Institute for Energy Economics and Financial Analysis

Briefing Note

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Domestic Gas Drives Industrial Consumption in India

Small-to-medium scale industries have cleaner and more efficient options available

- *Increased availability and affordability of domestic natural gas has led to a surge in its use by small-to-medium scale industries, such as tea plantations, manufacturing, liquefied petroleum gas (LPG) shrinkage and sponge iron.*
- *The limited availability of domestic natural gas puts a question mark on the viability of using domestic gas in the long term by small-to-medium scale industries.*
- *There are various clean and efficient solutions available, such as increasing energy efficiency and enhancing the use of renewable energy, to cut the increasing dependence on natural gas.*

Introduction

Natural gas consumption in India is recovering from the post-COVID-19 slump, primarily driven by the fertiliser, city gas distribution (CGD) and industrial sectors. Even though the power sector has shown an incremental increase in gas use for peak power demand in the last two fiscal years, it has not reached pre-pandemic levels yet. Small- to medium-scale industries, including tea plantation, manufacturing, liquefied petroleum gas (LPG) shrinkage and sponge iron, are driving consumption growth.

Table 1 shows the change in overall natural gas consumption per sector for the last fiscal in comparison to fiscal year (FY) 2019-20.

Table 1: Change in Sectoral Consumption for Natural Gas FY2019-20 to FY2023-24

	FY2019-20 (MMSCM)	FY2023-24 (MMSCM)	% change
Fertiliser	**16115**	**21046**	**30.6**
CGD	**10883**	**13491**	**24.0**
Power	**11080**	**9082**	**-18.0**
Refinery	**7786**	**5837**	**-25.0**
Petrochemicals	**3569**	**2667**	**-25.3**
Other industries	**7060**	**16639**	**135.7**

*The term "other industries" refers to sectors such as tea plantation, manufacturing, liquefied petroleum gas (LPG) shrinkage, sponge iron, etc.

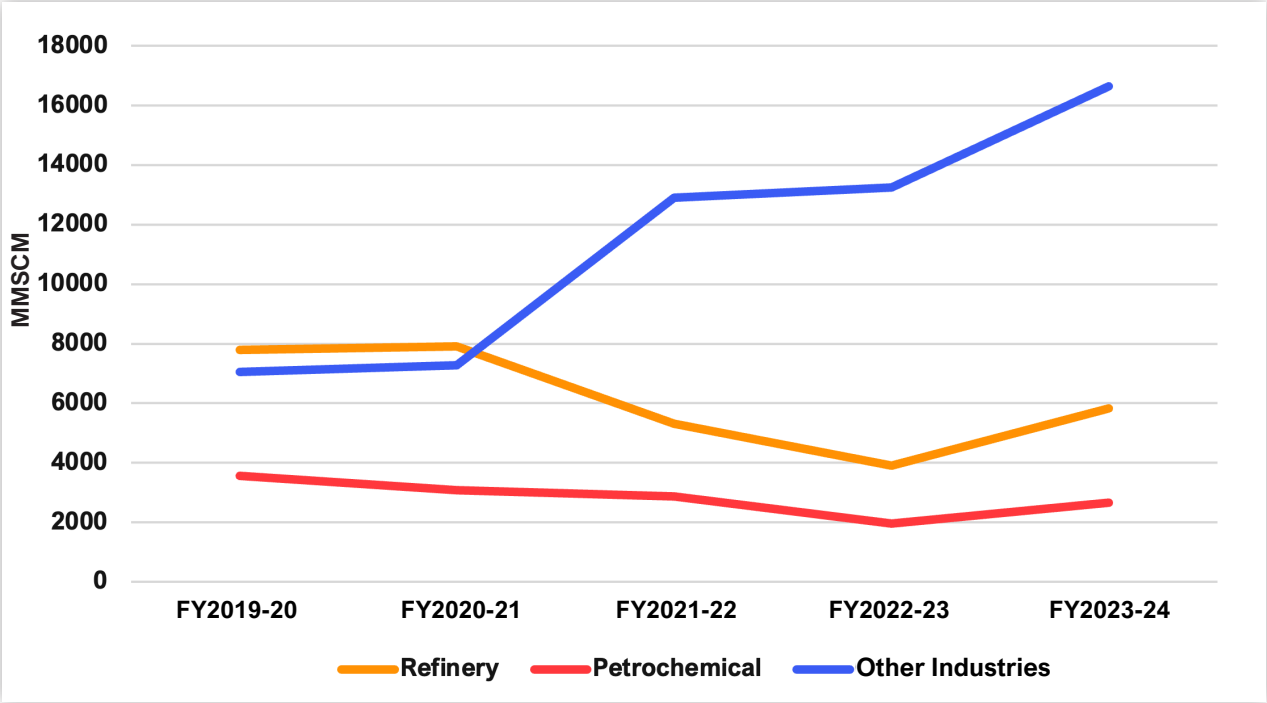
Source: IEEFA's analysis based on PPAC data

The industrial sector, including refinery, petrochemicals and other industries, witnessed a 37% increase in gas consumption in FY2023-24 from the pre-pandemic levels of FY2019-20. However, gas consumption by other industries – excluding refinery and petrochemicals – surged 136% over the period. Gas consumption by other industries shot up from around 7,000 million metric standard cubic meters (MMSCM) in FY2019-20 to over 16,000MMSCM in FY2023-24, accounting for almost two-thirds of the total gas consumption by the industrial sector.

Increased Availability of Domestic Gas Drives Industrial Consumption

Overall, the industrial sector witnessed an increase in natural gas consumption, while the refinery and petrochemicals sectors witnessed a 25% decline each between FY2019-20 and FY2023-24. Figure 1 shows the changes in natural gas consumption by different industrial sectors, whereas other industries have consistently increased consumption over the years.

Figure 1: Consumption of Natural Gas by Refinery, Petrochemical and Other Industries (FY2019-20 to FY2023-24) (MMSCM)



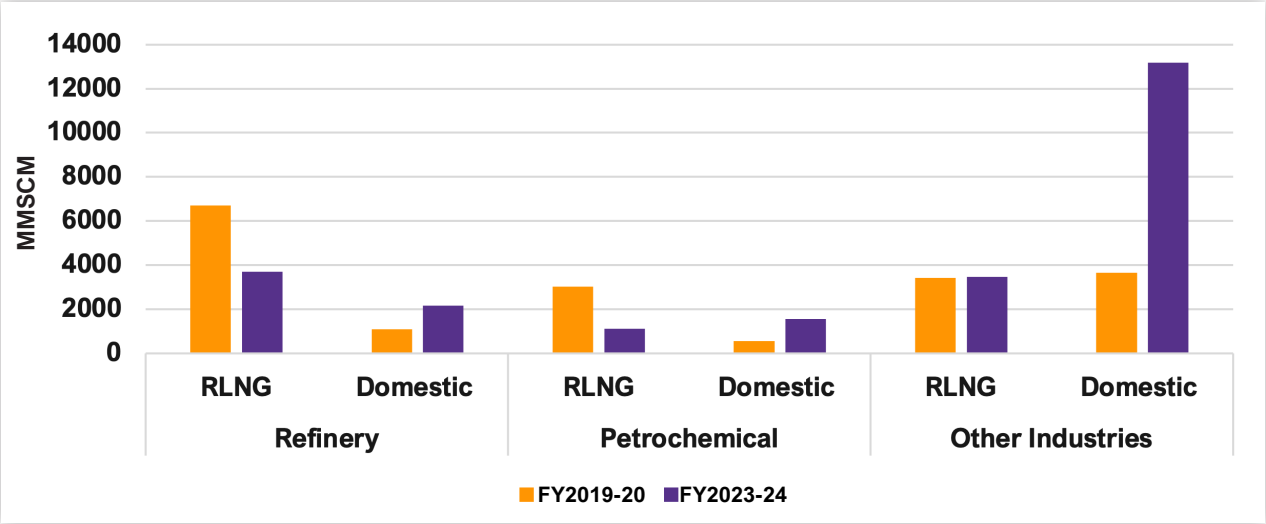
Source: IEEFA's analysis based on PPAC data

An unprecedented increase in global gas prices led to a major decline in consumption by the refinery and petrochemicals sectors in FY2022-23. The delay in deliveries of long-term liquefied natural gas (LNG) contracts to India for better returns in other countries and spot prices reaching a record high of US$56/ Metric Million British Thermal Units (MMBtu) (Rs4,699/ MMBtu) affected the fuel affordability of these sectors, leading to lower consumption.

Overall, industrial sector gas consumption declined by 9.3% in FY2022-23. However, other industrial and manufacturing sectors, including tea plantation, LPG shrinkage, sponge iron, ceramic, chemical, glass and metal and other small consumers, saw a 3% increase. This was on account of higher domestic gas use.

Figure 2 shows that even though domestic gas consumption by refineries and petrochemicals was higher than the pre-pandemic levels, there was a surge in the other industries segment. Increased availability of domestic gas could be a key reason for the surge.

Figure 2: Domestic Gas and RLNG Consumption for Industries in FY2019-20 versus FY2023-24



Source: IEEFA's analysis based on PPAC data

A plausible reason for the increased availability of domestic gas to other industries versus refineries and petrochemicals could be the connectivity of piped natural gas (PNG) to the former.

Expanding domestic market for goods produced by other industries using gas potentially makes allocating domestic gas easier for them. In contrast, the refinery and petrochemical sectors minimise gas consumption when gas prices increase as they have a high volume of exports. The high input cost of gas lowers not only the competitiveness of products in global markets but also returns to manufacturers, limiting production to domestic market needs. For instance, the export of naphtha or petroleum naphtha, a key refinery output, went down from 6.3 million tonnes in FY2019-20 to 4.4 million tonnes in FY2022-23, with domestic consumption decreasing only marginally.

Reduced domestic gas consumption by the fertiliser sector has also made domestic gas more readily available for other sectors. Even though the fertiliser sector receives priority allocation of domestic gas, regasified liquefied natural gas (RLNG) contributed to almost 86% of the total gas consumption for the sector in FY2023-24. The sector can absorb the high LNG prices as it is highly subsidised, with the price for fertiliser companies kept low through government support. The fertiliser sector's higher LNG consumption made more domestic gas available for the industrial sector. Small to medium industries, which cannot pass on the high cost of international gas prices, benefitted as domestic gas allocation increased to potentially avoid stranded capacity risks for these industries.

The government revised the domestic gas pricing formula in April 2023. As part of the revision, it linked domestic gas prices with the Indian crude basket and capped it at US$6.5/MMBtu (Rs545/MMBtu) for legacy fields for two years. This has helped limit the increase in domestic gas prices, improving its affordability. With this, the viability of domestic gas as an input fuel for other industries, which operate on limited profit margins, has increased.

Price Sensitivity Risks Remain

Gas consumption in India is price sensitive, especially for the industrial sector, where it competes with various alternatives.

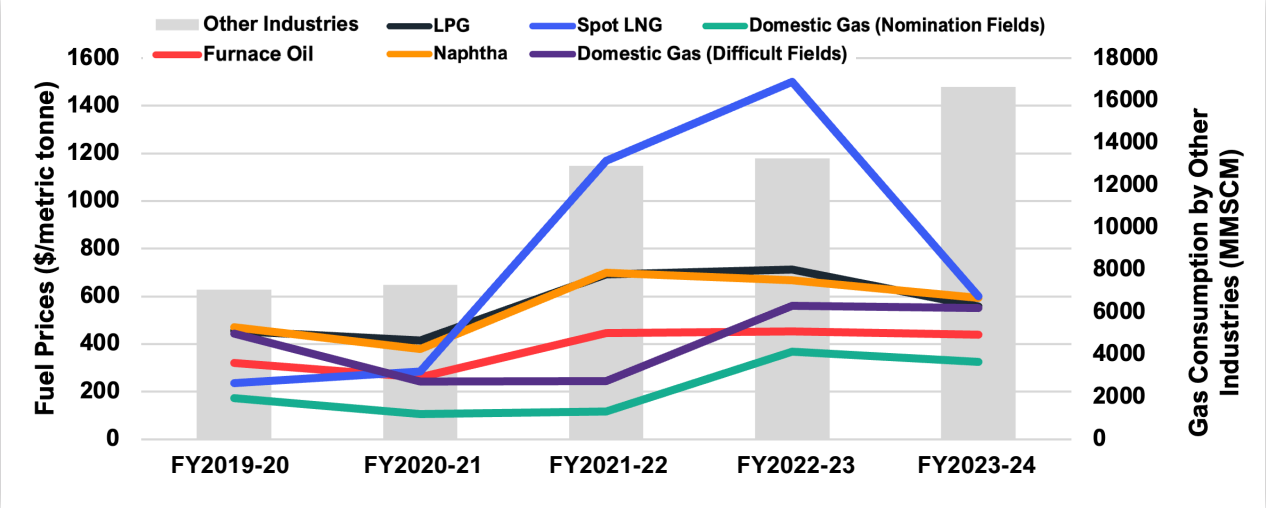
Natural gas pricing is volatile and affects the production cost of small and medium industries. While the increased allocation of domestic gas is currently favourable for other industries, there are concerns over limited domestic gas production and the proposed deregulation of gas pricing in 2027. Power and city gas distribution sectors seeking increased gas allocation, combined with rising global gas prices, put pressure on the competitiveness of gas as an input for small to medium industries. Industries can also resort to fuel switching if gas prices increase.

Exposure to volatile gas markets has led to extremely high production costs for industries. The industrial sector uses alternative fuels like furnace oil (FO), low sulphur heavy stock (LSHS), petcoke, naphtha and LPG. Consumption of all these fuels, except naphtha, which also comprises natural gas, increased in FY2022-23 when natural gas prices reached unprecedented highs. FO/LSHS consumption rose 11% in FY2022-23 and declined by 6% in FY2023-24, possibly due to increases and decreases in coal and gas prices, respectively. In the last five years, from FY2019-20 to FY2023-24, natural gas consumption has been growing for small to medium industries, but the pace was slowest in FY2022-23, indicating limited use by industries due to high prices.

While FO/LSHS consumption peaked in FY2004-05 and has reduced to half since then, its annual growth has seen marginal increases in the years when other fossil fuels were unavailable or unaffordable. Shipping, power generation, iron and steel, and chemical and aluminium manufacturing sectors use FO/LSHS. Petcoke and naphtha consumption has been growing driven mainly by the cement, iron and steel, chemical production and petrochemical industries. LPG consumption is also increasing due to the domestic cooking segment and other industries.

The figure below compares the international free-on-board (FOB) prices for alternative fuels and spot natural gas prices with domestic gas prices for nomination gas fields and difficult gas fields. The figure indicates the price advantage of imported LNG compared to other fuels before the Russia-Ukraine crisis and the pandemic-induced gas price crash, with industries relying on imported gas to meet their fuel needs. However, as spot LNG prices shot up, domestic gas consumption by industries increased (refer to Figure 1), along with the rise in alternative fuels' consumption. This was remarkable in FY2022-23, when the price of LNG reached an all-time high. Other industries switched to domestic gas and other fuels during that time. While total gas consumption by other industries increased only 3% in FY2022-23, domestic gas consumption by other industries grew 15% (refer to Figure 2).

Figure 3: Comparison of Alternative Fuels' International FOB Prices with Natural Gas ($/metric tonne) FY2019-20 to FY2023-24



Source: IEEFA's analysis based on PPAC data

In FY2023-24, when the price of different fuels converged, other industries preferred using gas, as evident in the 26% increase in gas consumption from FY2022-23 (refer to Figure 2). The US$6.5/MMBtu (Rs545/MMBtu) or US$325/metric tonne (Rs27,268/metric tonne) ceiling price set by the government for nomination fields for two years could be an enabler. Using the new pricing formula notified by the government at the start of each month for deriving the actual prices shows that average pricing for FY2023-24 for nomination fields will be US$8.2/MMBtu (Rs688/MMBtu) or US$410/metric tonne (Rs34,400/metric tonne), which would still be more competitive than alternative fuels. However, the limited availability of domestic natural gas and the high fiscal subsidy for fertilisers put a question mark on the viability of using domestic gas in the long term for the industrial sector. To address the production concerns, government has allowed a premium of 20% on gas pricing for new wells but that would also make the gas expensive taking away from its affordability.

Policy Options and Cleaner Alternatives for Industrial Use

To limit the use of gas, industries like glass, ceramics, sponge iron and tea can explore alternative, cleaner options. Some of these industries can consider using green hydrogen and biogas, along with focusing on energy efficiency. A cluster-based approach can also boost energy efficiency as demand linkages ensure the profitable production of green hydrogen. Enhanced policy and financial support can further help in the successful implementation of these alternatives.

Increasing Energy Efficiency

Improving energy efficiency can play a critical role in lowering carbon emissions when it comes to industries like ceramics and glass. Many small or unorganised industries that use natural gas for heating suffer massive heat loss and release of pollutants due to inefficient combustion. For instance, using fossil fuels for glass melting is an inefficient heat transfer method with less than 30% efficiency for the actual glass melting process.

Many ceramic units have implemented more efficient designs of kilns and operational strategies, such as shorter firing cycles and lower firing temperatures, to increase productivity and reduce energy usage.

Adopting a Cluster-based Approach

A cluster-based approach can work for industries such as ceramics, tea, glass and sponge iron. Most small and medium industries have operational clusters – the Morbi ceramic cluster in Gujarat, the Jorhat tea cluster in Assam, the Firozabad glass cluster in Uttar Pradesh, and the Sundergarh and Keonjhar sponge iron clusters in Odisha are all good examples. The Bureau of Energy Efficiency (BEE) adopted a cluster approach to increase energy efficiency in 29 clusters, including these four clusters. The BEE came out with manuals on energy conservation in 2010, which can be built upon now, considering new net zero targets and the availability of domestic natural gas. Deploying more renewable energy or producing green hydrogen could be more efficient and profitable in clusters due to demand linkages.

Using Green Hydrogen

Hydrogen blending can work in industries that use PNG as a fuel, such as tea plantations and glass manufacturing clusters. NTPC has successfully achieved the blending of hydrogen in PNG pipelines in its townships in Surat and Solapur. A study conducted by NTPC for the Firozabad glass cluster notes that 20% hydrogen blending can reduce emissions by 6-7%. While only

blending hydrogen will not reduce dependence on natural gas, it is a start.

Blending green hydrogen during manufacturing or using green hydrogen as a reductant can lower carbon emissions of small- to medium-scale industries dependent on fossil fuels.

Green hydrogen, instead of natural gas or coal gas, can also act as a reducing agent in sponge iron production. According to an IEEFA report on green steelmaking, green hydrogen-based direct reduced iron (DRI) is a key step in global steel decarbonisation, but the availability of high-quality ore with greater iron content, also known as DR-grade iron ore, could be a challenge. A way around that is the beneficiation of iron ore to improve the quality of hematite ore, which is prominently found in the country. The Indian government has announced that it is looking to form an iron ore beneficiation policy to maximise the use of iron ore in steel production.

Using Compressed Biogas

The possibility of using bioenergy – renewable energy generated from burning biomass fuel – in the tea industry has been explored. Tea waste comprises processing (factory) waste and garden waste. These can partially meet the energy requirements of tea processing.

An assessment study for the UK looks at using low-cost renewable waste-derived fuels (from cooking and waste oil) for glass and ceramics manufacturing in the country. The study found low-grade biofuel suitable for use in glass and ceramic kilns and does not impact product quality. However, using waste to produce biogas would be a more viable alternative in India.

Compressed biogas (CBG) has the same methane content and calorific value as natural gas. While blending CBG is a step towards cleaner energy as it reduces greenhouse gas (GHG) emissions, a complete transition to CBG can help achieve a circular economy. It is considered a good option for fuel switching for small and medium industries but would require policy and financial support for capital investment.

Enhancing Electricity Use

All electric heating is far more energy efficient than natural gas heating for industries like glass manufacturing and tea processing. Electric furnaces do not produce large volumes of harmful hot gases. While transitioning to electrical equipment would require high costs, hybrid renewable energy systems must be explored. A report published by the UK Government notes that a flexible hybrid-fuelled furnace is beneficial for dynamic fuel switching and allows for smart load balancing, but its use is limited.

For instance, using electric heating in glass manufacturing can increase heat efficiency to 75% as energy is fed directly into the glass, and even the top surface of the glass remains cold. This is much higher than the current 30% heat efficiency achieved through combustion.

Wider Deployment of Renewable Energy

Along with the increased use of electricity and electric equipment across gas-consuming industries, there is merit in expanding the use of renewable energy in different industries. Notably, tea gardens in Assam have solar installations to enhance energy supply and lower costs and emissions. Many experts have proposed agrivoltaics – agricultural production underneath or adjacent to solar panels – as a good solution for tea gardens, as these could help meet the energy requirements of some of the tea manufacturing processes. According to a study, "Tea is a typical weak light tolerant plant and the best crop for building a PV-agriculture system."

Solar power-based electric power for glass melting and manufacturing can bring economic

and environmental benefits with savings in fuel cost and increased heat efficiency. Similarly, many of the key processes in ceramic production require electricity and could be transitioned to clean energy using solar or wind. According to BEE, using solar energy for preheating slurry input to the spray dryer could lead to significant savings in natural gas consumption.

Conclusion

Small-to-medium scale industries have taken advantage of lowered domestic natural gas and LNG prices to use these fuels in their production processes. However, the volatility of natural gas prices, import dependence, limited domestic production and expensive infrastructure are all risk factors in this adoption, which can be concerning for industries with limited margins. Solutions are available to minimise this increasing dependence on gas, which is not a feasible economic or environmental proposition. It is essential to focus on energy efficiency and enhance the use of renewable energy in these industries.

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