CREDENCE CAPITAL

(Investment Club of IIM Lucknow)

OIL & GAS SECTOR REPORT

INTRODUCTION

India is the third largest energy consumer in the world after China and USA. It is also the fastest growing energy consumer, consumed at almost 4.9 million barrels per day (BPD) in 2021, up from 4.65 million BPD in 2020. With a share of ~6% of the world's primary energy consumption, India's energy requirements are fulfilled by Coal, Crude Oil, Natural Gas and Renewable Energy. Oil and gas sector within the energy mix play a predominant role as over 1/3rd of the energy requirement is met by hydrocarbons. Growing economyand population growth are the main drivers for oil & gas demand, increasing every year.

Amongst commodity imports, share of imports of Oil & Gas sector (Oil, Petroleum product and Liquified Natural Gas ('**LNG**')) was 21.98% in 2021-22 of India's overall imports (US $52 thousand million). Continued imports of oil & gas to the Indian economy underscore the need for a robust strategy for assuring supply. Recognizing the imperative need for increasing production of oil & gas resources, Ministry of Petroleum & Natural Gas has takenup many initiatives and policy reforms to boost investment in the upstream sector activities to accelerate new hydrocarbon discoveries.

India has a robust refining sector with a refining capacity of 221.26 MMTPA (Million Metric Tonne Per Annum) for FY 2022. With increase in the domestic refining capacity, which has overtaken domestic consumption, India became a net exporter of petroleum products. The consumption volume of petroleum products in India was approximately 194 million metric tons in fiscal year 2021. While the domestic consumption has increased from 2018-19 to 2019-20, India is in a position to export surplus productsafter meeting domestic demand.

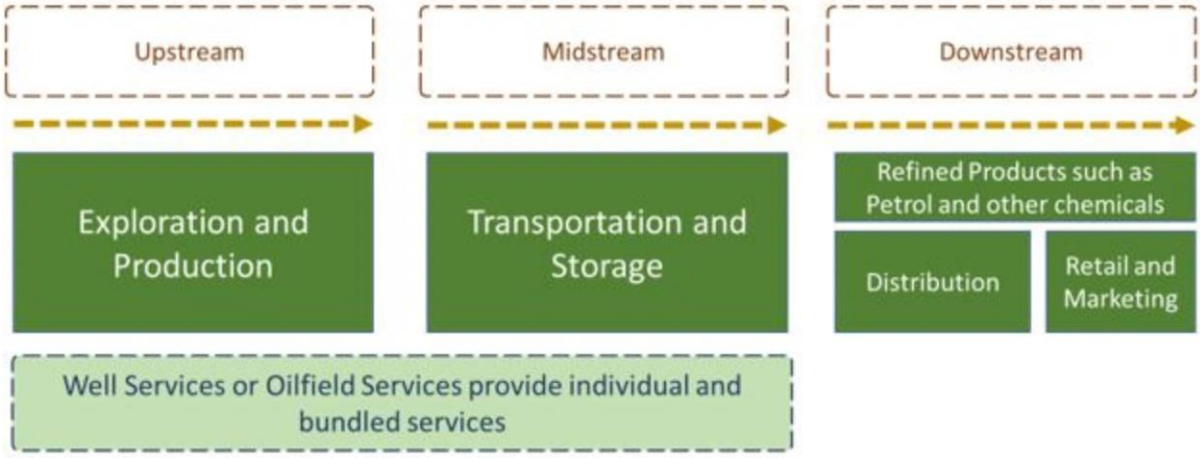
The COVID-19 pandemic has been a watershed moment for the Indian Oil & Gas industry, just like it has been for the global economy. Due to the steep decline in global energy requirements, there was a decline in the oil & gas prices which is now on the upswing with increasing demand coupled with production cuts planned by OPEC. After pandemic, when the world economy is reviving from the covid, Russia Ukraine crisis alleviated the problem. India was indirectly impacted by the Russia-Ukraine war. Russia accounts for 11-12 per cent of the global crude oil supply, but India depends on less than 1 per cent for its crude oil import requirements on Russian oil. Supply disruptions in Russia impacted global crude oil supply thereby further exacerbating prices, which are already on a boil due to better-than-expected economic recovery last year and production bottlenecks. In order to shield the economy from the negative impact of the recent surge in crude oil prices, India started importing additional oil at discounted rates from Russia. The majority of the crude oil purchase from Russia for India has been done by Indian Oil Corporation. Another important aspect affecting the Oil & Gas industry is the move to cleaner, green fuel as opposed to fossil fuels which may cause a paradigm shift in the globalOil & Gas industry in the years to come.

OVERVIEW OF THE OIL & GAS SECTOR

In order to understand the Oil & Gas sector, it is imperative to first understand the value chain of the industry right from extraction of hydrocarbons to selling refined products. There are three main facets of the value chain:

A. **Upstream**: Extraction and Production;
B. **Midstream**: Transportation and Storage; and
C. **Downstream**: Refining and Marketing

Below is a brief snapshot of the value chain, which has been described in further detail in the report:



Upstream

Companies in the upstream sector are involved in identifying and assessing the potential Oil & Gas producing blocks, drilling exploratory wells, devising Field Development Plans (FDPs) and developing infrastructure in economically viable oil fields to produce commercial quantities of hydrocarbon.

Midstream

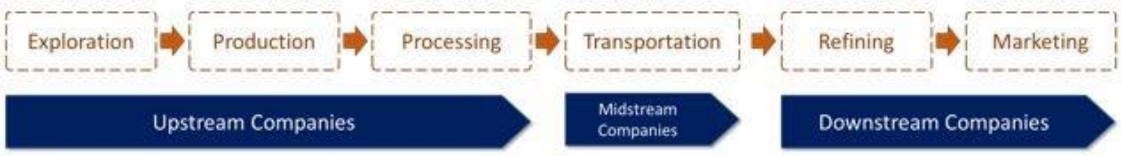
Companies in the midstream sector are involved in transportation of the hydrocarbons through pipelines, maritime, rail or road, depending on the nature of hydrocarbons being transported.

Downstream

Companies in the downstream sector are involved in refining the hydrocarbons into a varierty of derivative products which are then marketed and sold to different end consumers ranging from individuals to corporations.

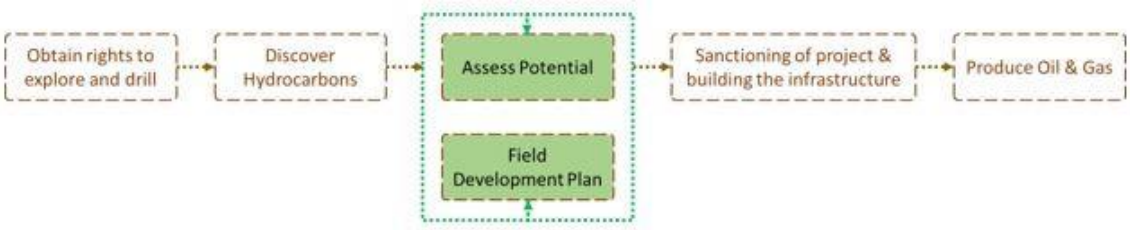
OIL SECTOR

Below is a detailed value chain of the Oil sector:



Upstream sector

As mentioned previously, companies in the upstream sector carry out the exploration and production of hydrocarbons, and in case of the oil sector, crude oil. This is a high risk, high reward sector as it is strictly regulated by governmental agencies and it involves huge upfront investment in identifying fields with adequate potential for extracting crude oil by using the most advanced technologies and concepts, which is also referred to as devising Field Development Plans ('FDP'). On the basis of the FDPs, wells are drilled to extract crude oil to the extent available, which is then transported to local or international downstream companies for refining and subsequent sale of derived products to ultimate consumers. A brief description of the activities undertaken by the upstream companies is as under:



Companies in the upstream sector may themselves extract crude oil after devising the FDPs or outsource the contract to specialized 'Well Services Companies' as crude oil extraction requires highly specialized equipment and skill sets. The Well Services Companies may provide individual services like well construction, supply of various materials and chemicals and the like or provide bundled services which the upstream companies may require.

Global outlook

Review of 2022

- **Demand** - Global oil demand growth is estimated at 2.5 mb/d y-o-y in 2022. In OECD Americas and Europe, lower-than-expected transportation fuel demand outpaced jet fuel demand recovery, leading to y-o-y growth of 1.4 mb/d for the OECD. In the non-OECD, y-o-y growth of 1.2 mb/d is expected. Renewed lockdowns in China weighed heavily on oil demand, with the country registering an oil demand contraction in 2022.

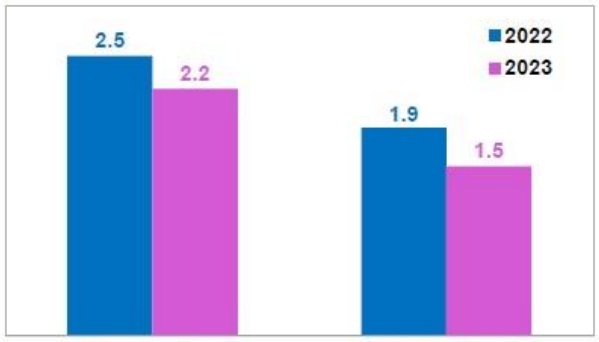
- **Supply** - Non-OPEC supply growth in 2022 is estimated at 1.9 mb/d. The main drivers of growth

are estimated to have been the US, Canada, Guyana, Russia, China and Brazil. US shale oil companies continued to focus on shareholder returns, with higher production costs amid supply chain shortages and inflation limiting overall production growth.

Outlook for 2023

- **Demand** - For 2023, world oil demand is expected to increase by 2.2 mb/d y-o-y. OECD oil demand is forecast to increase by 0.3 mb/d. This is mostly in OECD Americas, while other OECD regions are not expected to see noticeable growth. In the non-OECD, oil demand is forecast to increase by 1.9 mb/d, with China and India seeing the largest growth. This forecast assumes the successful containment of COVID-19 and a resumption of pre-pandemic economic growth in China, while India's oil demand is projected to be supported by continued healthy economic growth.
- **Supply** - In 2023, non-OPEC supply is forecast to expand by 1.5 mb/d y-o-y. US tight oil output and offshore start-ups in Latin America and the North Sea are expected to drive growth. The US is expected to lead the way with a share of about 75% of total growth, followed by Norway, Brazil, Canada, Kazakhstan and Guyana. Non-OPEC upstream sector investment in 2022 is estimated at around $424 billion, up around 19% y-o-y. It is forecast at $459 billion in 2023, up by 8% y-o-y

Graph 2: World oil demand and non-OPEC supply growth in 2022-2023 (mb/d)



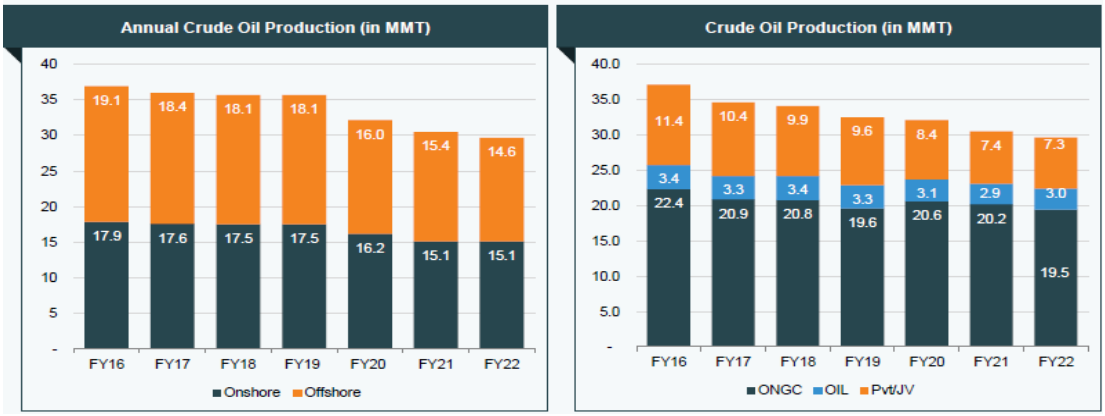
Source: OPEC.

Indian outlook

The Indian Oil sector is well developed and matured as India has been producing oil for the past ~60 years. The oil and gas sector comes under the Ministry of Petroleum and Natural Gas (MoPNG). The Director General Hydrocarbons regulates the upstream sector.

The upstream sector of oil in India is dominated by the state-owned companies Oil & Natural Gas Corporation Ltd ('**ONGC**') with a market share of ~70%, followed by Oil India Ltd ('**OIL**') with a market share of ~10% and fragmented private players having the balance ~20% market share

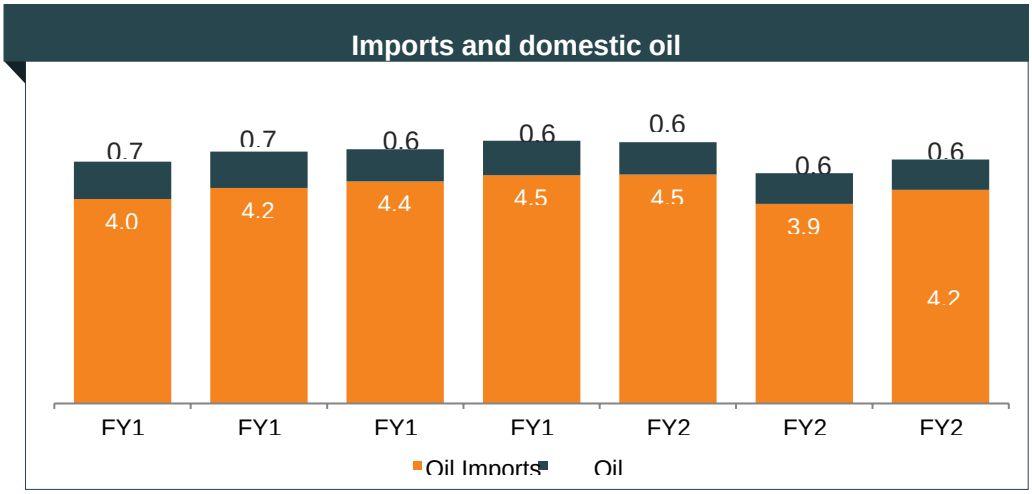
Following is a summary of crude oil production by the domestic players geography-wise and company-wise:



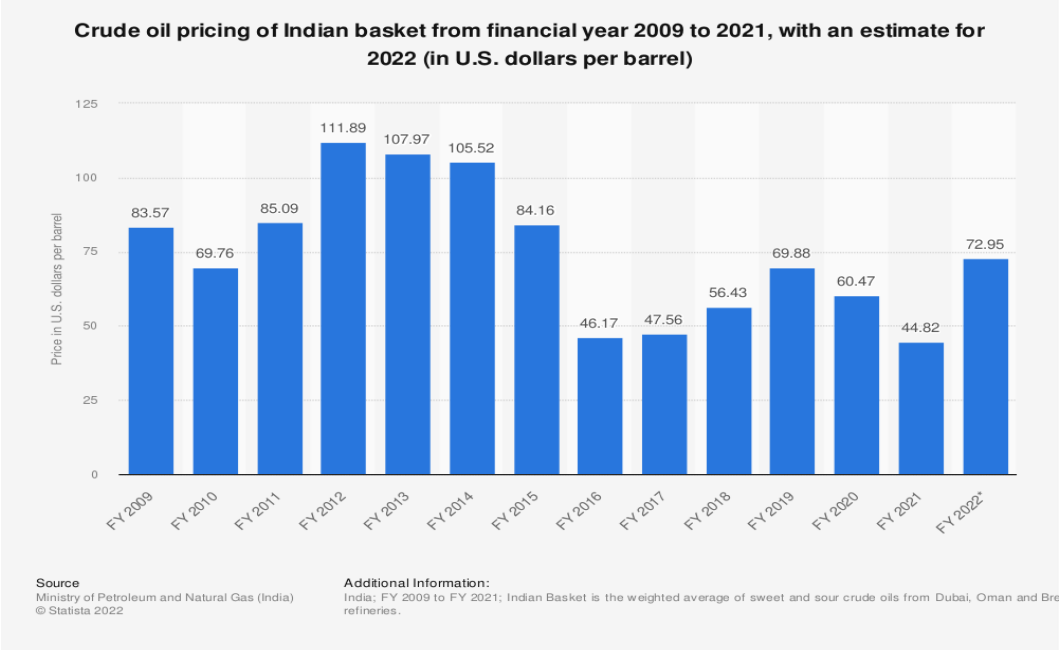
.Almost 50% of India's crude oil production is from offshore fields; however, this share is diminishing inthe past few years due to diminishing production from the ageing Mumbai High field. ONGC accounted for 65.51% of the total crude oil production in India in FY22. India's domestic crude oil production has been declining since the last decade as most of India's crude oil production comes from ageing wells that have become less productive over time. Domestic exploration companies are attempting to extend the life of currently operational wells.

A lack of new oil discoveries coupled with a long lead time to begin production from discovered wellshas led to a steady decline in India's crude oil production making India increasingly dependent on imports.

Following is a summary of the proportion of oil imports and domestic oil production in India



Following is a summary of crude oil average prices over the years in India:


Crude oil pricing of Indian basket from financial year 2009 to 2021, with an estimate for 2022 (in U.S. dollars per barrel)
Price in U.S. dollars per barrel
125
100
75
50
25
0
83.57
69.76
85.09
111.89
107.97
105.52
84.16
46.17
47.56
56.43
69.88
60.47
44.82
72.95
FY 2009
FY 2010
FY 2011
FY 2012
FY 2013
FY 2014
FY 2015
FY 2016
FY 2017
FY 2018
FY 2019
FY 2020
FY 2021
FY 2022*
Source
Ministry of Petroleum and Natural Gas (India)
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Additional Information:
India; FY 2009 to FY 2021; Indian Basket is the weighted average of sweet and sour crude oils from Dubai, Oman and Bre
refineries.

Challenges of the upstream sector

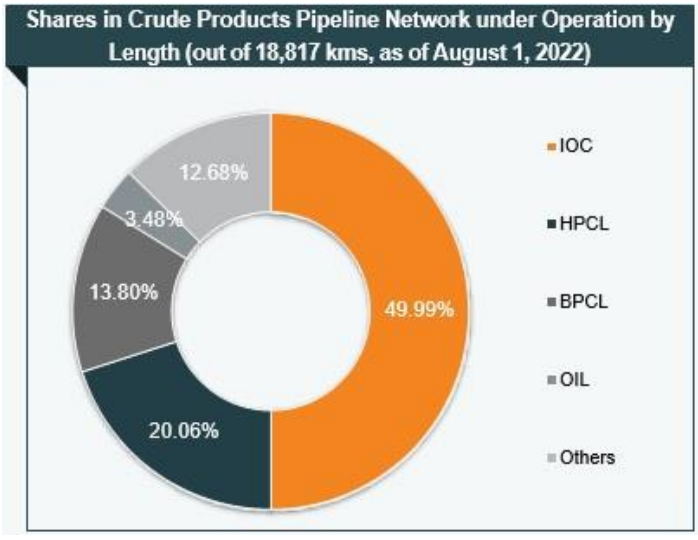
- High government regulation leading to barriers to entry in the sector
- Heavy upfront investment in identifying and acquiring new exploration fields, and subsequently devising FDPs
- Significant capital expenditure in setting up the oil wells and rigs, using the latest technologies and equipment
- Geopolitical happenings considering crude oil reserves are concentrated with a few countries but whose demand is global
- Rising fuel efficiency shall leading to reduction in fuel consumption, increasing penetration of electric vehicles, emergence of LNG as an alternate fuel and shifting focus to renewables shall lead to reduction in crude oil demand in the long term

Midstream sector

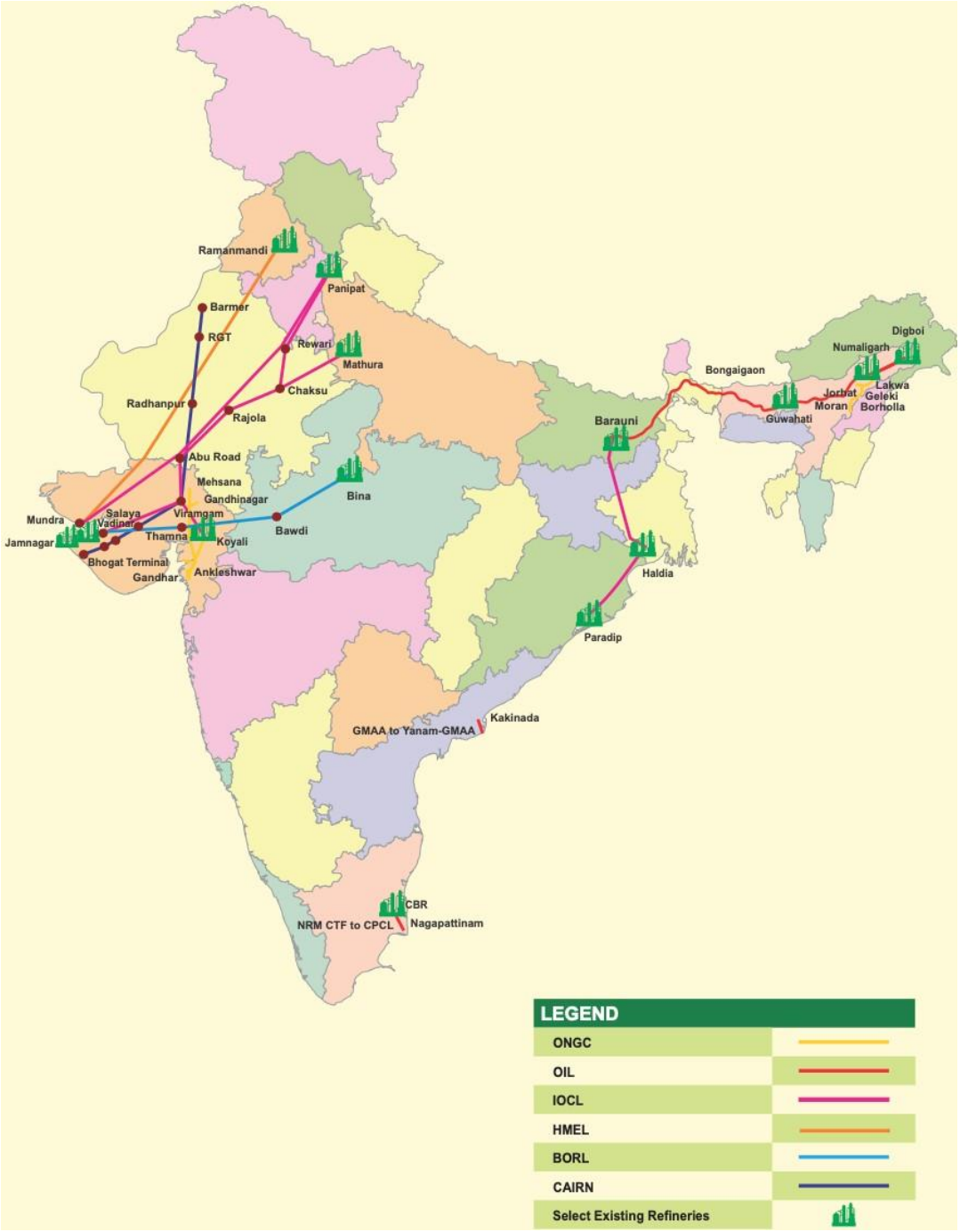
The midstream sector is concerned with the transportation and storage of crude oil produced by the upstream sector. Naturally, the performance of the midstream sector companies is dependent on the performance of the upstream sector companies. In order to generate synergies, a number of downstream companies also undertake midstream activities. In the global context, leading companies like BP Plc, Royal Dutch Shell Plc, Chevron Corporation undertake the midstream activities through their comprehensive network of pipelines.

In the Indian context, majority of the midstream sector companies are also state-owned like Indian Oil Corporation Ltd ('**IOCL**'), which is also the leading downstream sector company, followed by Hindustan Petroleum Corporation Ltd ('**HPCL**'), Bharat Petroleum Corporation Ltd ('**BPCL**') and OIL.

Following is a summary of the share in products pipeline network of the midstream sector companies:



The crude oil pipelines connecting to the refineries in India is as below:



Challenges of the midstream sector

The major challenge faced by the midstream sector companies is its heavy reliance on operations of the upstream sector companies, whose production levels are very volatile. With such a high dependency, it becomes very difficult for midstream companies to estimate the level of scaling up required in its infrastructure, which is quite expensive to set-up and operate. Even the day-to-day functioning of the pipelines and its maintenance involves huge monetary and non-monetary costs.

Downstream sector

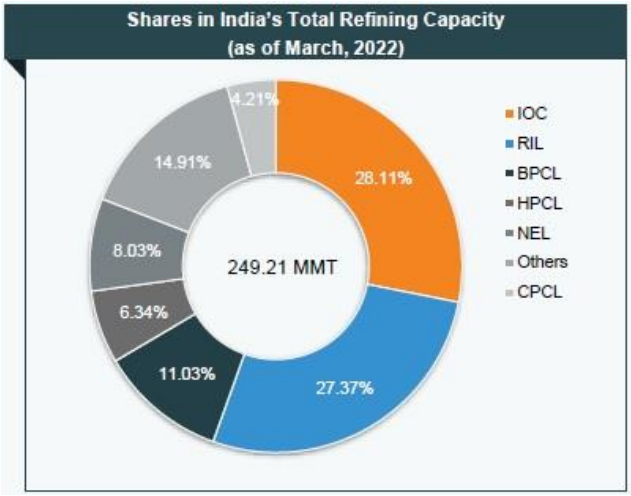
The companies in the downstream sector obtain crude oil from the upstream sector through the infrastructure provided by the midstream sector and refine them into various derivative products like petrol, diesel, Aviation Turbine Fuel ('**ATF**') and the like. The downstream companies are also generally involved in the marketing and sales of the derivate products through B2B or B2C channels. The downstream sector is regulated by the Petroleum and Natural Gas Regulatory Board (PNGRB).

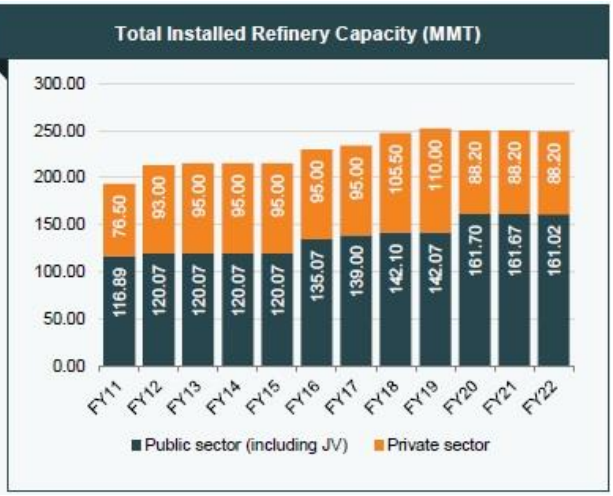
India has 23 refineries – 18 in the public sector, 2 in the joint sector and 3 in the private sector as on April 1, 2020, which are summarized below:

Sr No	Refinery/ Location	Company	Sector	State	Capacity (10^6 tons/y)
1	Jamnagar (for export market)	Reliance Industries Ltd ('**RIL**')	Private	Gujarat	35.2
2	Jamnagar (for domestic market)	RIL	Private	Gujarat	33
3	Nyara Energy	Nyara Energy Ltd	Private	Gujarat	20
4	Kochi	BPCL	Public	Kerala	15.5
5	Mangalore	ONGC	Public	Karnataka	15
6	Paradip	IOCL	Public	Odisha	15
7	Panipat	IOCL	Public	Haryana	15
8	Gujarat	IOCL	Public	Gujarat	13.7
9	Mumbai	BPCL	Public	Maharashtra	12
10	Guru Govind Singh	HPCL, HPCL Mittal Energy Ltd.	Joint	Punjab	11.3
11	Manali, Chennai	Chennai Petrol Corporation Ltd	Public	Tamil Nadu	10.5
12	Vishakhapatnam	HPCL	Public	Andhra Pradesh	8.3
13	Mathura	IOCL	Public	Uttar Pradesh	8
14	Haldia	IOCL	Public	West Bengal	8
15	Bina	Bharat Oman Refinery Ltd.	Joint	Madhya Pradesh	7.8
16	Mumbai	HPCL	Public	Maharashtra	7.5
17	Barauni	IOCL	Public	Bihar	6

18	Numaligarh	OIL Government of Assam	Public	Assam	3
19	Bongaigaon	IOCL	Public	Assam	2.35
20	Guwahati	IOCL	Public	Assam	1
21	Nagapattnam	CPCL	Public	Tamil Nadu	1
22	Digboi	IOCL	Public	Assam	0.65
23	Tatipaka	ONGC	Public	Andhra Pradesh	0.07

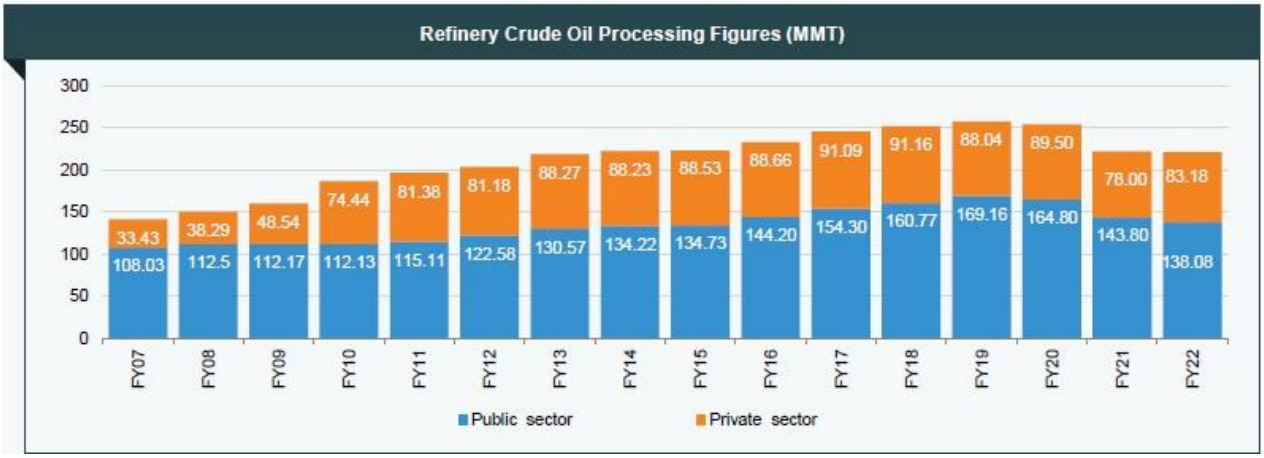
Following is a summary of India's refining capacity:





Indian refinery industry has done well in establishing itself as a major player globally. India is the 4th largest refiner globally and 2nd in Asia, after China. Refinery capacity utilization was ~102% for the year 2019-20. India's state refineries have upgraded their facilities to comply with a new government requirement to produce oil products with the equivalent of Euro VI emission standards. Crude oil throughput of public sector refineries increased at a CAGR of 1.65%, from 108.03 MMT in FY07 to 138.08 MMT in FY22. At the same time, crude oil throughput of private sector refineries recorded growth at a CAGR of 6.27%, from 33.43 MMT to 83.18 MMT.

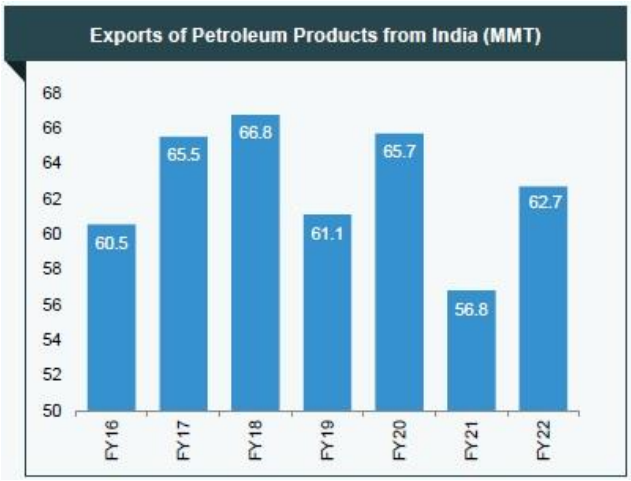
The trend in refinery crude oil processing is as follows:

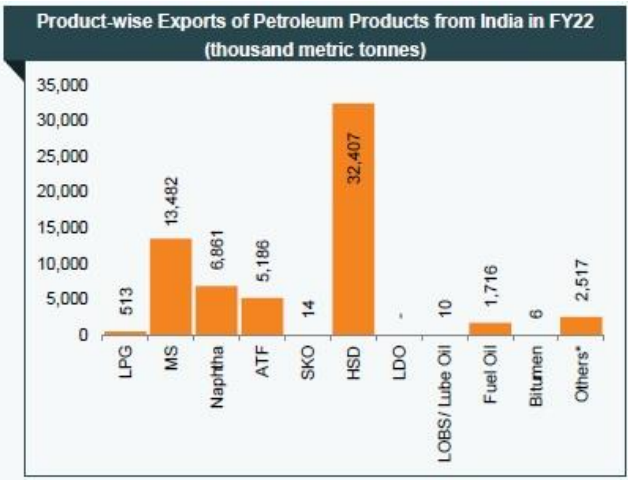


As of March, 2022, the sector's total installed provisional refinery capacity stood at 249.21 MMT, and IOC emerged as the largest domestic refiner with a capacity of 70.05 MMT. In FY22, the top three companies, IOC, RIL and BPCL contributed over 66% to India's total refining capacity. In August 2021, India's state refiners announced plan to invest Rs. 2 trillion (US$ 26.96 billion) by 2025 to increase oil refining capacity by 20% in India.

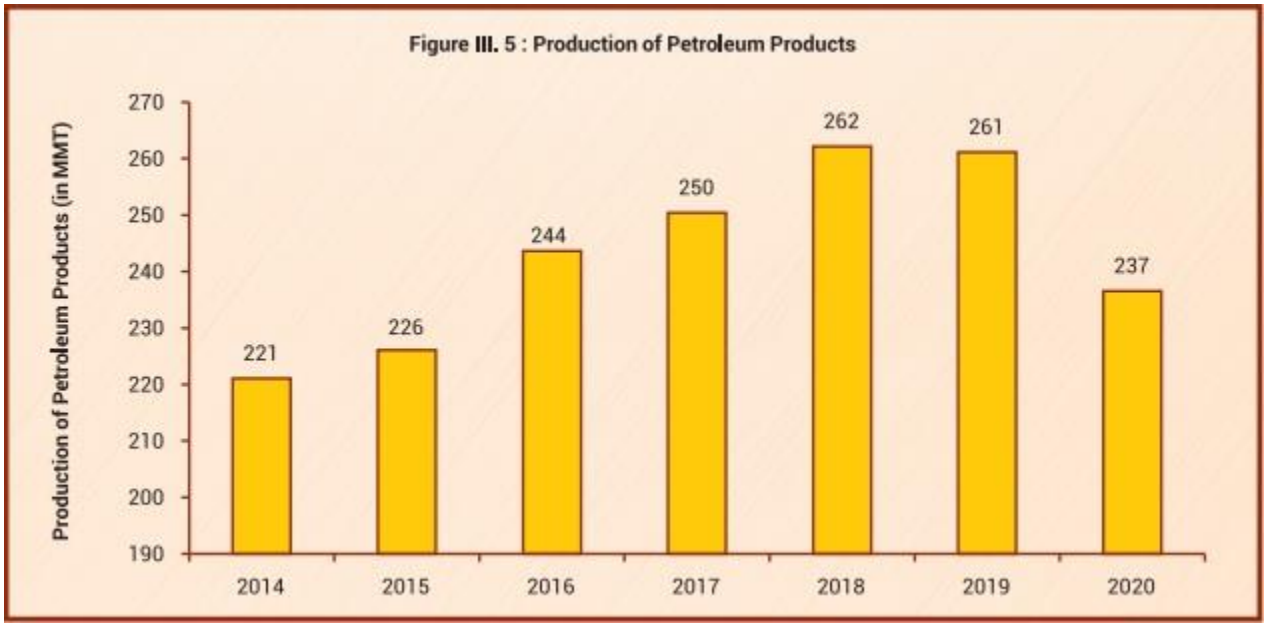
India is one of the major exporters of petroleum products and it has established itself as a major global player. Exports of petroleum products from India reached 62.7 MMT in FY22 from 60.5 MMT in FY16. HSD was the major export item among petroleum products, followed by MS, Naphtha and ATF. India is emerging as a refinery hub and the total refinery capacity far exceeds the demand. Indian exports of petroleum products contributes a lion's share to India's GDP and balance ofpayments.

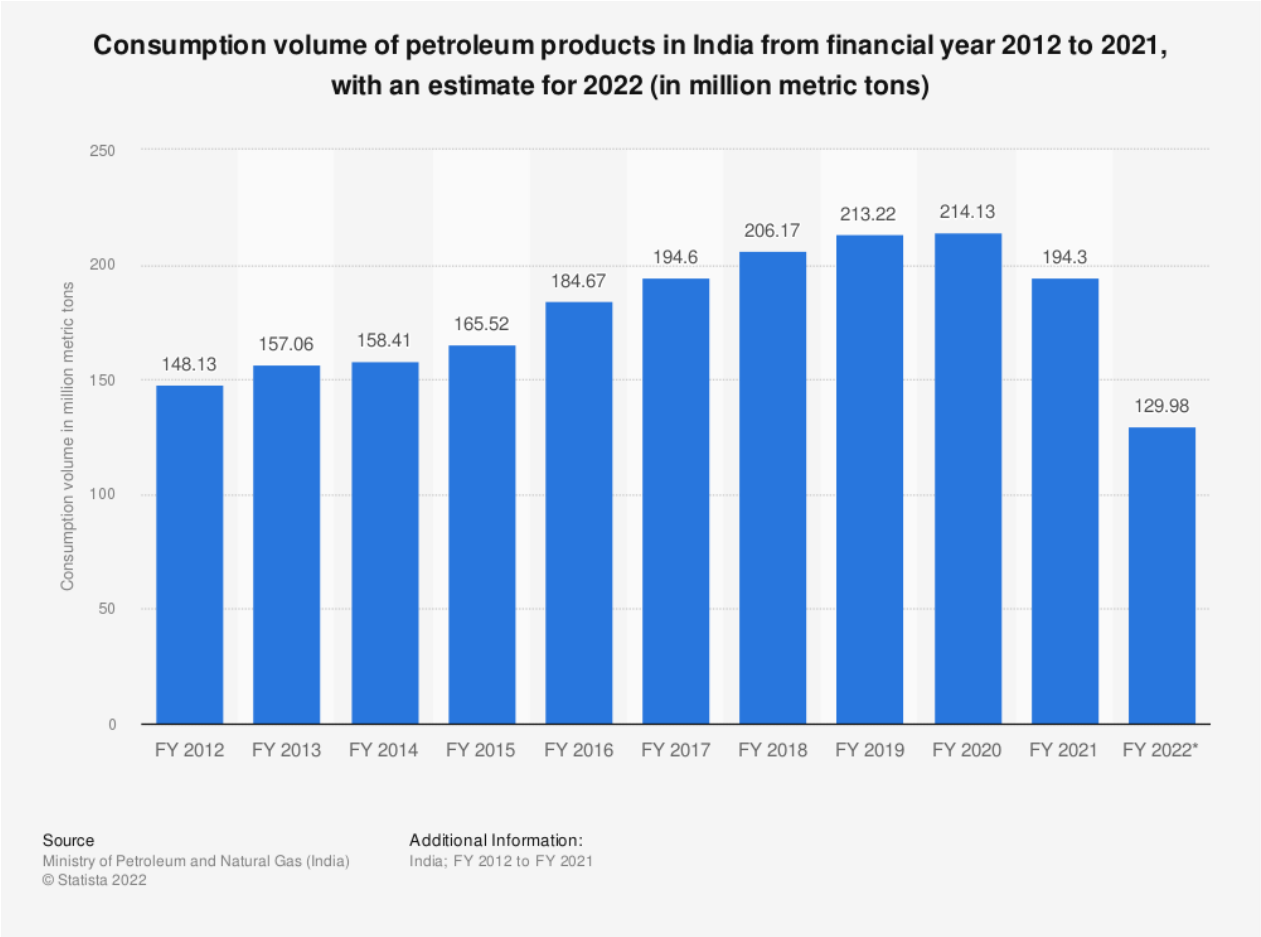
Following is a summary of the exports of petroleum products from India:



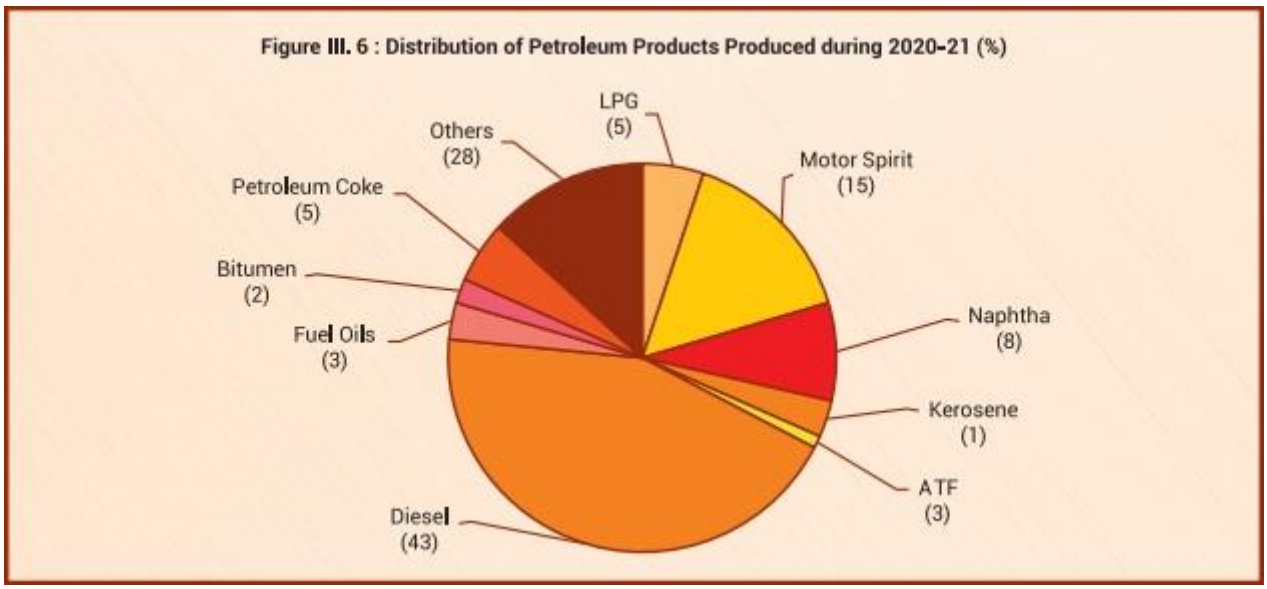


Following are the graph of the domestic production and consumption of petroleum products in India:





Derivate product-wise distribution of the petroleum products is as follows:



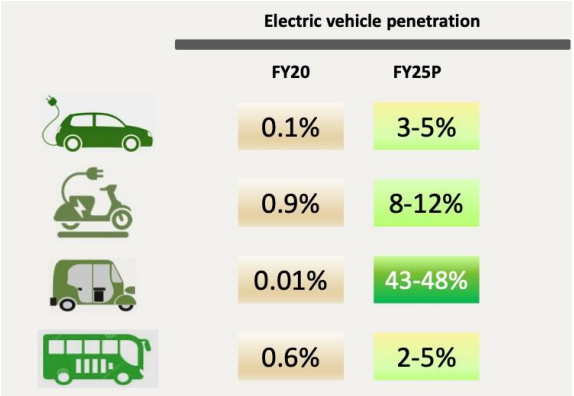
Bifurcation of petroleum products by its general usage is as follows:

Sr No	Petroleum product	Usage
1	Diesel	Transportation
2	Petrol	
3	ATF	
4	LPG	Household
5	Kerosene	
6	Naphtha	Industrial
7	Petcoke	Others
8	Furnance Oil	
9	Bitumen	

Challenges of the downstream sector

As the downstream sector companies are mainly at the mercy of their upstream and midstream sector counterparts, its challenges are similar in as much as predicting the level of operations becomes very difficult due to the constant volatility. Also, downstream sector companies are the face before the ultimate customers who are the worst affected due to the volatility in prices of petroleum products.

From a specific product perspective, shift towards petrol passenger cars and shift of LCVs to CNG may restrict long-term growth of diesel, though diesel may witness a recovery in 2022 supported by higher sales of commercial vehicles. Even railway electrification shall result in a reduced offtake of diesel by the railways in the long-run. Even petrol growth may recover in the short-run but may moderate in the long-run due to tough competition from CNG which is more cost competitive. Most importantly, increasing penetration of electric vehicles shall reduce demand of petrol and diesel considerably. Two and three wheelers will have a sizeable Electric Vehicles ('**EV**') penetration on account of declining battery prices, availability of charging infrastructure, favourable cost of ownership and government's focus on electric mobility adoption. Following is the projection of EV penetration by FY 2025:



Kerosene consumption has been declining over the years and is expected to decline further on account of substitution by LPG.

Major Players in the Oil sector

Following are the important metrics of the major players in the oil sector in India[1]:

(Rs in crs)

#	Company	U/M/D	Market Cap	ROCE	P/E	P/BV	Div/ Share	Promoter %
1	RIL	D	Rs 17,16,385	8.02	28.64	2.29	8	50.57
2	ONGC	U, M, D	Rs 1,85,370	13.19	4.53	0.79	10.50	58.89
3	IOCL	M, D	Rs 1,13,040	17.61	2.90	0.82	11.40	51.50
4	BPCL	M, D	Rs 74,744	15.28	6.54	1.47	16	52.98
5	HPCL	M, D	Rs 35,449	10.43	5.24	0.92	14.00	54.90
6	OIL	U, M, D	Rs 22,642	18.17	4.60	0.85	14.25	56.66

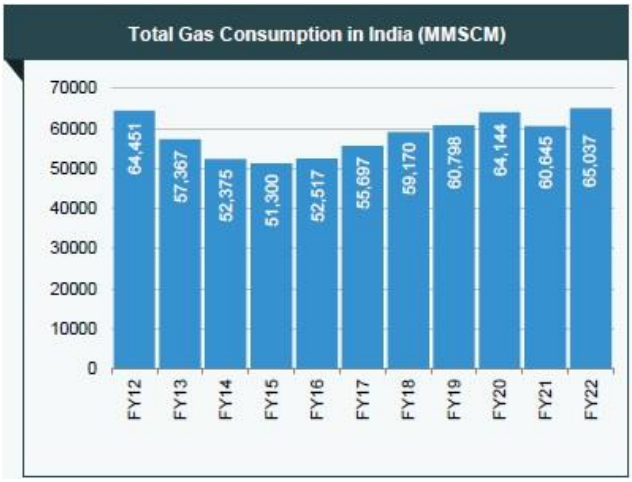
All data as on 7January 2023

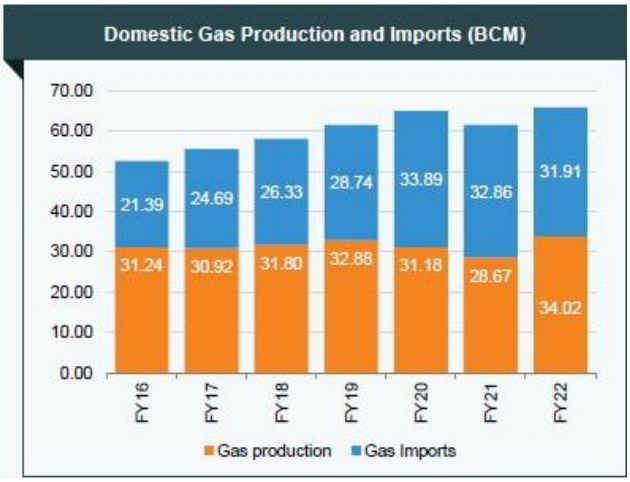
NATURAL GAS SECTOR

Below is a detailed value chain of the Natural Gas sector:

The value chain of the natural gas sector is quite similar to the oil sector. Also, a number of players in the natural gas sector are the same as that of the oil sector. Accordingly, the operations and functioning are quite similar, along with the challenges. However, natural gas being a cleaner fuel compared to oil is beginning to have a comparatively higher acceptance.

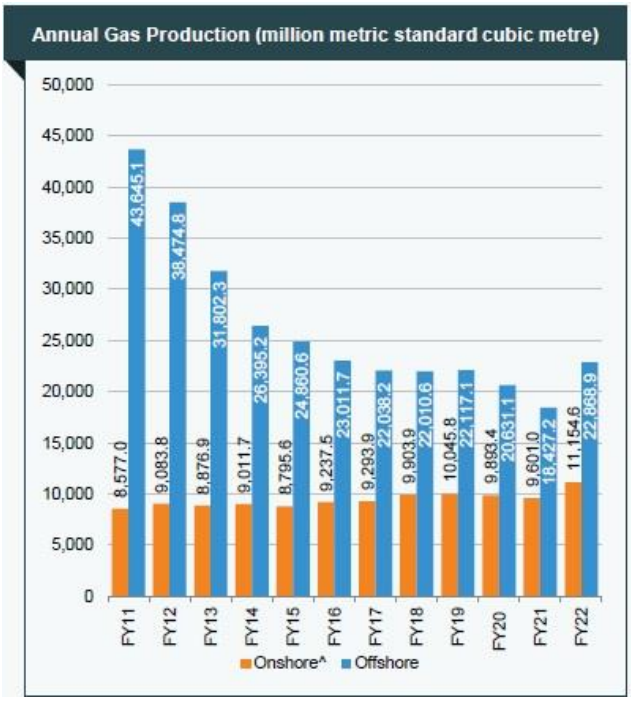
The natural gas production and consumption is both on the rise, with a slight reduction in FY21 on account of the COVID-19 pandemic. Following is a brief summary of the demand and supply (domestic and imports):

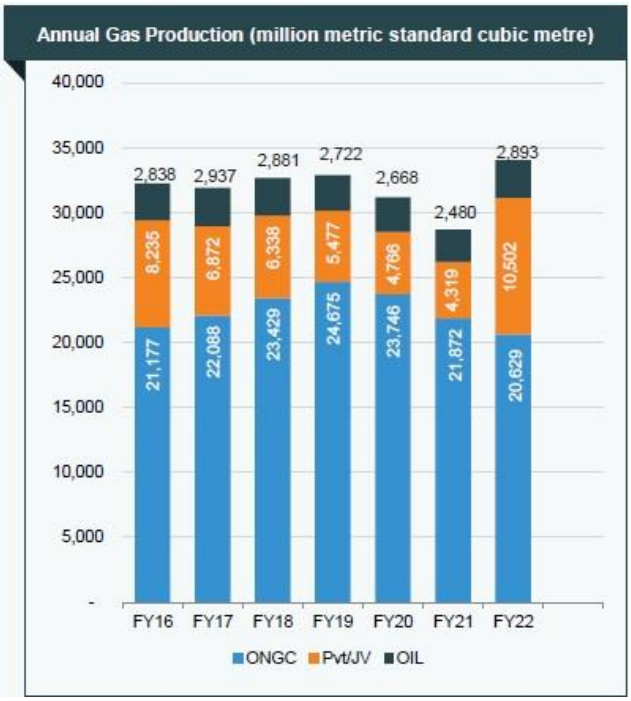




Upstream

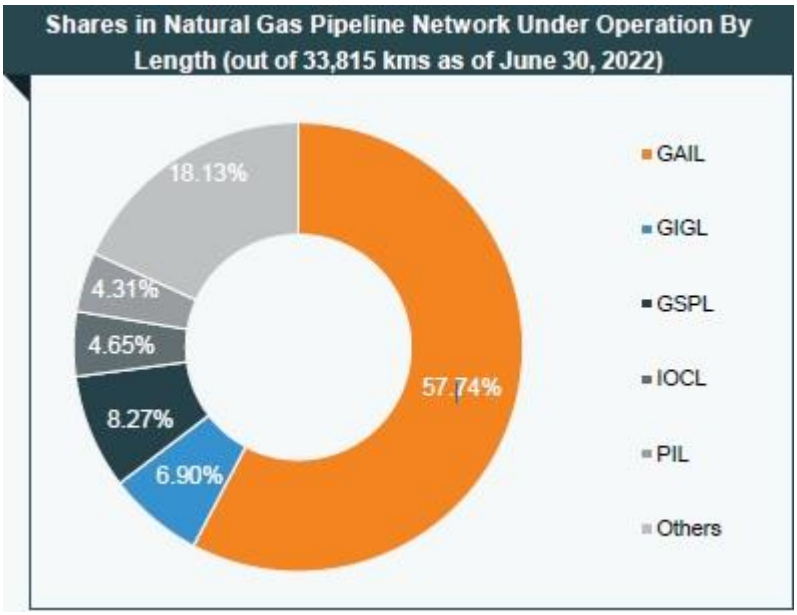
The major players in the upstream sector for natural gas are the same as the oil sector namely ONGC and OIL. Following is a summary of the annual gas production, bifurcated into onshore and offshore as well as by producer companies:





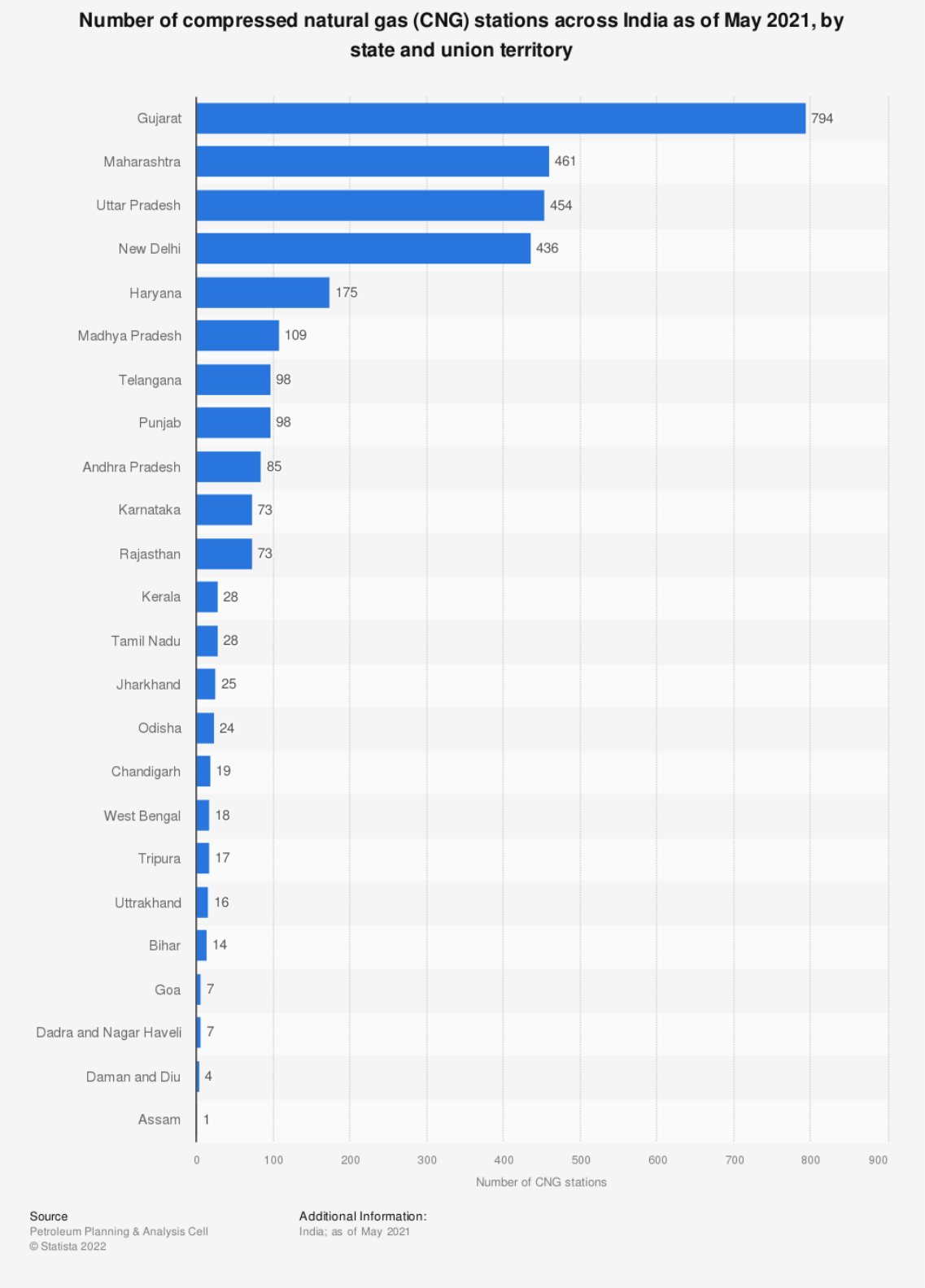
Midstream

The major midstream sector players in natural gas area are also state-owned companies namely Gas Authority of India Ltd ('GAIL') with a share of ~70%, followed by Gujarat State Petronet Ltd. Due to the affordability and clean nature of natural gas, the government through PNGRB is aggressively attracting investments for building gas infrastructure by simplifying the country's gas pipeline tariff structure to make fuel more affordable for distant users. Following is a snapshot of the pipeline network of various midstream sector players.



Downstream

There is an aggressive push by the government to have more and more CNG outlets. A number of CNG outlets operate side by side with the petrol and diesel outlets, but a number of standalone CNG outlets are also coming up. Following is the number of CNG stations state-wise in India:



Major players in the Natural Gas sector

Following are the important metrics of the major players in the natural gas sector in India[2]:

(Rs in crs)

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2	ONGC	U, M, D	Rs 1,85,370	13.19	4.53	0.79	10.5	58.89
3	Adani	M, D	Rs 3,91,026	24.79	464.32	97.81	0.25	74.80
4	IOCL	M, D	Rs 1,13,040	17.61	2.90	0.82	11.40	51.50
5	GAIL	M	Rs 63,943	17.06	3.76	1.08	10.0	51.9
6	Petronet	M	Rs 32,685	25.65	8.45	2.13	11.50	50.00
7	GSPL	M	Rs 15,546	24.25	8.92	1.85	2.00	37.63
8	OIL	U, M, D	Rs 22,642	18.17	4.60	0.85	14.25	56.66

[2] As on January 7, 2023

GOVERNMENT POLICIES AND INITIATIVES

National Monetization Pipeline ('NMP')

Natural gas

Under the NMP unveiled by the Finance Minister on August 23, 2021, natural gas pipelines of 8,154 km having indicative monetization value of ~Rs 25k crore and having a 4% share in overall NMP in value terms is proposed to be monetized. As part of the government's environment agenda, the share of natural gas in India's primary energy requirement is proposed to be increased from 6% currently to 15% by 2030.

The state owned midstream sector company GAIL has been operating about ~49-52% capacity utilization in recent years, which is sub-optimal. Accordingly, it is proposed to monetize ~8,154 km of GAIL's pipeline network for ~Rs 3 cr per km (calculated using the enterprise value method), of which 7,928 km are from existing operational pipeline assets and the rest from pipelines that are expected to become operational during NMP period. During FY22, two pipelines with a total length of 2,229 km have been identified for monetization. The monetization is proposed to be undertaken by the Carry-Operate-Transfer ('**COT**') structure or by creation of a pipeline InvIT. The InvIT based structure has a precedent in India Infrastructure Fund wherein an InvIT sponsored by Brookfield Asset Management took over 100% ownership of 1,375 km long Kakinada to Bharuch natural gas pipeline from a private sponsor for a period of 20 years against an upfront consideration. The indicative expected monetization under the NMP for natural gas pipelines is as under:

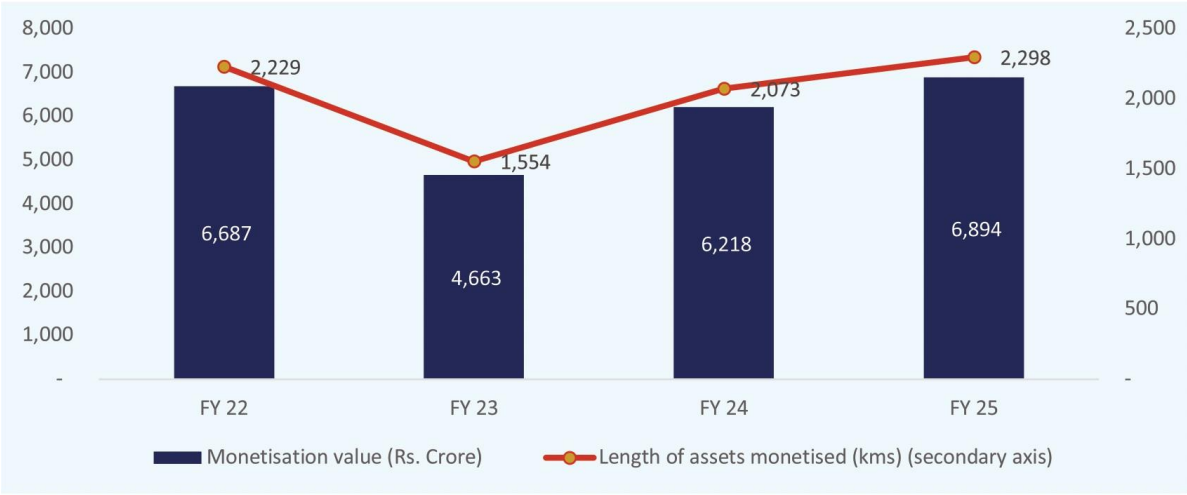


Figure 16: Pipeline phasing – Natural gas pipelines (Rs crore)

In fact, the government will kickstart the NMP process by monetizing the natural gas pipelines of GAIL.

Petroleum, petroleum product pipelines and other assets

The government proposed to monetize the following petroleum product and LPG pipelines:

S.No.	Asset type	FY22	FY23	FY24	FY25	Total
1	Petroleum product pipelines (km)	755	629	906	906	**3,196**
2	LPG pipelines (km)	-	141	296	296	**733**
3	Hydrogen generation plants (nos.)	1	1	-	-	**2**

Pipelines of aggregate length 3,930 km are proposed to be monetized for a value of ~Rs 23k crores having ~4% share in overall NMP in value terms is proposed to be monetized. These pipelines are owned by IOCL, HPCL and GAIL.

The indicative expected monetization under the NMP for petroleum product and LPG pipelines is as under:

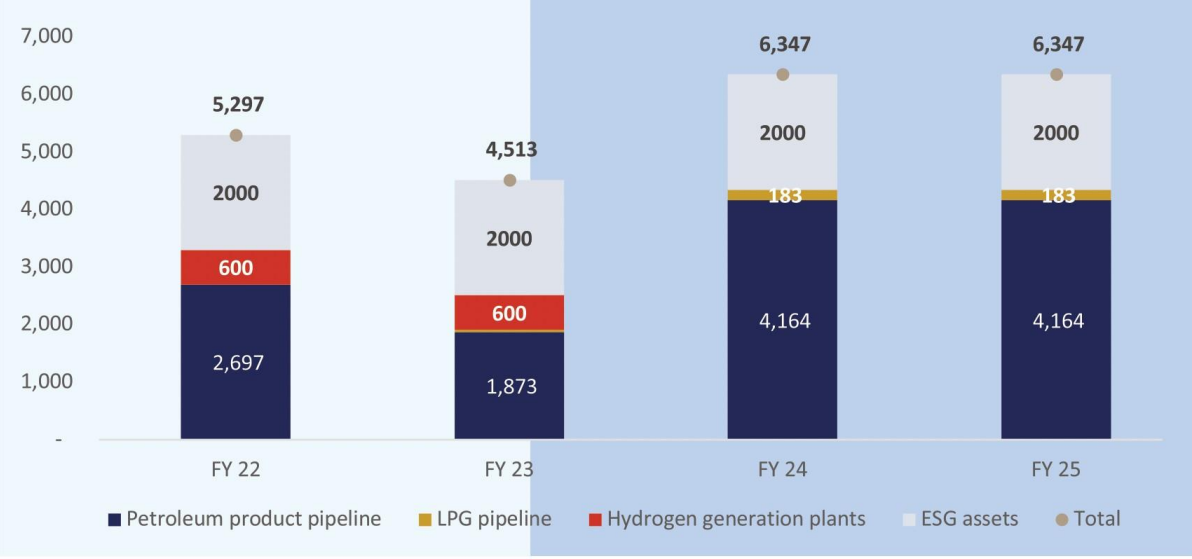
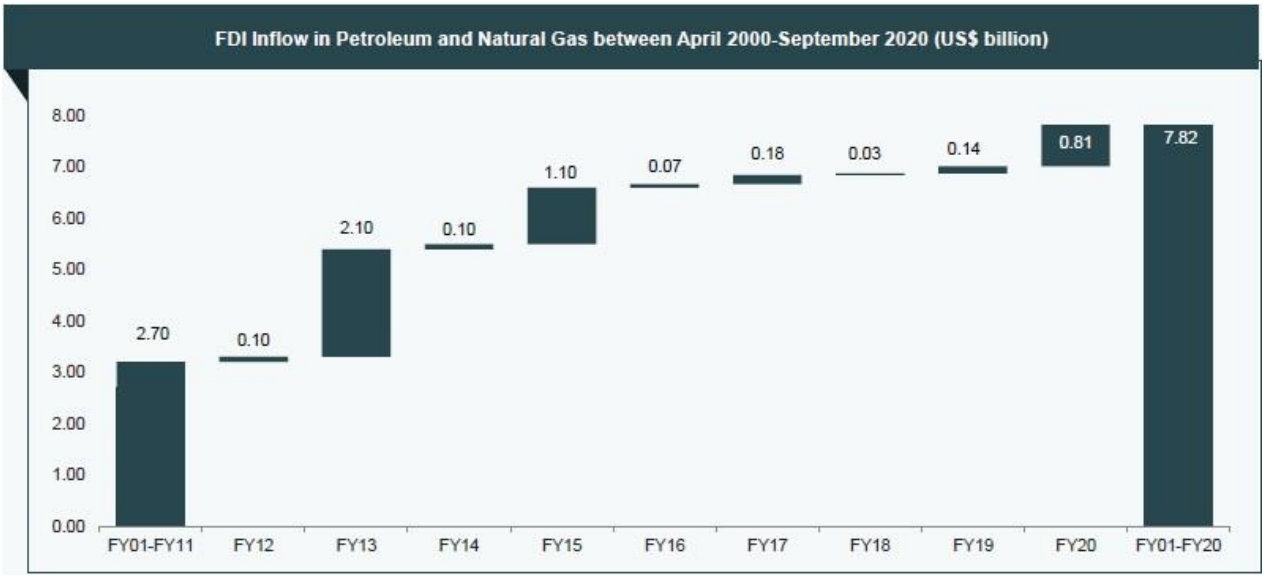


Figure 17: Pipeline phasing – Petroleum product / LPG pipeline & other assets (Rs crore)

Foreign Direct Investment ('FDI')

The Government of India permits Foreign Direct Investment (FDI) across the hydrocarbon value chain covering the upstream, midstream and downstream sectors. The present FDI policy allows 100% FDI

in petroleum and natural gas sector under the automatic route for exploration and production, refining by private companies (49% for PSUs without any disinvestment or dilution of domestic equity in existing PSUs), marketing of petroleum products, pipelines, storage and LNG regasification infrastructure and all related services, subject to existing sectoral policy and regulatory framework in the oil and gas sector. Inflow of FDI in petroleum and natural gas has varied considerably over the years, which could partly be due to the requirement of a large investment commitment. Following chart summarizes the trend of FDI in the Oil & Gas sector:



BPCL privatization

The government, which holds a 52.98% stake in BPCL, is in the process of divesting its holdings, for its plan to raise a record Rs 1.75 trillion from disinvestment proceeds in FY 2022. The government has given access of BCPL's data to prospective bidders in April 2021 and so far, mining to oil conglomerate Vedanta and PE firms Apollo Global and I Sqaured Capital's arm Think Gas are in the race to buy the government's stake in BPCL.

Proposed unified pipeline tariff

PNGRB had proposed implementation of the unified tariff for natural gas grid in September 2020. Under this regime, the tariff calculation will be based on the weighted average of the zonal tariffs for the pipeline network. This will likely reduce the landed cost of gas to the consumer located far from the source of gas. As per this structure, buyers will be charged a fixed tariff for the transport of gas within 300 kms of a source and a fixed tariff for the transport of gas beyond 300 kms on a single pipeline network. This is likely to result in buyers from nearby gas sourcing hubs to bear a higher cost while those further away to benefit. This plan is expected to encourage new pipeline development.

The Green Hydrogen Policy

The Ministry of Power issued the Green Hydrogen Policy on 17 February 2022. This policy is in furtherance of the National Hydrogen Mission of the GoI in which the government has set an ambitious road map to make India one of the leading hydrogen manufacturers globally. The Green Hydrogen Policy is a significant stepping stone towards adopting alternative non-conventional fuel to reduce India's carbon footprint. Although the policy is named the Green Hydrogen Policy, it also provides a framework for the production of green ammonia.

Green hydrogen and green ammonia have been defined as hydrogen or ammonia produced by way of electrolysis of water using renewable energy, including renewable energy which has been banked or produced from biomass.

The Green Hydrogen Policy provides a suite of incentives to attract both domestic and foreign investors to tap in to the hydrogen market. Some of the key incentives provided under the Green Hydrogen Policy are:

- a waiver of interstate transmission charges between the green hydrogen/green ammonia manufacturing plant and the renewable energy project supplying the electricity;
- developers have been given the option to manufacture green hydrogen/green ammonia by using renewable energy produced by projects developed by them or a third party anywhere, or sourced from a power exchange;
- the allotment of land in renewable energy parks for setting up green hydrogen/green ammonia plants as well as bunkers in ports for storage of green ammonia for export; and
- time-bound single-portal clearance for statutory clearances and permission required for the manufacture, transportation, storage and distribution of green hydrogen/green ammonia.

Although the policy does not mandate purchase obligations on particular industries, one such hydrogen consumer industry that will play a significant role in the development of the hydrogen market is the oil refinery industry.

City Gas Distribution Infrastructure

The GoI aims to increase the share of natural gas in the energy mix by 15% by 2030. The amount of natural gas in the primary energy mix increased from 6.3% to 6.7% from 2020 to 2021 and this is expected to grow in the coming years.

The city gas distribution (CGD) infrastructure has been the backbone of the government’s vision for a gas-based economy and India has seen phenomenal growth in the CGD sector. The CGD infrastructure is attracting not only domestic, but also foreign, investors. The Petroleum and Natural Gas Regulatory Board (PNGRB), the authority that regulates the development and operation of the CGD infrastructure, recently concluded its 11th bidding round for the CGD infrastructure across the country, cutting across different cities.

After the 11th CGD bidding round, the PNGRB authorised/issued letters of intent for 289 Geographical Areas (GAs). Furthermore, under the 11A CGD bidding round, the PNGRB has invited bids for six GAs covering 28 districts. On completion of the 11th and 11A CGD bidding rounds, the CGD network will potentially cover 98% of the population and 88% of the GAs of the country, including smart cities situated within the GAs.

NOTABLE TRENDS

Expansion

- In May 2022, ONGC announced plans to invest US$ 4 billion from FY22-25 to increase its exploration efforts in India.
- In March 2022, the Board of IOCL approved plans to invest Rs. 7,282 crore (US$ 932.6 million) for the development of City Gas Distribution (CGD) network in 9 geographical areas (GAs).
- In March 2022, the Board of Oil India approved an investment of Rs. 6,555 crore (US$ 839.49 million) for the Numaligarh petrochemical project.
- In January 2022, Indian Oil Corp. Ltd. (IOCL) announced plans to expand its city gas distribution (CGD) business, looking to invest Rs. 7,000 crore (US$ 918.6 million).
- In January 2022, Adani Total Gas Ltd (ATGL), a joint venture between the Adani Group and Total Energies, won licences to expand its City Gas Distribution (CGD) network to 14 new geographical areas, with an investment of Rs. 20,000 crore (US$ 2.62 billion).
- In October 2021, the Ministry of Petroleum & Natural Gas approved a revised project cost of Rs. 28,026 crore (US$ 3.8 billion) to increase refining capacity for the ongoing Numaligarh Refinery Expansion Project from 3 to 9 MMTPA.
- In August 2021, Indian Oil Corp (IOC) announced investment of Rs. 1 lakh crore (US$ 13.12 billion) to raise its refining capacity by almost a third over the next 4-5 years.
- To expand beyond the natural gas business, in July 2021, GAIL (India) Ltd. announced an investment of Rs. 5,000 crore (US$ 670.18 million) to establish a portfolio of renewable energy targeting a capacity of at least 1 gigawatts and build plants for both compressed biogas and ethanol.
- In February 2021, the government launched key oil & gas projects in Assam, such as INDMAX Unit at Indian Oil's Bongaigaon Refinery, Oil India Limited's secondary tank farm at Madhuban, Dibrugarh and a 'Gas Compressor Station' at Hebeda Village, Makum and Tinsukia remotely from Dhemaji in Assam.
- In February 2021, the government launched key oil and gas projects such as the Ramanathapuram – Thoothukudi natural gas pipeline and Gasoline Desulphurisation Unit at Chennai Petroleum Corporation Limited, Manali.
- State run energy firms Bharat Petroleum, Hindustan Petroleum and Indian Oil Corp have plans to spend US$ 20 billion on refinery expansions to add units by 2022.

Diversification

- Oil companies are focusing on vertical integration for the next stage of growth. For instance, oil producer Oil India Ltd. is planning to build and operate refineries, while Indian Oil is planning to enter oil and gas exploration
- In July 2021, India diversified procurement for crude by announcing its first shipment from Guyana. This move also indicates a future roadmap for extended alliance with Guyana in the oil & gas sector.

Investments to enhance production

- In February 2022, Minister of Petroleum & Natural Gas, and Housing & Urban Affairs, Mr. Hardeep Singh Puri, said that India will more than double its exploration area of oil and gas to 0.5 million sq. km. by 2025 and to 1 million sq. km. by 2030 with a view to increase domestic output
.
- In November 2021, Oil and Natural Gas Corp. Ltd (ONGC) announced that it invested up to Rs. 6,000 crore (US$ ~800 million) in the petrochemicals arm—ONGC Petro Additions Ltd. (OPaL)—to meet its equity requirements.

- In September 2021, Bharat Petroleum Corporation Ltd. (BPCL) announced its plan to invest over Rs. 1 lakh crore (US$ 13.66 billion) over a period of five years to enhance petrochemical capacity and improve refining efficiency, gas proliferation, upstream oil & gas exploration, production, and to augment the (fuel) marketing infrastructure.

- In July 2021, BPCL announced plan to establish its first-generation ethanol production plant in Telangana at an estimated investment of Rs. 1,000 crore (US$ 134.04 million).

Commercial use of Oil

- In October 2020, the Cabinet Committee on Economic Affairs (CCEA) allowed Abu Dhabi National Oil Co. (ADNOC) to commercially use 50% of the oil it had stored in Indian underground strategic reserves.

- This flexibility will encourage the company to store more oil in the three strategic petroleum reserves built at Visakhapatnam, Mangalore, and Padur and will act as an insurance against supply and price disruptions

Pilot Project initiated for Shale Gas Production in India

- Cairn Oil & Gas, a Vedanta Group company, has announced plans to invest US$ 700 million to boost the drilling infrastructure at its 100 exploratory wells in the country, including in the pilot project for shale oil/gas in Rajasthan's Barmer region.

- Oil and Natural Gas Corp (ONGC) has started shale gas exploration by spudding the first Shale Gas well RNSG-1 in Burdwan district of West Bengal.

- In July 2021, Great Eastern Energy Corporation Limited (GEECL) announced plans to invest Rs. 15,000 crore (US$ 1.96 billion) for shale gas core well exploration in West Bengal.

Move to non-conventional energy resources

- In April 2022, Indian Oil Corporation Limited, Larsen & Toubro and Goldman Sachs-backed renewable energy producer ReNew Power formed a joint venture by signing a term sheet. This JV will develop green hydrogen projects, helping India cut down its carbon emissions.

- In February 2022, Nepal and India agreed to form a Joint Hydro Development Committee to explore the possibility of viable hydropower projects.

- In September 2021, Indraprastha Gas Limited (IGL) signed a memorandum of understanding with the South Delhi Municipal Corporation (SDMC) to build a waste to energy plant in Delhi to fuel vehicles.

- In July 2021, Indian Oil Corporation (IOC) announced plans to establish India's first green hydrogen plant at the Mathura refinery to introduce green hydrogen activities and projects in the oil and gas sector in the country.

- In July 2021, NTPC and ONGC, an upstream oil company, announced plans to expand the offshore wind energy development in India and accelerate presence in the renewable energy space.

More focus upon small companies

- Private sector units like Adani, Sun Petrochemicals and few new entrants have bagged 1/3rd of small oil and gas fields.

ONGC Videsh

- In June 2021, ONGC Videsh is in the process to raise $ 525 million in overseas foreign money loans from a mixture of home and overseas lenders to repay bonds maturing in the subsequent months.

- ONGC Videsh, the abroad arm of the state-run explorer ONGC, is in discussion with half a dozen international and domestic banks for the loan and intends to close the deal this month and draw down next month.

Innovate for India

- In April 2022, Bharat Petroleum Corporation Ltd. (BPCL) and Microsoft established a strategic cloud partnership targeted at speeding up the company's digital transformation and influencing the oil and gas industry's future innovation.
- In February 2021, Indian Oil Corp. Ltd. signed a ‘statement of intent’ with Greenstat Hydrogen India Pvt. Ltd. to establish a centre of excellence for hydrogen value chain and other related technologies such as hydrogen storage, fuel cells, etc.

Model Retail Outlet Scheme

- In November 2021, Indian Oil, Bharat Petroleum Corporation Limited and Hindustan Petroleum Corporation Limited announced the launch of Model Retail Outlet Scheme and a Digital Customer Feedback Programme called Darpan@petrolpump. These three oil PSUs have joined hands to launch Model Retail Outlets to enhance service standards and amenities across their networks, which serve over six crore consumers every day.

Opportunities

Upstream Segment

- Locating new fields for exploration: 78% of the country's sedimentary area is yet to be explored.
- Increasing the share of natural gas: The government is working towards increasing the share of
- gas from 6.2% (currently) to 15% of the energy mix by 2030.
- Development of unconventional resources: CBM fields in deep sea.
- Opportunities for secondary/tertiary oil producing techniques.
- Higher demand for skilled labour and oilfield services and equipment.

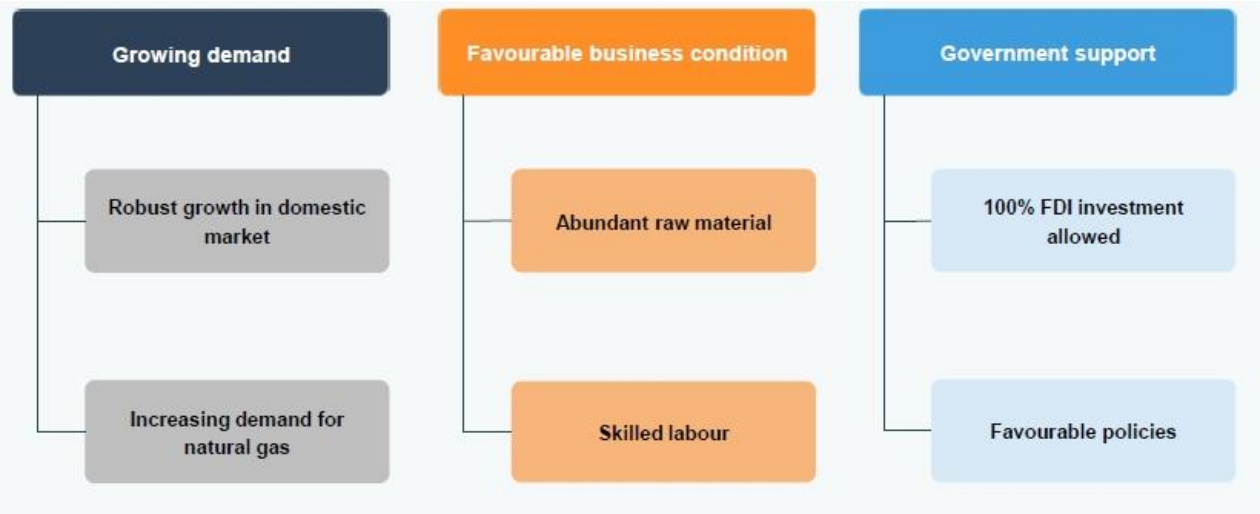
Midstream Segment

- Expansion in the transmission network of gas pipelines.
- As of March 2021, the Petroleum and Natural Gas Regulatory Board (PNGRB) authorised the 33,764-km natural gas pipeline network to develop a national gas grid and boost the availability of natural gas in India.
- LNG imports have increased significantly, which provides an opportunity to boost production capacity.
- In light of mounting LNG production, huge opportunity lies for LNG terminal operation, engineering, procurement, and construction services.

Downstream Segment

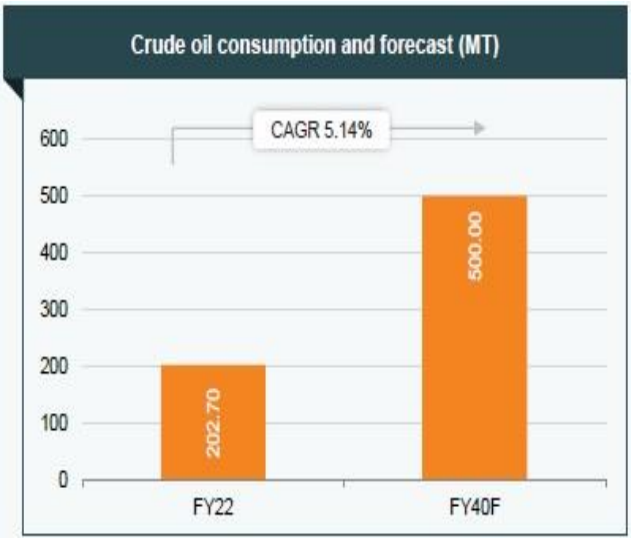
- India is already a refining hub with 21 refineries, and expansion is planned for tapping foreign investment in export-oriented infrastructure, including product pipelines and export terminals.
- Development of City Gas Distribution (CGD) networks similar to Delhi and Mumbai's CGDs.
- India is set to expand its natural gas grid to 34,500 kms by adding another 17,000 km worth of gas pipelines. The regasification capacity of the existing 42 MMT per annum will be expanded to 61 MMT per year by 2022.
- Indian companies are expected to spend Rs. 100 billion (US$ 1.35 billion) over three years on 1,000 liquefied natural gas (LNG) stations along main roads and industrial corridors and in mining areas to cut diesel consumption.

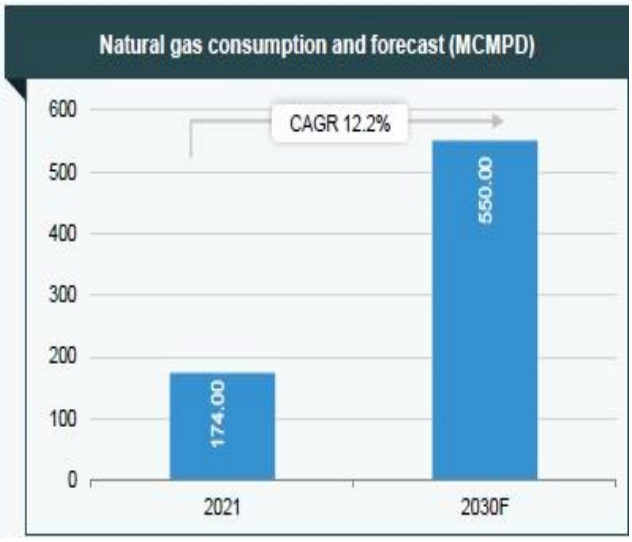
Growth Drivers



- Energy demand of India is anticipated to grow faster than the energy demand of all major economies on the back of robust economic growth. Consequently, India's energy demand as a percentage of global energy demand is expected to rise to 11% in 2040 from 6% in 2017.
- Crude oil consumption is expected to grow at a CAGR of 5.14% to 500 million tonnes by FY40 from 202.7 million tonnes in FY22.
- Natural Gas consumption is forecast to increase at a CAGR of 12.2% to 550 MCMPD by 2030 from 174 MCMPD in 2021.
- Diesel demand in India is expected to double to 163 million tonnes by 2029-30.
- India's oil consumption is forecast to rise from 4.05 MBPD in FY22 to 7.2 MBPD in 2030 and 9.2 MBPD in 2050

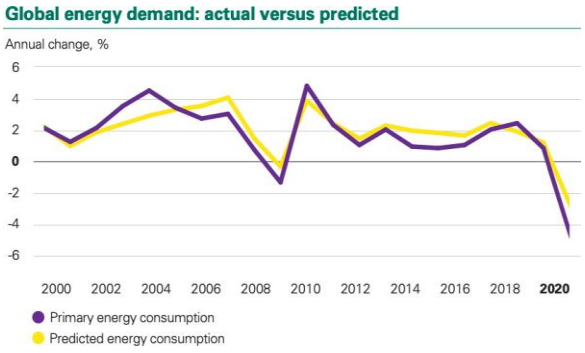
Following is the graph of both Crude oil and Natural Gas consumption and Forecast.

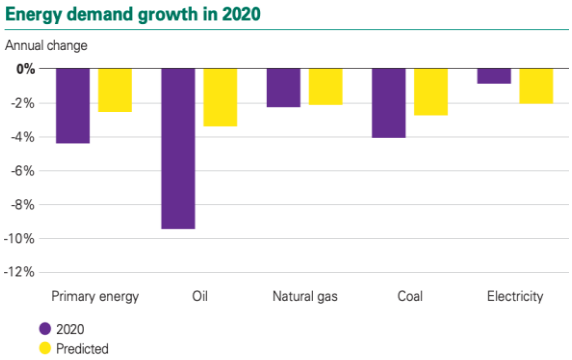




IMPACT OF COVID-19 ON OIL & GAS SECTOR

The COVID-19 pandemic has disrupted the entire global economy and has considerably impacted the global oil and gas industry. The world energy demand is estimated to have fallen by 4.5% and global carbon emissions from energy use by 6.3%; such large falls were last seen during World War II. US, India and Russia contributed the largest declines in energy consumption.

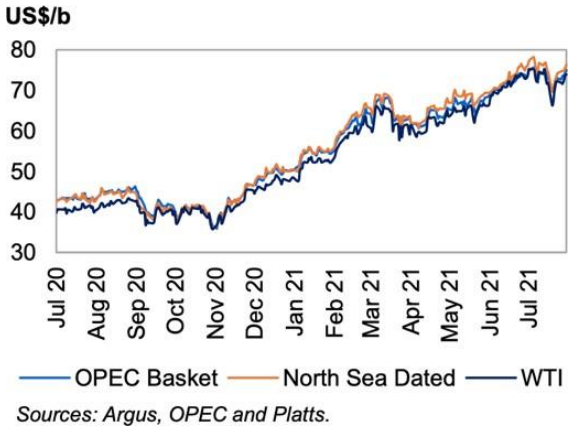




Oil demand is estimated to have fallen by 9.3% (9.1 mbpd) in 2020. Oil demand fell most in the US (-2.3 mbpd), the EU (-1.5 mbpd) and India (-0.48 mbpd) whereas China was the only country where consumption increased (0.22 mbpd).

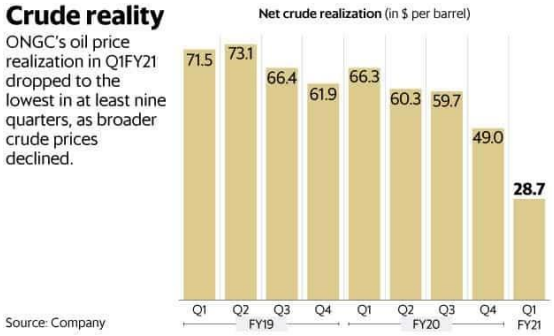
	2019	2020E	2021P
World oil supply (mbpd)	94.96	88.39	91-93
On-year change (mbpd)	0.11	(6.57)	3-4

Crude prices have been volatile over the past 1.5 years due to increase in output by OPEC+ coupled with falling global demand due to lockdown measures to contain COVID-19. At one point in time, the price of US benchmark crude WTI became negative in April 2020 due to onerous storage costs. The crude prices have since stabilized due to increase in demand and certain output cuts by OPEC+ as well as America.



Sources: Argus, OPEC and Platts.

Low crude prices are a grave cause of concern for domestic upstream companies like ONGC which have a comparatively higher BEP. In Q1 of FY 2020, crude price realisations fell by almost 57% on a YoY basis to $28.72 per barrel for ONGC which is a huge hit on its bottom line considering the break-even point for ONGC is ~$40 per barrel.



Similarly, ONGC suffered a considerable hit on its profits from its LNG sales where the domestic prices were set at $2.4 per mmBtu for April-September 2020, which was further reduced to $1.79 mmBtu for October-March 2021 when at the same time the cost of production for ONGC was higher at $3.5 mmBtu.

The domestic demand and consumption of petroleum products suffered greatly but is now seeing a gradual recovery; following is a summary of the consumption of petroleum products in FY 2020-21:

Petroleum products	FY20	Apr-20	May-20	Jun-20	Jul-20	Aug-20	Sep-20	Oct-20	Nov-20	Dec-20	Jan-21	Feb-21	Mar-21
Transportation fuel													
Petrol	6%	-60%	-35%	-14%	-10%	-8%	3%	4%	5%	9%	6%	-2%	27%
Diesel	-1%	-56%	-29%	-15%	-19%	-21%	-6%	7%	-7%	-3%	-2%	-8%	28%
ATF	-4%	-91%	-84%	-66%	-65%	-62%	-52%	-48%	-47%	-41%	-40%	-37%	-2%
Household fuel													
LPG	6%	11%	12%	15%	2%	-5%	5%	3%	4%	7%	2%	7%	-2%
SKO	-31%	-49%	-32%	-38%	-19%	-43%	-6%	-18%	-18%	-11%	-11%	-26%	2%
Industrial fuel													
Naphtha	4%	-17%	25%	25%	-13%	-24%	3%	15%	7%	-3%	-8%	-4%	-2%
Petcoke	1%	-66%	17%	-4%	9%	-22%	-23%	-16%	-16%	-20%	-17%	-10%	-3%
FO	-7%	-41%	-9%	10%	-11%	7%	-7%	13%	12%	-11%	11%	5%	10%
Others													
Bitumen	-5%	-73%	-19%	37%	-4%	39%	38%	49%	18%	21%	14%	10%	72%
Total													
Overall consumption	0%	-49%	-20%	-9%	-12%	-16%	-4%	3%	-3%	-1%	-3%	-5%	17%

IMPACT OF CLIMATE CHANGE AND THE MOVE TO GREEN ENERGY

COVID-19 resulted in a material drop in global energy demand; however, this is not the biggest threat facing the oil and gas industry. One of the most important systemic risk to the global economy is climate change. Over the past few years, pressure has been building to shift the energy system away from the one dominated by hydrocarbons to the one in which low-carbon sources play the lead role. Due to the increasing emphasis on Environment, Social and Governance ('**ESG**') investing, investors' interest in sustainable, resilient assets, including renewables has sharpened. Investors are increasingly seeking out positions that reduce their exposure to climate change. Accordingly to analysis conducted by the Wall Street Journal, in the first three quarters of 2020 alone, oil and gas companies in North America and Europe wrote down asset values of $145 bn, roughly equivalent to 10% of their market value.

A number of oil and gas companies have already set net-zero-emission targets, despite the current economic challenges and are sustaining efforts to decarbonize their operations and their value chains – for example, ExxonMobil has announced its carbon emission in December 2020: reducing the intensity of operated upstream greenhouse gas emissions by 15-20% over the next 5 years relative to 2016 levels while continuing to invest in lower-emission technologies and support sound policies that put a price on carbon.

India is not far behind; the country has set an ambitious goal of 450 GW of renewable energy by 2030. In addition, the country has created initiatives to develop the electric vehicles market, alternative fuels, and is also strengthening its partnership with other countries of the world.

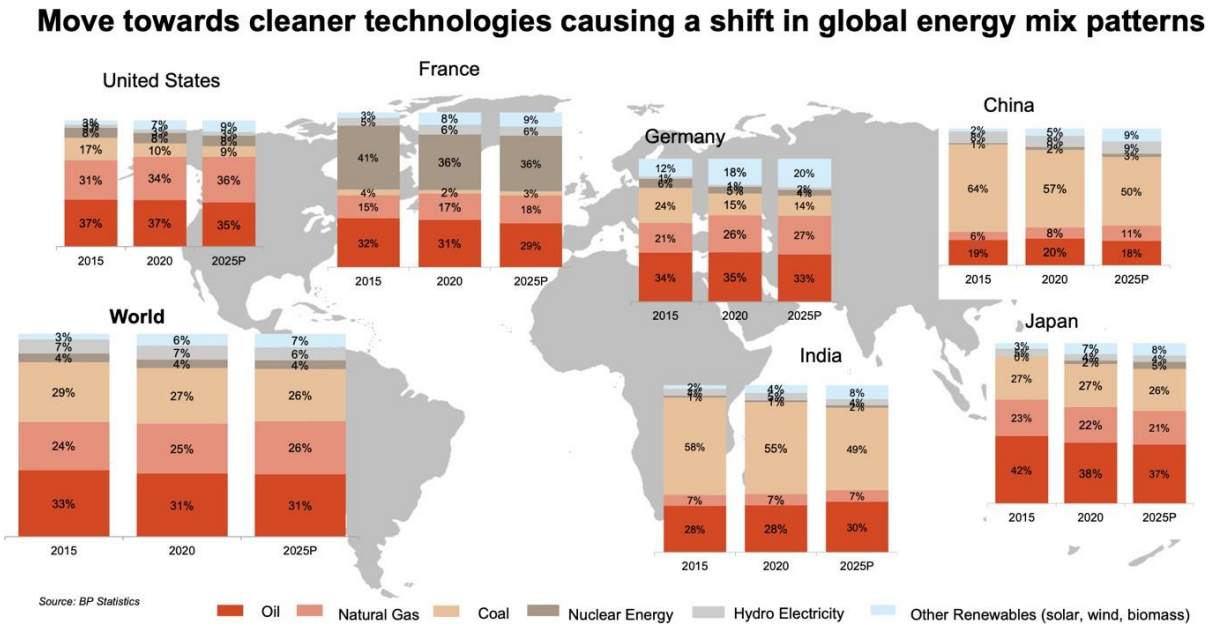
The need to embrace sustainability as a development framework is not just for the governments, society also needs to contribute. As countries prioritize climate change in their own economic planning, powerful multinationals also need to ensure that they adopt their own climate-friendly targets.

Indian companies are making their own climate commitments and leveraging next-generation solutions, from hydrogen-based steel manufacturing to developing next-gen carbon capture and energy storage technologies. Though India has so far not committed to the 'net zero emission' target as its national goal. The climate commitments by Indian companies augurs well for India's own renewable energy goals. The net-zero announcements and voluntary pledges by the Indian companies to move towards carbon neutrality can go a long way to inspire other smaller businesses and individuals in society.

Strengthening the sector's traditional business model and making it financially resilient is increasingly becoming a function of climate resilience. Therefore, the oil and gas companies will need to build a portfolio that is resilient to higher carbon prices, which offers the best combination of lower break-even carbon prices and lowers emissions intensity. Apart from strengthening the existing business model, the oil and gas companies may need to re-evaluate their strategic responses to energy

transition which may go well beyond decarbonizing their own operations to reduce their emissions considerably. The global large oil and gas companies may need to either become integrated energy players like BP who shall look to retain their profitable core while also capturing some of the opportunities in low-carbon markets, including renewables, bioenergy, hydrogen and the like or become low-carbon pure plays like some Danish/ Finnish companies like Neste which shall bet heavily on building future-proof, low-carbon businesses while divesting themselves of legacy, high carbon portfolios.

Following is a summary of the projections of global energy mix patterns on account of a move towards cleaner technologies:



While in India, oil consumption is projected to increase by 2025; however, globally, there is an expectation of decline of oil consumption which is substituted by increase in use of natural gas and renewable power.

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