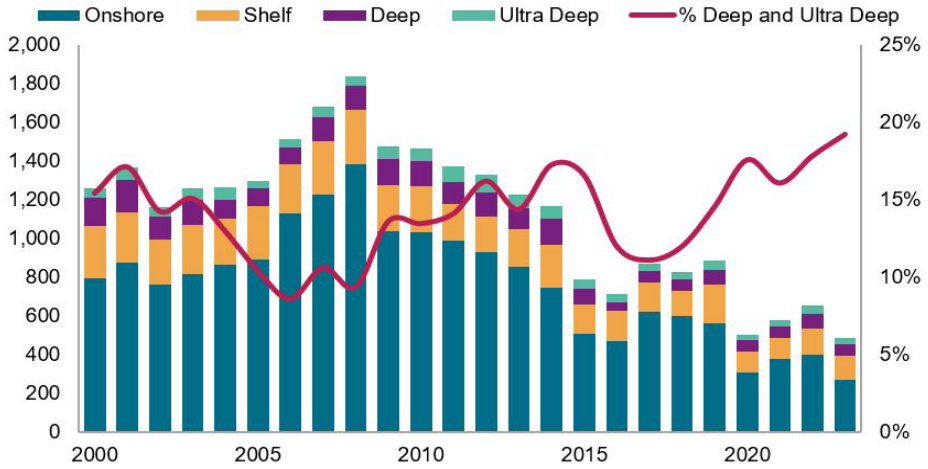
Over the past few years, S&P Global Commodity Insights has noted that upstream exploration activity has reduced significantly across the globe, yielding fewer discoveries. Many international oil companies (IOCs) are facing selective portfolio exhaustion and are looking for fresh avenues of growth.

For IOCs and NOCs with limited 'basin dominance' across their portfolio, frontier exploration in new jurisdictions could offer this path to growth.

The IOCs and NOCs are now keenly looking at opportunities in India.

Global NFW by terrain

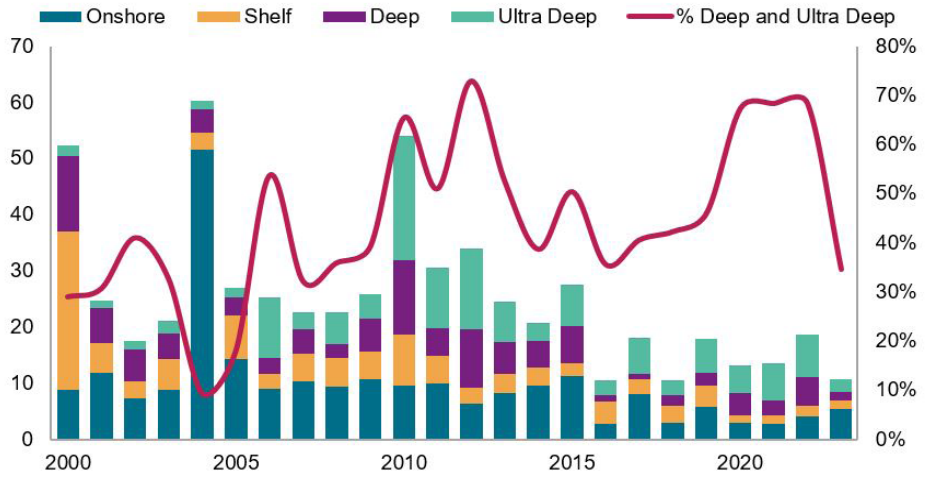
NFW count (LHS), pct in deep and ultra deep water (RHS)



Data compiled: December 2023.
Source: S&P Global Commodity Insights upstream E&P content (EDIN).

Global discovery by terrain

Billion boe (LHS), pct in deep and ultra deep water (RHS)



Data compiled: December 2023.
Source: S&P Global Commodity Insights upstream E&P content (EDIN).

Looking forward

Although most IOCs and NOCs have reported mixed success in India's energy markets so far, India continues to hold promise of being a large growth market. This opportunity has been further enhanced by the recent legislative changes in the country.

Looking forward, how India prepares for potential supply chain disruption would be an indicator to watch: the largely benign global oil price environment rewards India's import strategy, but energy security now goes beyond physical supply security.

The diversification of India's energy regulatory environment would also be important, especially as India seeks to draw investor intent in spaces like renewable energy and nuclear on its path to straddle energy security and energy transition.

About the S&P Global India Research Chapter

The India Research Chapter brings together experts from across divisions and functions of S&P Global and Crisil (an S&P Global company) to focus on the opportunities, risks and potential that will shape India's future.

It is a strategic initiative aimed at providing in-depth, timely insights and thought leadership into the complexities and dynamism of the Indian economy and its diverse sectors and industries. The 2025 key research themes are:

1) India's Economic Landscape
2) Balancing Energy Security & Energy Transition
3) Future of Capital Markets
4) Digital Disruption and Artificial Intelligence
5) Geopolitical Scenarios
6) Trade, Resources & Supply Chains
7) Agriculture
8) Sustainability

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