

# Challenges Faced by Petrochemical Industry in India

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## Abstract

The article provides the latest scenarios on the petrochemical industry in India in terms of supply, demand, capacities, and feedstock situation. India has higher naphtha-based capacity and being a crude oil derivative, the volatility in oil prices also leads to volatility in naphtha prices with resultant impact on petrochemical pricing. India is also short of petrochemical intermediates capacity, leading to rising imports. Demand for petrochemicals is expected to go up in the next few decades and therefore the prospects for new crackers are quite promising as mentioned in the article. The way forward will be to set up multifaceted crackers.

## Introduction

Petrochemicals are downstream hydrocarbons derived from crude oil and natural gas. The downstream process involves the refining of crude oil and purifying and processing of natural gas. The refining process requires fractional distillation which fragments crude oil into its constituent parts and results in the production of main petrochemical feedstocks like petroleum gases, naphtha, kerosene, and gas oil. Ethane, propane and natural gas liquids derived from natural gas are the other vital feedstocks used in the petrochemicals industry. Petrochemicals are used in the day-to-day activities and have been playing a crucial role in the development and smooth functioning of various industries and human life. As they are derived out of petroleum, their prices tend to move in line with that of petroleum. The major petrochemicals industry in India is broadly divided into three segments: basic major petrochemicals (second-largest segment), intermediates (the largest segment), and other petro-based chemicals (the smallest segment). Furthermore, based on composition, building blocks for petrochemicals are divided into two subgroups: olefins and aromatics. Petrochemical products are an integral part of our day-to-day lives and are present in numerous products including plastics, fertilizer, digital devices, clothing, tyres, etc.



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## Current global trend

Globally, petrochemical demand has been continuously rising and has been higher than the demand for crude oil. As per IEA, the growth in demand for petrochemical products means that petrochemicals are set to account for over one-third of the growth in oil demand to 2030, and nearly half to 2050, ahead of trucks, aviation, and shipping. The demand for plastics (one of the most common petrochemical products) across the globe has been on the rise and has outpaced other bulk materials such as cement, steel, and aluminium. It is noteworthy to mention that petrochemical products such as plastics act as an alternative to various natural resources and thus have helped to restrict the strain on those natural resources, which in the absence of such substitutes would have been much higher. The per capita usage of plastic is much higher in the developed economies when compared to developing economies, thereby indicating a huge potential in those developing economies. Though there have been efforts to curb single-use plastic due to a lack of better alternatives, developing economies have been heavily relying on the usage of plastic leading to a high growth rate.

## Current domestic trend

As per the Ministry of Chemicals and Fertilizers, the market size of the Chemicals & Petrochemicals sector in India is around US \$165 billion during 2019-20. The size is expected to grow up to US \$300 billion by 2025. To meet the growing demand, India will need five crackers by 2025 and an additional fourteen by 2040.

The production of total major chemicals and petrochemicals in 2018-19 was 37,518 thousand MT with capacity utilization of around 90% during 2018-19. During the last 5 years, the basic major petrochemicals

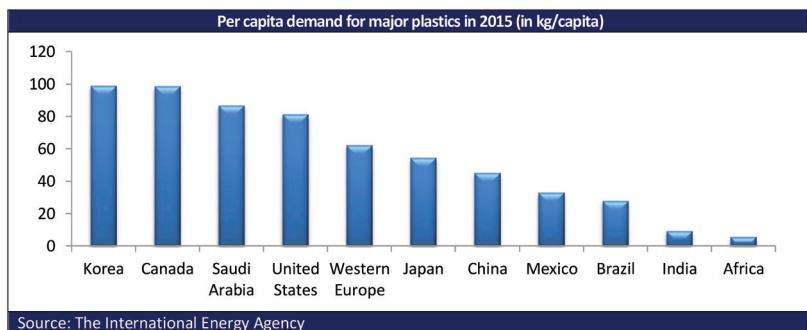


Fig 1

segment has grown at the fastest pace of 4.9% CAGR compared with the other two segments of the industry. This has increased the share of the basic major petrochemicals segment in the total major petrochemicals industry to 43.4% in FY19 compared with its share of 41.7% in FY15. The intermediates segment and other petro-based chemicals segment grew at a slower CAGR of 3.2% and 2.8%, respectively, during these years. Resultantly, the share of intermediates segment contracted to 50.8% in FY19 from 52% in FY15 and that of other petro-based chemicals segment reduced to 5.8% in FY19 from 6.1% in FY15. Overall, the major petrochemicals industry production rose at a CAGR of 3.9% to 37.5 million tonnes in FY19 from 32.2 million tonnes in FY15.

Among the basic major petrochemicals, the poly-

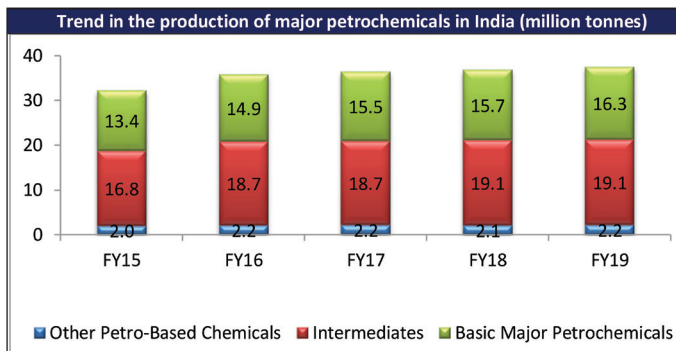


Fig 2

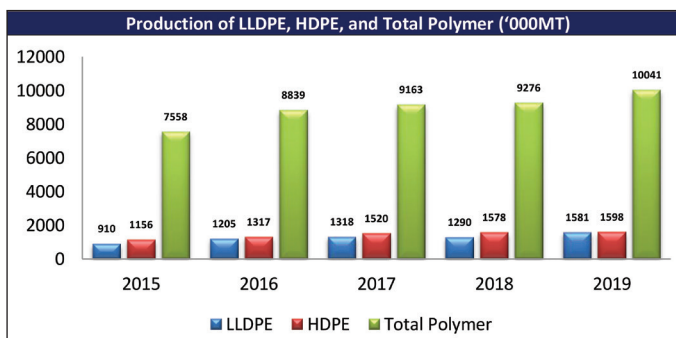


Fig 3

mer segment has demonstrated one of the highest growth rates during the past five years at 7.36% for 2015-2019. Linear low-density polyethylene (LLDPE) and high-density polyethylene (HDPE) combined have posted a CAGR of 11.37% during the same period, thus indicating high demand for plastics in the country.

With respect to international trade, India has been a net-importer in all the three segments of major petrochemicals except for the intermediates segment during FY18 when exports exceeded imports by 0.7 million tonnes. The overall major petrochemical exports grew at a faster CAGR of 12.1% compared with imports that increased at a CAGR of 7.9% during the period FY14 to FY18. This was mainly on account of exports from intermediates and other-petro-based chemicals segment that rose at a higher CAGR of 18.6% and 19.1%, respectively, compared with their imports. The exports of basic major petrochemicals, however, rose at a slower 5.9% CAGR compared with the imports that increased at a CAGR of 10.5%.

### Key challenges faced by the industry

#### Volatility in raw material: Linkages between crude and naphtha

India has eleven cracker complexes in operation in the country with a combined annual ethylene capacity of 7.27 million MT.

As mentioned in the Fig. 4, out of the eleven crackers, three are pure naphtha-based crackers, while three are dual-feed crackers (which can use naphtha and gas interchangeably as feedstock). Therefore, a significant proportion of the capacity is based on naphtha which

Owner	No of crackers	Feedstock	Total Design Capacity (KTPA Ethylene)
GAIL (India) Ltd	2	Gas	860
Haldia Petrochemical Ltd	1	Naphtha	700
Indian Oil Corporation Ltd	1	Naphtha	857
Reliance Industries Limited	5	3 Gas + 1 Naphtha + Dual	3580
Brahmaputra Cracker and Polymer Ltd	1	Gas + Naphtha	220
ONGC Petro additions Limited	1	Gas + Naphtha	1060
<b>Total</b>	<b>11</b>		<b>7277</b>

Fig 4

➤ In terms of the portfolio of products to be produced, naphtha is used when a wide range of products including propylene and butadiene derivatives are to be produced. On the other hand, natural gas is used when higher ethylene output is needed given the high yield compared to naphtha. All these factors had led to higher naphtha-based capacity in the country. We believe a shift to multi-feed cracker provides more flexibility to the players in terms of selection of the feedstock to protect their margins and should be the way forward.

is a crude oil derivative. Crude oil, and thus naphtha, has demonstrated significant price volatility leading to the prices of petrochemical products to be highly volatile. Unlike the dual-feed crackers, the pure naphtha-based cracker's profitability is linked to the fortunes of crude prices, as they cannot use gas as an alternative feedstock during a high naphtha price regime.

As indicated in the Fig 5, naphtha has mostly mimicked crude oil prices as it is a crude derivative. When compared with the average price of major polymers, it can be witnessed that the spread is inversely related to naphtha prices. For average polymer prices, HDPE, LLDPE, and Polypropylene prices have been used for the same period.

It is noteworthy to mention here that the selection of feedstocks is based on three major factors: availability, cost, and the portfolio of products to be produced. Naphtha production in the country has been on the rise and has increased from 17,466 thousand metric tonnes in 2014-15 to 20,577 thousand metric tonnes in 2019-20. Though consumption has also witnessed a similar trend during the period, availability has never been a concern. In terms of the portfolio of products to be produced, naphtha is used when a wide range of products including propylene and butadiene derivatives are to be produced. On the other hand, natural gas is used when higher ethylene output is needed given the high yield

Name	Product	Expected year of completion
Indian Oil Corporation Ltd	Integrated Para-Xylene (PX) and Purified Terephthalic Acid (PTA) complex	2024
BASF India Ltd	Double the capacity for polymer dispersions	2021
Mangalore Refinery and Petrochemicals Ltd	Refinery expansion to 18 MTPA-to focus on petrochemicals such as ethylene, propylene, and butane	-
Hindustan Petroleum Corporation Ltd	Greenfield refinery-cum-petrochemical project	2022
Bharat Petroleum Corporation Ltd	Specialty petrochemicals plant to produce Acrylic Acid, Oxo Alcohols, Polyols and Acrylates	2024

Fig 6

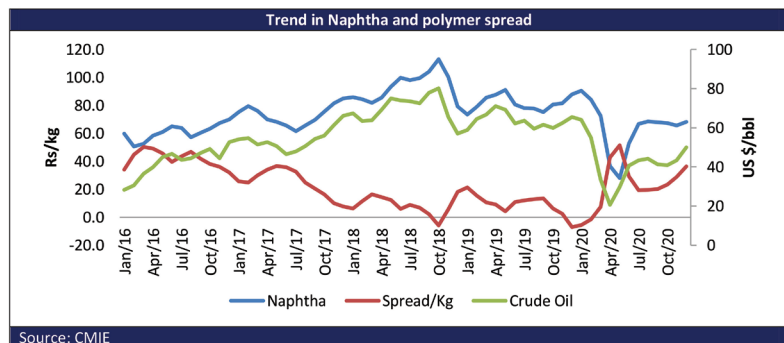
compared to naphtha. All these factors had led to higher naphtha-based capacity in the country. We believe a shift to multi-feed cracker provides more flexibility to the players in terms of selection of the feedstock to protect their margins and should be the way forward.

### Short-fall in petrochemical intermediate capacity

One of the key links in the value chain of the domestic petrochemical industry which has been traditionally weak is the intermediate segment. In order to grow at a healthy pace, the industry needs strong intermediate capacities as intermediates play a major role in the production of various petrochemical and specialty chemicals. India has primarily been relying on imports for various intermediates such as acrylic acid, mono ethylene glycol (MEG), purified terephthalic acid (PTA), etc. India has been lacking in the production of intermediates as most of the building block chemicals were used for the production of basic polymers due to their strong domestic demand. However, over time, some of the ethylene and propylene has started to get diverted for the production of petrochemical intermediates, thus, reducing the import dependency. Furthermore, various upcoming projects which are expected to go into production in the next five years are expected to ease out the pressure.

### Impact on environment

There is no doubt on the benefits of petrochemical products in our day-to-day lives; however, the environment has paid a substantial price for it. The industry uses crude oil de-



Source: CMIE

Fig 5



rivatives and natural gas for the majority of its production. A substantial amount of toxic and non-toxic waste is released into the environment during their extraction, processing, and transportation. Various pollutants are released in the environment directly or indirectly during the manufacturing process of petrochemical products. The petrochemical industry is an important source of the principal greenhouse gases responsible for global warming.

Plastics, being one of the major petrochemical products, has garnered quite a negative opinion in recent years due to its long-lasting negative impact on the environment. Although the polymer segment (HDPE/LLDPE) in the country has demonstrated a CAGR of over 7.36% for 2015-2019, any major policy to curb single-use plastic such as HDPE/LLDPE may hurt the domestic petrochemical producers in the long-term. Nevertheless, we believe that due to the lack of any better alternative, continuous increase in demand due to high population growth and rising disposable income, the demand for plastics would continue to grow in the medium-term. The need of the hour is to resort to various Clean Technology Scenarios (CTS) to curb air and water pollution at the same time reducing CO<sub>2</sub> emission. Petrochemical players need to invest in research & development to find some alternative to single-use plastic, development of a strong recycling infrastructure and putting strong checks on CO<sub>2</sub> emission would be the way forward for the industry.

### Global competition

Middle Eastern countries and the United States have a clear advantage of feedstock as the Middle East has ethane in abundance, while the United States has shale gas in its reserves. As per the International Energy Agency, the United States is home to around 40% of the global ethane-based petrochemical production capacity. Lower ethane prices in the United States as compared with naphtha for an extended peri-

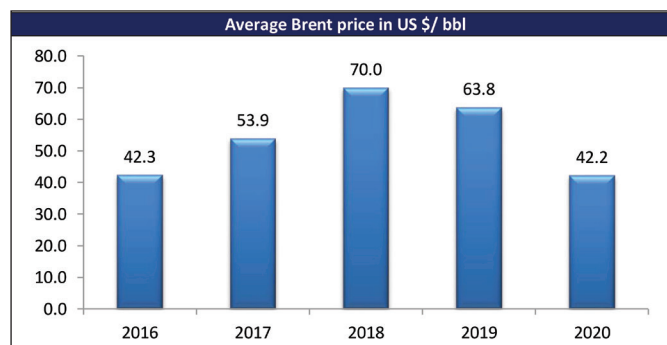
od have provided them a competitive advantage over the domestic players who have been more skewed towards naphtha-based crackers.

As indicated from Fig 7, the average crude oil price for CY17 to CY19 has remained on a higher side thus keeping the naphtha prices firm as well. The domestic players were at a natural disadvantage and felt pressure on their margins given high competition from the international supply. The recent turmoil in the crude industry since March 2020 followed by the outbreak of COVID-19 has led to the prices plunging to one of the lowest price levels making naphtha again a lucrative option. However, the fact that the crude price is expected to remain firm in the long run owing to increasing demand and supply constraints; the domestic petrochemical players will continue to be at a disadvantage when compared to its international competition.

### Conclusion

The total major petrochemical production in the country has demonstrated a CAGR of around 4% during the period 2015-2019 and is expected to grow at around 5%-7.5% in the medium term owing to increased demand backed by high population growth, increasing disposable income and lack of better substitutes for products such as plastic (HDPE/LLDPE). The key challenges that the industry has been witnessing are with respect to the volatility in the feedstock prices, competition from imports which have a cost advantage, environmental challenges, and lack of adequate intermediate capacities. We believe that there is a huge opportunity for the domestic petrochemical industry, however, infrastructure to ensure the availability of feedstock should be created. Furthermore, with expected higher availability of natural gas at a competitive price would make the domestic players more competitive in the global landscape.

With respect to the credit perspective, the tolling margins of the domestic petrochemical companies have remained subdued and are expected to remain so in the near term. The outbreak of Covid-19 has acted as a further deterrent for the industry at least in the immediate term. The industry is typically capital intensive; however, the fact that the majority of the petrochemical players in the country are either large oil & gas players or are associated with such large players, the credit profiles of these players are expected to remain comfortable in the medium term.



Source: CMIE

Fig 7