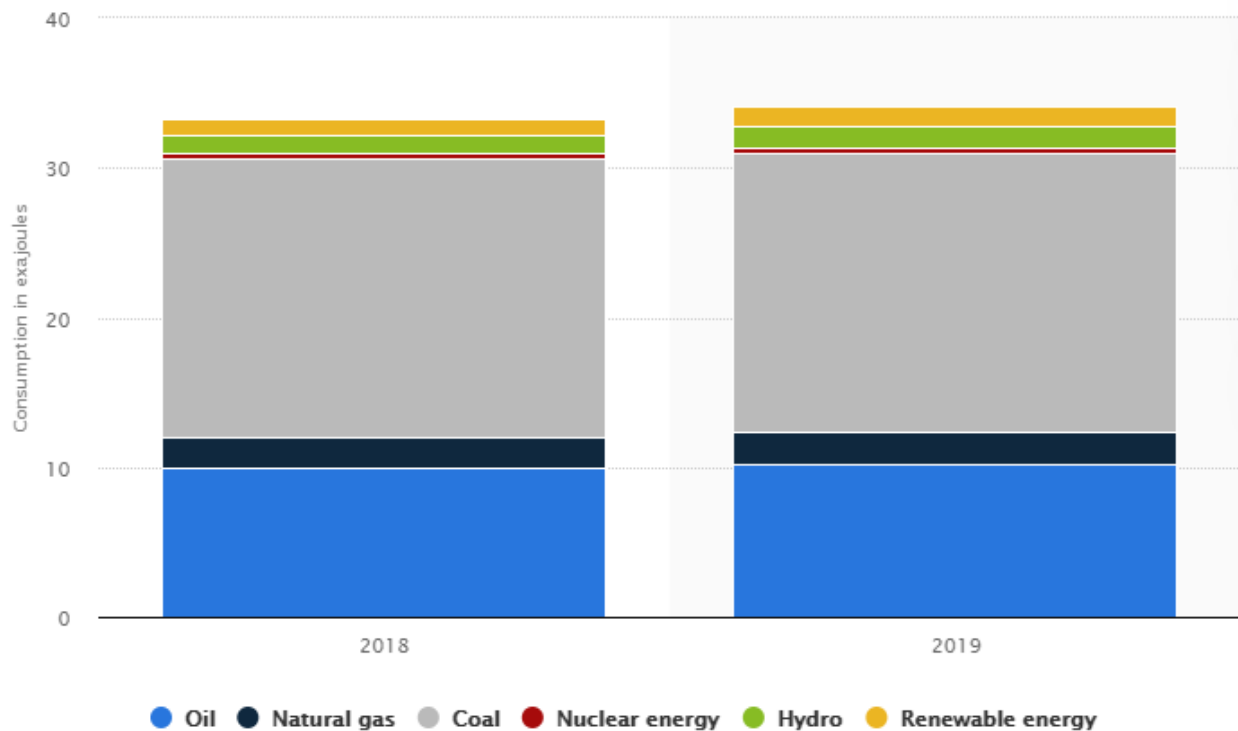
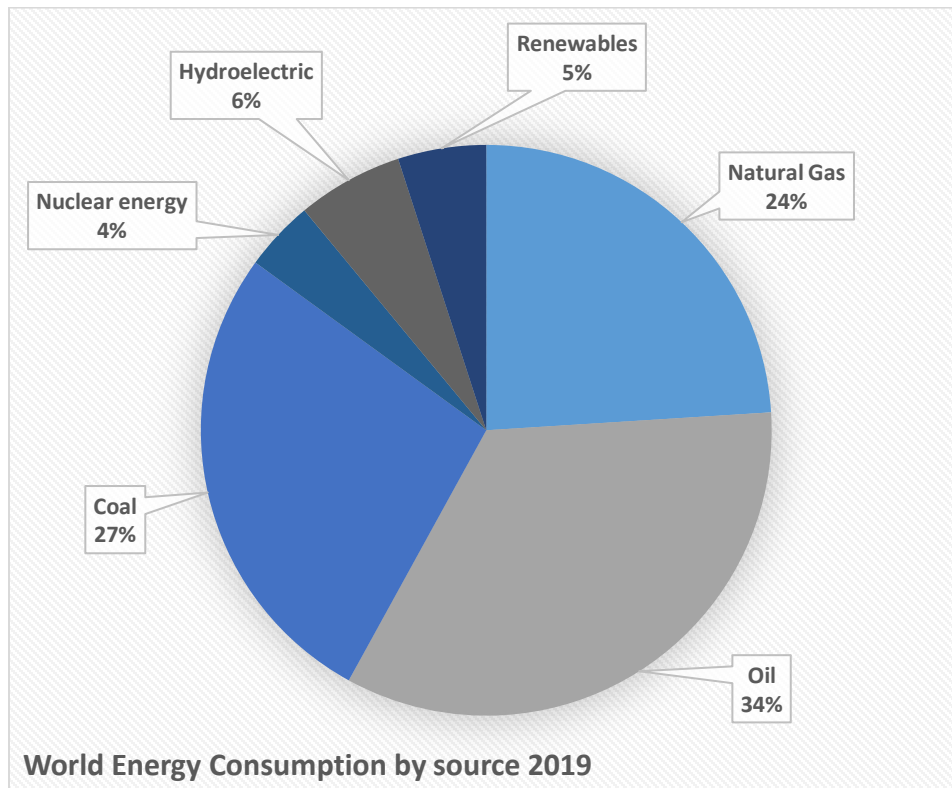


# Credence Capital

Oil & Gas Industry



## Energy consumption based on source worldwide and in India (2019)

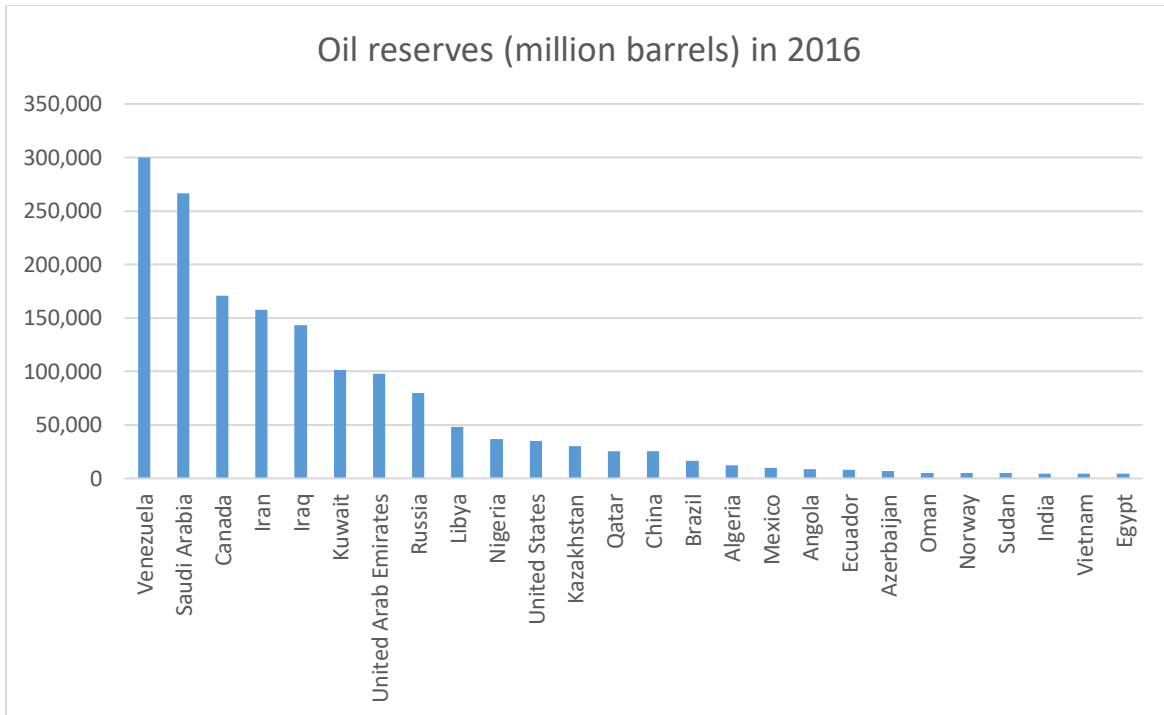


### Energy consumption in India by fuel (2019)

India's energy requirements are fulfilled primarily by coal, crude oil and natural gas. Oil and gas sector play a predominant role as they fuel over one third of this energy requirement.

## Oil in India

### Reserves:



**Why is the oil industry in Venezuela collapsing?** Experts blame the production drop on government mismanagement, corruption and a failure over many years to invest in infrastructure upgrades and maintenance. These problems have been amplified by US sanctions aimed at starving President Nicolas Maduro's regime of a major source of funds in a bid to force him from power. Between 2004 and 2015, Venezuelan oil exports raked in \$750 billion, and the country had more than \$42 billion in international reserves -- now down to just \$6.4 billion, according to the Central Bank. Venezuela's economy has been devastated by six years of recession, and it is experiencing the world's highest inflation rate -- all before the COVID-19 pandemic even struck.

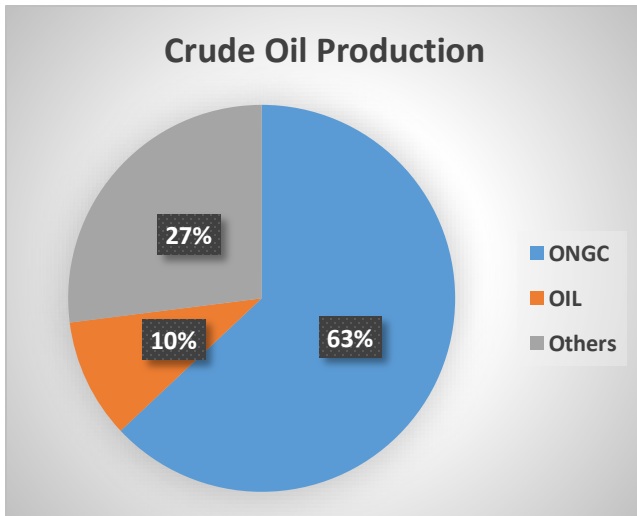
The two upstream National Oil Companies viz. Oil and Natural Gas Corporation (ONGC) and Oil India Limited (OIL) play a dominant role with a total share of about 73% oil and 84% in gas production (excluding JV share) in the country in the year 2018-19.

## Production:



### Crude oil production in India 2016-20

In India, crude oil is mainly produced by Oil & Natural Gas Corporation (ONGC) and Oil India Ltd which together make up for about 90% of the market share. There are also a few other private players & joint ventures.



**Market Capitalization – INR 86,930 crores**  
**Nifty weight – 0.62%**



**Market Capitalization – INR 9,618 crores**

Data as of October 2020

India's domestic crude oil production has been declining since the last decade. There has been a fall in production in western offshore and onshore fields operated by ONGC, OIL, other private players and joint venture (JV) operators.

Most of India's crude oil production comes from aging wells that have become less productive over time. A lack of new oil discoveries in India coupled with a long lead time to begin production from discovered wells has led to a steady **decline in India's crude oil production** making India increasingly dependent on imports. The output of these

aging wells is declining faster than new wells can come up according to experts. Domestic exploration companies are attempting to extend the life of currently operational wells.

### Why are there not more private players?

While there are some private players in the upstream oil sector including Cairn India and Hindustan Oil Exploration Company there has been a lack of interest in exploration and production in India from major private players, particularly those based abroad. According to experts, this is because of long delays in the operationalization of production even after an oil block is allotted due to delays in approvals. Some of the key approvals which are required to begin production include environmental clearances and approval by the Directorate General of Hydrocarbons. The best-case scenario from allotment to production is at least 5-7 years.

### Production locations

**Table 2.8 : Basin-wise PEL & PML under Nomination Regime as on 31.12.2019**

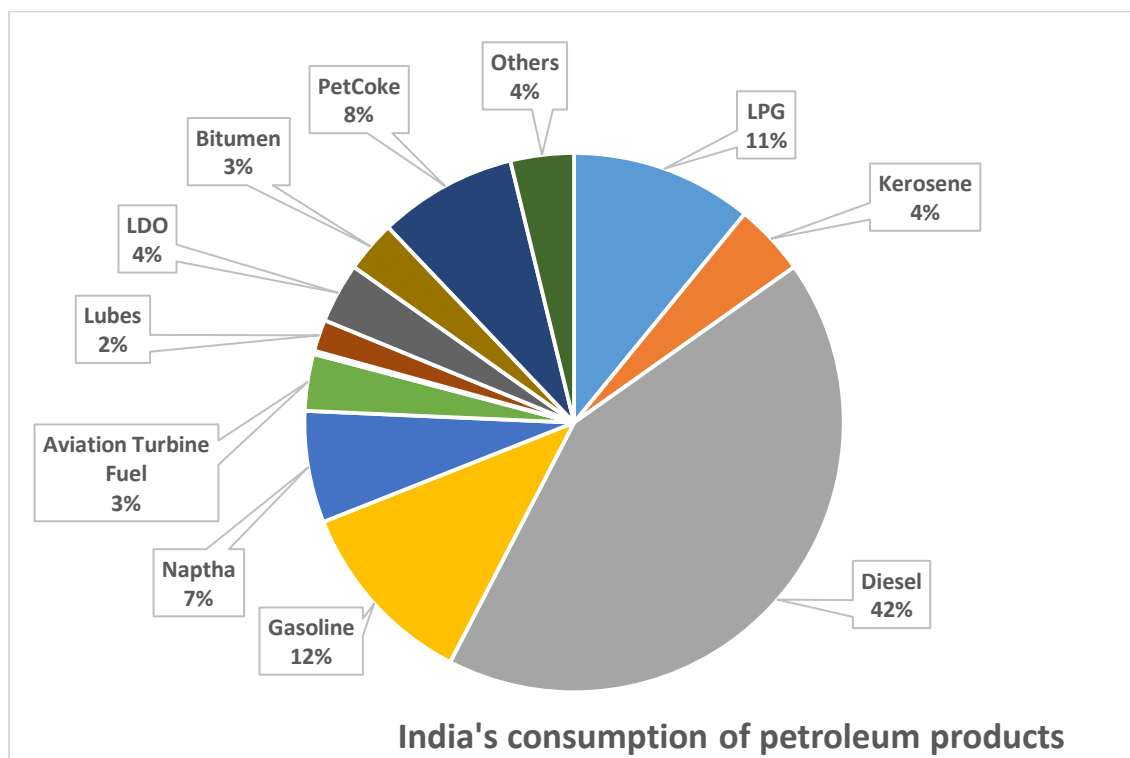
Basin/State		ONGC-Nomination							
		PEL		PML				Total	
				Long term		Short term (7year)			
No.	Area (Sq Km)	No.	Area (Sq Km)	No.	Area (Sq Km)	No.	Area (Sq Km)		
Assam-Arakan	Assam	-	-	42	1920.99	4	875.29	46	2796.28
	Nagaland	3	1590	1	12	-	-	4	1602
	Tripura	-	-	16	1682.07	2	1345.99	18	3028.06
Cambay	Gujarat	-	-	166	5610.72	3	111.25	169	5721.97
Cauvery	Tamil Nadu-Onland	-	-	25	660.14	3	2685.63	28	3345.77
	Cauvery-Offshore	-	-	1	11	1	74.83	2	85.83
Himalayan Foreland	Himachal Pradesh	1	1828	-	-	-	-	1	1828
	Krishna - Godavari	-	-	35	1083.75	5	3465.48	40	4549.23
	KG-Offshore	1	283.05	11	894.29	2	186.81	14	1364.15
	Kutch Offshore	1	420	1	840	2	786.5	4	2046.5
	Saurashtra Offshore	-	-	1	392.52	1	1906.13	2	2298.65
	Mumbai Offshore	1	985	24	15499.91	7	13168.23	32	29653.14
Jaisalmer	Rajasthan	-	-	4	809.57	-	-	4	809.57
Vindhyan	Madhya Pradesh	-	-	-	-	1	1135	1	1135
<b>Total - ONGC</b>		<b>7</b>	<b>5106.05</b>	<b>327</b>	<b>29417.0</b>	<b>31</b>	<b>25741.1</b>	<b>365</b>	<b>60264.2</b>

OIL-Nomination						
Basin/State	PML		PEL		Total	
	No.	Area (Km <sup>2</sup> )	No.	Area (Km <sup>2</sup> )	No.	Area Km <sup>2</sup> )
Rajasthan	-	-	2	460	2	460
Assam-Arakan	3	332	22	4276	25	4608
<b>Total OIL</b>	<b>3</b>	<b>332</b>	<b>24</b>	<b>4736</b>	<b>27</b>	<b>5068</b>

## Consumption

India is the 3<sup>rd</sup> largest oil consumer in the world after China and USA.

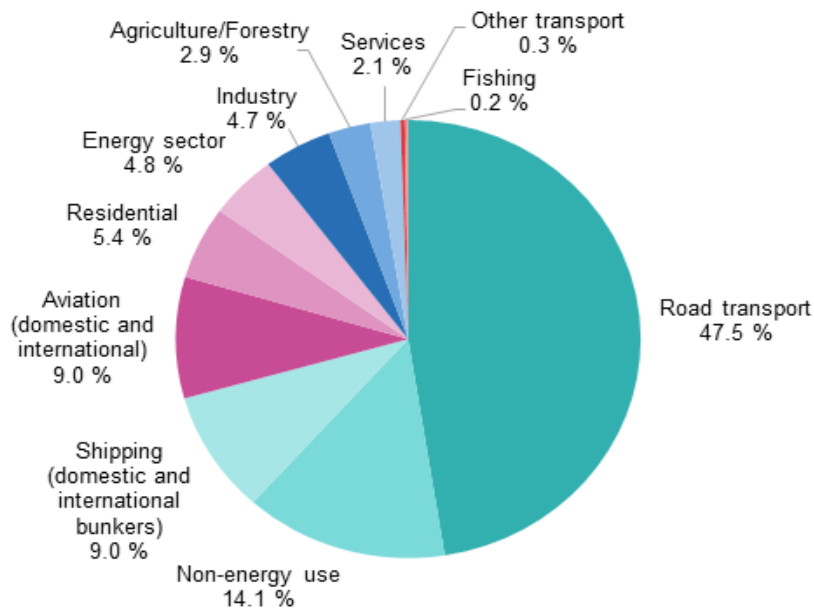
Diesel is the largest oil product consumed in India. While gasoline's share remains far below that of diesel, it has experienced the highest average growth rate over the past decade. LPG which is mostly used for cooking is the 2<sup>nd</sup> largest oil product consumed in India. In 2019 India became the 2<sup>nd</sup> largest consumer of LPG after China, with supplies coming from Saudi Arabia and the United Arab Emirates.





Consumption by sector (2018):

**Consumption of oil in selected sectors, EU-27, 2018**  
(%)



Source: Eurostat (online data code: nrg\_bal\_c)

eurostat 

Quality	Petrol	Diesel
Calorific value	45.8 Mega Joules/kg	45.5 Mega Joules/kg
Density	Lesser	More
Energy/volume	Lesser	~15% more
Boiling point	40-250 degree Celsius	250-350 degree Celsius
Engine weight	Lighter	Heavier
Engine efficiency	Lesser	~20% more
RPM	Runs at higher RPM	Runs at lower RPM



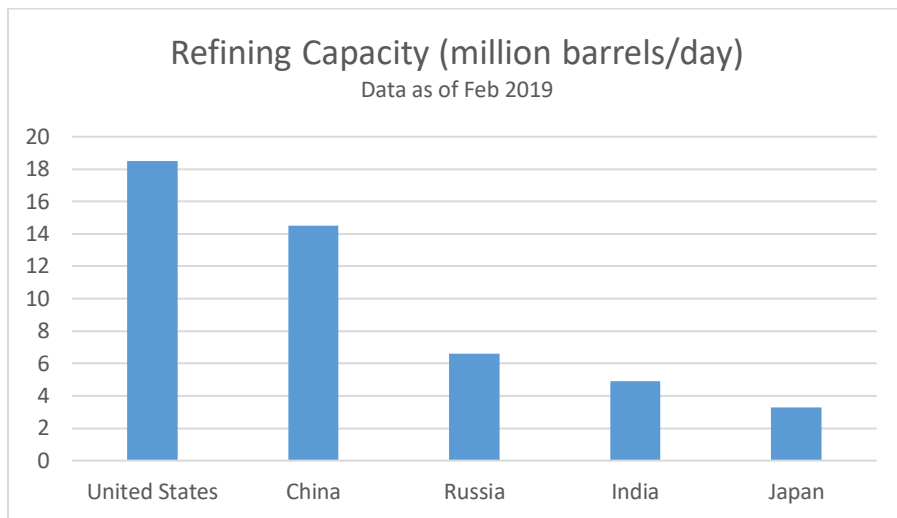
### Shale oil details

Around the world, below the gravel, rocks, and deposits of crude oil that helped build oil-rich nations like Saudi Arabia, sits the shale layer. Where most modern oil deposits average depth of around 6,000, the shale layer can range as deep as 9,000 feet.

The primary distinction between crude or conventional oil and shale oil is the way it collects. The oil in shale is typically found in smaller batches. As a result, shale oil often needs to be fractured so that the oil trapped within the shale can be recovered.

As technology advanced, so, too, did the means for discovering and recovering oil. Modern methods allow for holes 9,000 feet deep and more than 10,000 feet horizontally. The United States tech-first

## Refining



The Indian **refining** industry has established itself as a major player globally. India is emerging as a refinery hub and refining capacity exceeds the demand. The country's refining capacity has increased over the last several decades and at present comprises of 23 refineries- 18 under public sector, 3 under private sector and 2 in joint venture. The refining capacity is not only sufficient for domestic consumption but also leaves a substantial surplus for export of petroleum products. India is the largest exporter of petroleum products in Asia since 2009.



**IndianOil**

**Market Share by volume sales- 46%**  
**IOCL Market Capitalization- INR 69,224 lakh crores**



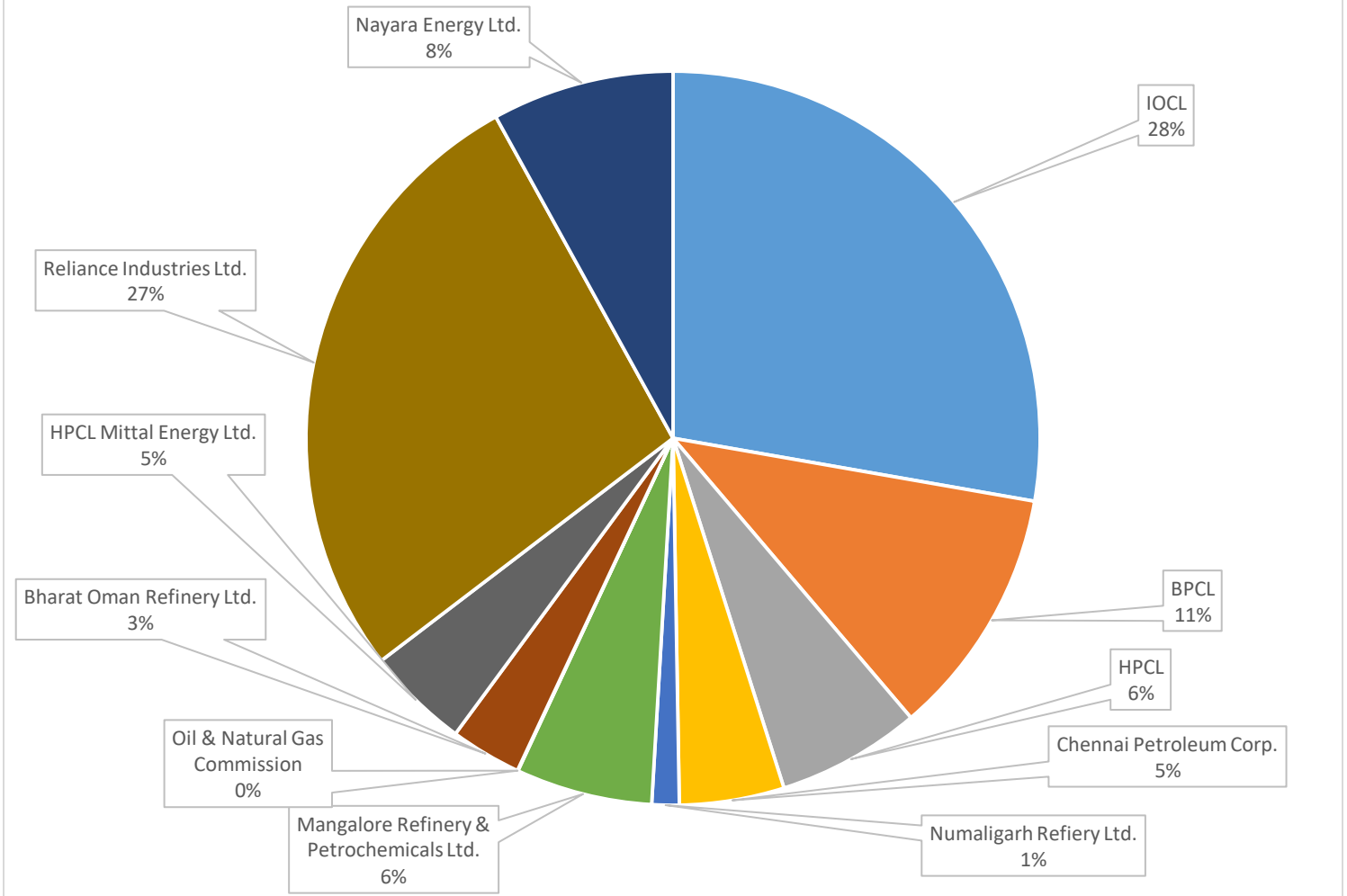
**Market Share by volume sales- 23%**  
**BPCL Market Capitalization- INR 76,419 lakh crores**



**Market Share by volume sales- 21%**  
**HPCL Market Capitalization- INR 26,735 lakh crores**



## Refining Capacity (MMPTA)



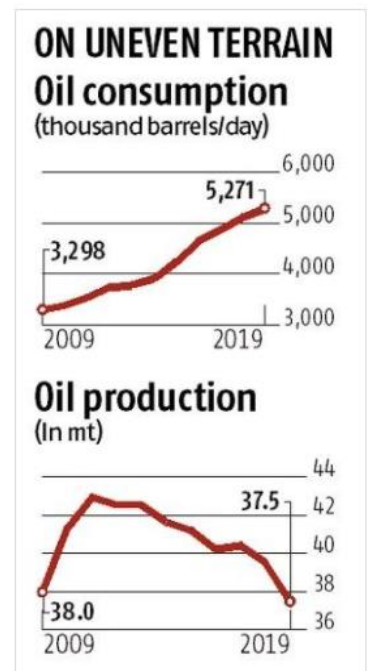
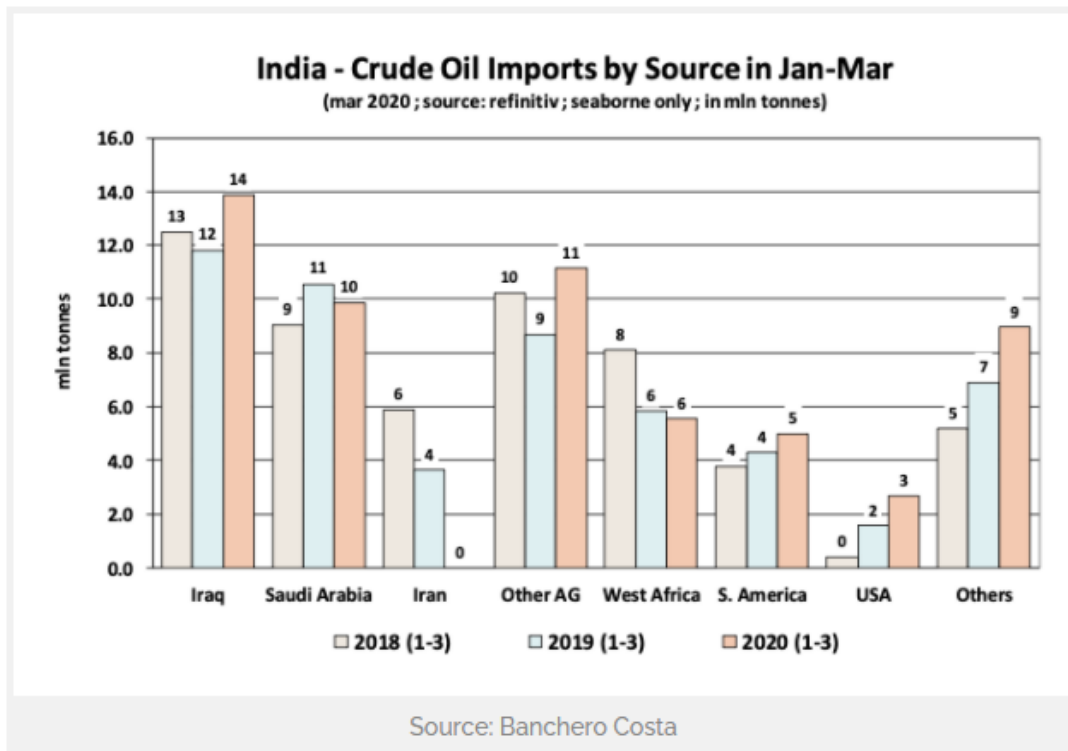
SI No.	Refineries	State	Name of the company	Capacity (MMPTA)
<b>PSU Refineries</b>				
1	Digboi	Assam	Indian Oil Corporation Ltd. (IOCL)	0.65
2	Guwahati	Assam		1.00
3	Barauni	Bihar		6.00
4	Koyali	Gujarat		13.70
5	Bongaigaon	Assam		2.35
6	Haldia	West Bengal		7.50
7	Mathura	Uttar Pradesh		8.00
8	Panipat	Haryana		15.00
9	Paradip	Odisha		15.00
10	Mumbai	Maharashtra	Hindustan Petroleum Corporation Ltd. (HPCL)	7.50
11	Vishakhapatnam	Andhra Pradesh		8.30
12	Mumbai	Maharashtra	Bharat Petroleum Corporation Ltd. (BPCL)	12.00
13	Kochi	Kerala		15.50
14	Manali	Himachal Pradesh	Chennai Petroleum Corporation Ltd.	10.50
15	Nagapattinam	Tamil Nadu		1.00
16	Numaligarh	Assam	Numaligarh Refiery Ltd.	3.00

17	Mangalore	Karnataka	Mangalore Refinery & Petrochemicals Ltd.	15.00
18	Tatipaka	Andhra Pradesh	Oil & Natural Gas Commission	0.066
<b>Total</b>				142.07
<b>JV Refineries</b>				
19	Bina	Madhya Pradesh	Bharat Oman Refinery Ltd.	7.80
20	Bathinda	Punjab	HPCL Mittal Energy Ltd.	11.30
<b>Total</b>				19.10
<b>Private Sector Refineries</b>				
21	DTA Jamnagar	Gujarat	Reliance Industries Ltd.	33.00
22	SEZ Jamnagar	Gujarat		35.20
23	Vadinar	Gujarat	Nayara Energy Ltd.	20.00
<b>Total</b>				88.20
<b>Grand Total</b>				<b>249.366</b>

## Imports

Driven by rapid economic growth, oil demand in India has been growing for decades across all sectors. Total oil **demand** has grown by more than 50%, mostly led by rapid growth in gasoline and diesel for transport, the largest oil consuming sector, and liquefied petroleum gas in cooking.

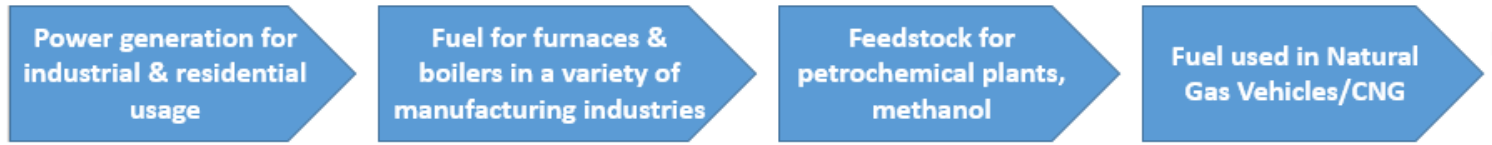
With continued strong growth in demand against falling domestic production, India has become more reliant on oil **imports** which hovered around 83% in 2018. At the same time, India's import bill for crude oil has increased by 27% from USD 88 billion in 2017 to USD 112 billion in 2018.



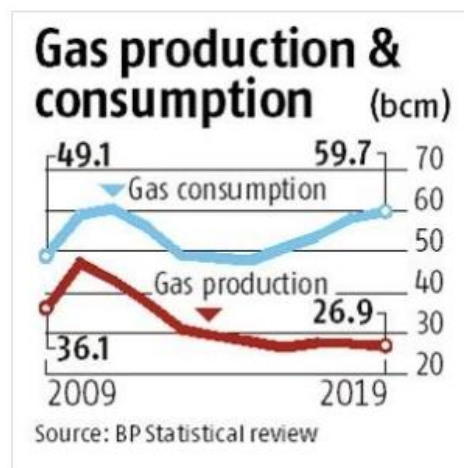
Iraq & Iran sell crude oil to India in Rupees and not US Dollars which helps to hedge FX risk. This is why Indian imports are highest from these countries.

# Natural Gas in India

Natural gas is the fastest growing and the most preferred energy resource. It is used in-



Abundant	Clean	Versatile	Affordable	Efficient
<ul style="list-style-type: none"> <li>The natural gas resources base can last for ~234 years at the current consumption rates supported by technological innovation that allows additional extraction of natural gas in unconventional rock formations like shale, tight sands and coal beds.</li> </ul>	<ul style="list-style-type: none"> <li>It is the cleanest burning conventional fuel, producing 45% less CO2 emissions than coal &amp; 30% less CO2 emissions than oil when combusted.</li> <li>The use of natural gas therefore mitigates some adverse climatic changes often attributed to burning of fossil fuels.</li> <li>Natural gas produces ~65% less emissions than coal &amp; 25% less emissions than oil when used to generate electricity.</li> </ul>	<ul style="list-style-type: none"> <li>Natural gas can be used in a variety of ways from electricity generation, running of the manufacturing plants, feedstock for a range of products, heating &amp; cooling as well as fuels for transportation.</li> <li>Even where renewable energy sources are used for power generation, natural gas is always there to complement the unreliable nature of renewable energy sources.</li> </ul>	<ul style="list-style-type: none"> <li>On an energy-equivalent basis and the recent gas prices, abundant supplies of natural gas are available at lower prices when compared to energy content of other fossil fuels.</li> </ul>	<ul style="list-style-type: none"> <li>Of all the conventional energy sources, natural gas is the most efficient (reaching ~60% efficiency) when combusted in the internal combustion engine of gas fired power plants.</li> <li>This allows the utility companies to generate more electricity with less fuel consumption.</li> </ul>



### Liquefied Petroleum Gas (LPG)

LPG has been made available as a cooking energy fuel in developing countries where it has helped reduce the use of wood and biomass in households. It is a blend of light hydrocarbon compounds, mainly butane (C<sub>4</sub>H<sub>10</sub>) and propane (C<sub>3</sub>H<sub>8</sub>). LPG in domestic cylinders used for cooking generally comprises more butane than propane, because the fuel value per kilogram of butane is higher than propane and it also liquefies under much lower pressure than propane and thus the handling is safer.

Natural gas is made up of gases and liquids to varying degrees. In most cases the gas has to be processed to remove impurities such as ethane, propane, butane and water, to meet the specifications of commercial natural gas. The separated propane and butane are used as LPG. Thus, 1 - 10% of the total 'raw petroleum gas' will become LPG.

LPG also appears as an accompanying gas during oil extraction. Each ton of raw oil contains some amount of accompanying gas. This is immediately extracted in order to stabilize the raw oil. The accompanying gases are then either processed or burnt on the spot. If they are processed in oil and gas refineries, LPG is separated from other derivatives in the distillation column. 4 - 5 % of the total raw oil can usually be extracted as LPG.

### Institutions for regulation:

The Ministry of Petroleum and Natural Gas (MoPNG) regulates the entire value chain of the oil sector, including exploration and production, refining, distribution and marketing, import and export, and conservation of petroleum products. Under the MoPNG, the Directorate General of Hydrocarbons (DGH) regulates the upstream side of the oil sector, as well as the coal bed methane projects. The Petroleum and Natural Gas Regulatory Board (PNGRB) was created in 2006 to protect the interests of consumers and entities engaged in the sector and to promote competitive markets. PNGRB is also mandated to regulate the refining, processing, storage, transport, distribution, marketing and sale of petroleum, petroleum products and natural gas, excluding production of crude oil and natural gas, so as to ensure uninterrupted and adequate supply in all parts of the country. The PNGRB Act (2006) provides for the promotion of competition in the oil and gas sectors by ensuring the nondiscriminatory open access of oil and gas pipeline infrastructure on a common carrier/contract carrier principle at regulated tariffs determined by PNGRB under its notified regulatory framework.

### Growth prospects for oil & gas industry:

- Increasing oil and gas drilling activities

Due to the high demand for oil and gas around the globe and maturing existing hydrocarbon resources, the focus has shifted towards unexplored reservoirs in order to keep pace with the growing demand. By tapping into these unexplored resources, the production levels can be significantly increased, which can bridge the gap between demand and supply.

- Increasing exploration of unconventional gas resources

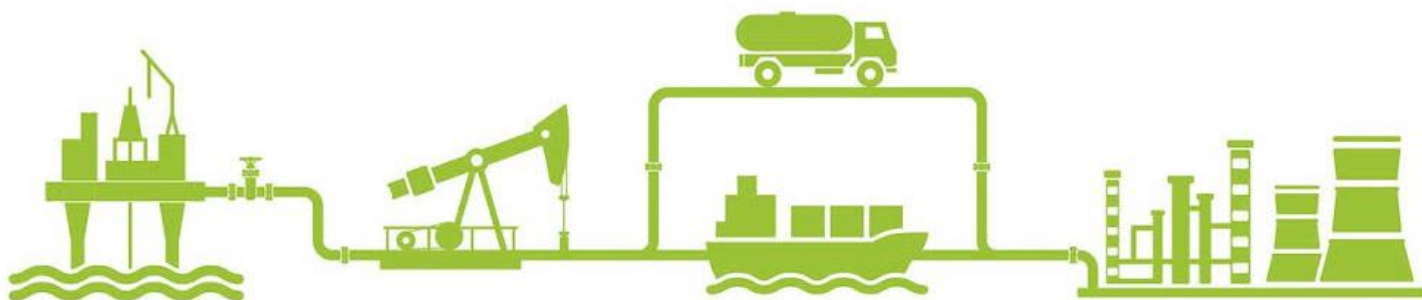
In recent years, the depleting conventional gas sources have resulted in a shift from conventional gas to unconventional sources. This in turn can lead to several challenges in the demand for natural gas across the globe. By shifting focus towards unconventional gas sources, the Oil and Gas Industry can reduce the dependency on conventional gas sources as well as reduce its carbon footprint. The extraction of

unconventional gas requires horizontal drilling, which requires different equipment and technology for the extraction of gas from the reservoir.

- Rapid technological advancements

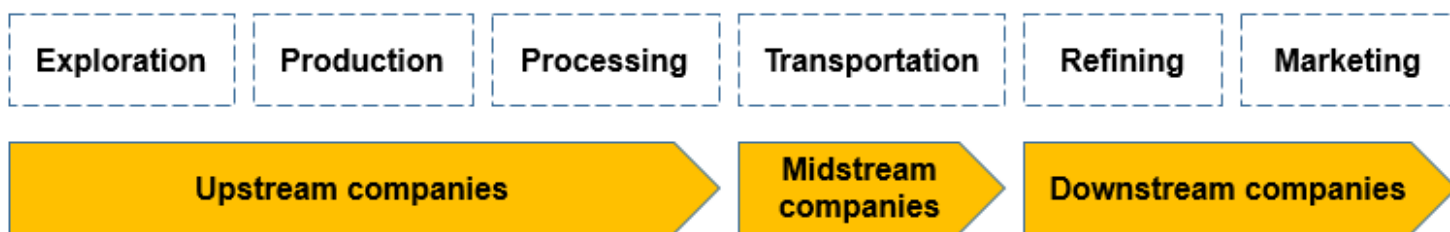
There has been a tremendous increase in technological advancements, which has led to the increasing usage of oilfield equipment in the market. The technological advancements resulted in the adoption of different types of drilling for oil and gas extraction such as horizontal and directional drilling. This in turn has resulted in the increased usage of various types of drilling equipment. Moreover, oil companies are increasing their investments in R&D to increase the efficiency of this equipment in order to improve the volume of oil and gas production and reduce the environmental impact. Therefore, the rapid technological advancements are expected to propel the growth of the market during the forecast period.

## Value chain

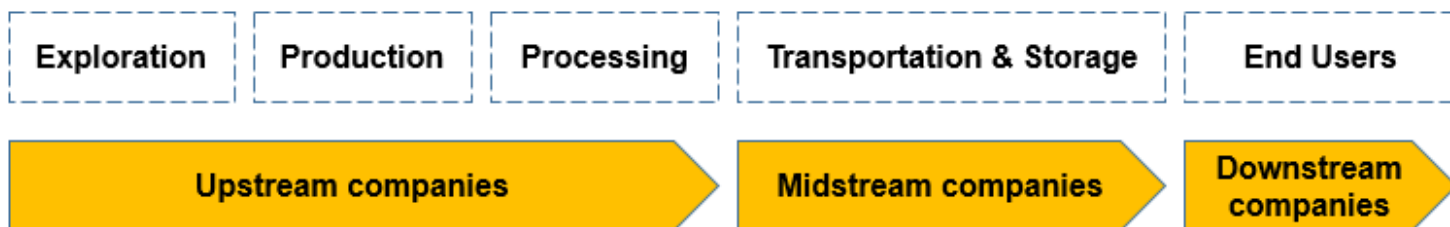


Source: RobecoSAM

Oil:



Natural gas:



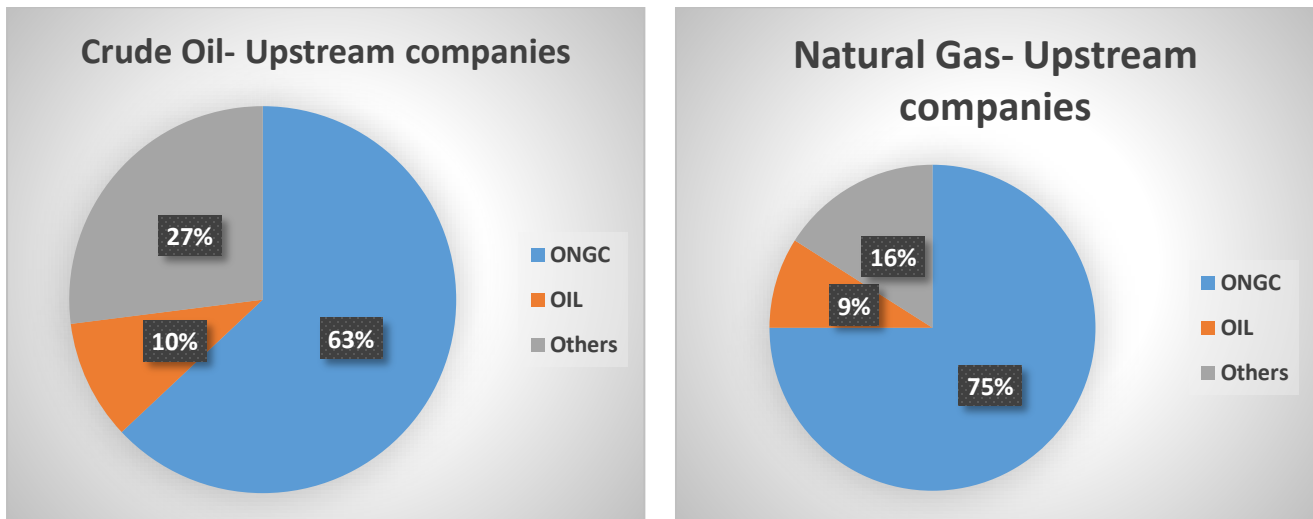
## Upstream-

This is also called the Exploration & Production sector.

What are upstream companies responsible for? Upstream companies are responsible for conducting seismic surveys to search for potential underground or underwater oil and gas fields/producing blocks, drilling of exploratory wells, devising field development plans (FDPs), developing infrastructure in economically viable oil fields to produce commercial quantities of hydrocarbons, and subsequently operating the wells that recover and bring the crude oil and/or raw natural gas to the surface. Finally, the extracted hydrocarbons sold to downstream companies who refine and sell the derived products to end customers.

Who are the leading players?

Oil and Natural Gas Corporate and Oil India Ltd.



Challenges faced?

- It is highly regulated by governmental agencies
- Getting new exploration fields involves heavy upfront investments
- Even though drilling programs account for estimated subsurface or subsea pressures, possible fluctuations in reservoir pressure, could lead to increased capital expenditure
- The uncertainty of seismic and geological data failing to translate into a commercially viable FDP could lead to a financial loss for an E&P company. The upstream companies may recover partial or no investment
- Maintaining the reservoir pressure to keep a sustained production requires highly accurate analysis and repetitive studies to closely monitor the pressure levels

## Midstream

What are midstream companies responsible for?

The midstream sector companies transport the produced hydrocarbons from upstream companies to downstream companies, who in turn, refine and sell the derived products to the end customers. The activities of the midstream industry include transportation, processing, and storing of hydrocarbons such as natural gas, oil, and natural gas liquids. These activities done by midstream



companies would enable downstream companies to leverage on readily available hydrocarbons to get refined and sold to end customers. The midstream sector has the below listed activities:

1. Gathering and Processing
2. Transportation
3. Storage and logistics

**Oil Gathering & transportation:** In the case of offshore production, a network of smaller sized field gathering pipelines accumulate the oil that then moves along the coast or through rivers in smaller barges & is transported internationally in tankers or vessels. In the case of onshore production, land transportation consists of sets of pipelines, trucks and rail.

**Natural Gas Gathering & transportation:** Natural gas generally flows at a much higher pressure than crude oil. Hence, it is transported via large-diameter, high-pressure handling pipelines called transmission lines.

**Crude Oil Storage:** This happens through bulk terminals, refinery tanks, holding tanks etc. to ensure that the materials are ready to be forwarded to be shipped via a vessel.

#### Who are the leading players?

Indian Oil Corporation Ltd., Bharat Petroleum Corporation Ltd., Hindustan Petroleum Corporation Ltd., GAIL Ltd., Reliance Industries Ltd.

#### Challenges faced?

- The Midstream companies rely heavily on operations of upstream companies
- With high external dependencies, it is difficult for midstream companies to scale-up/scale-down the infrastructure (predominantly permanent) that consume large amounts of resources
- Pipeline maintenance & other logistics involved require skilled human resources that strain midstream companies' finances

## Downstream

#### What are downstream companies responsible for?

The companies in the downstream sector obtain extracted hydrocarbons from the upstream sector via the infrastructure provided by midstream companies, and refine them into derivative products. These companies then further extend their work towards marketing the derivative products. In a refinery, crude oil is transformed into market fuels and other petroleum products. All the products are then marketed through Business-to-Business (B2B) and Business-to-Consumer (B2C) channels by downstream companies.

#### Who are the leading players?

Indian Oil Corporation Ltd., Bharat Petroleum Corporation Ltd., Hindustan Petroleum Corporation Ltd, Reliance Industries Ltd., Shell, Adani, GAIL

#### Challenges faced?

- Although, crude prices & other external factors determine the prices of various fuels & petroleum products, end consumers tend to associate price fluctuations in the refined

products with downstream companies' pricing policy. Downstream companies face the supply vs. demand problems firsthand with customers

## Market structure

India's retail oil market is largely dominated by the state-owned refining and marketing companies Indian Oil, Hindustan Petroleum and Bharat Petroleum, who own around 90% of India's fuel stations (63 000). Reliance, India's largest private refiner and petrochemicals producer, is a small player in the oil retail market (1 400 fuel stations across India). To obtain a retail license to sell petrol, diesel and jet fuel in India a foreign player is obligated to make a minimum investment in India's oil production, refining or distribution. In August 2019 the Government of India indicated plans to abolish this obligation to further liberalize the market. To date, only one foreign company has a presence in India's retail market (Shell, with around 100 stations in 2018). India's growing domestic oil market is attracting foreign players. In 2019 Saudi Aramco acquired a 20% stake in Reliance's refining and petrochemicals business. BP signed a joint venture with Reliance (49% stake) to expand Reliance's network to 5 500 stations in the next five years and sell jet fuel at 30 Indian airports. In 2018 Total entered into a partnership with India's private Adani group and plans an investment in 1 500 petrol stations in the country over the next ten years. BP has made investments in India's gas exploration and production business, and secured a license in 2016 to set up 3 500 retail fuel outlets.

## Pricing

From the 1970s to 2002, the Administered Price Mechanism (APM) was used to control the pricing of petroleum products at four stages: production, refining, distribution and marketing. The purpose of APM was to compensate the related companies for normative costs set by the government and to ensure a return on the oil companies' investments. However, with an upward swing in oil prices in 1980s, the need to deregulate the market grew and the new Industrial Policy in 1991 opened up India's refinery sector to private competition. APM was abolished in April 2002 and the state-owned oil marketing companies (OMCs) were allowed to set retail product prices. While this liberalization of India's retail sectors resulted in the emergence of small private-sector players, the government maintained its heavy subsidies on LPG and kerosene due to its importance in India's domestic economy as an energy source for low-income households. In 2004 the Government of India reintroduced price controls over four "sensitive" petroleum products: petrol, diesel, LPG and kerosene. In order to insulate domestic consumers from the price volatility of essential fuels, the government regulated the OMCs to make sales at centrally determined prices. As compensation for the OMCs' losses, the government provided grants to them on top of fiscal subsidies, which resulted in added pressure on the Government of India budget in times of high global oil prices, such as in 2008. Eventually, prices for petrol and diesel were deregulated in 2010 and 2014 respectively. Since then, the OMCs have been setting the price of petrol and diesel in line with international prices and other market conditions. The tax components levied on petrol and diesel include excise duty, imposed by the central government, value-added tax (VAT) and dealer commission, imposed by the state oil companies.

## Foreign Direct Investment

100% FDI is allowed in private refineries via the automatic route and up to 26% in government-owned ones.

100% FDI is also granted in cases of petroleum products, gas pipelines, exploration, and marketing or retail via the automatic route. Mauritius, Singapore, Japan, Netherlands, UK and USA are the top investing countries.

## Policies

To address production declines from mature basins, the GoI has taken several measures to enhance exploration and production (E&P) of oil and gas in the country:

- Hydrocarbon Exploration and Licensing Policy (HELP): Approved in March 2016 and implemented since July 2017, the HELP replaced the previous licensing policy, the New Exploration Licensing Policy (NELP), which was criticized for its narrow scope and long, burdensome procedures. The HELP unifies the permitting authority into a single register to grant licenses for E&P and covers both conventional and non-conventional oil and gas resources.
- Open Acreage Licensing Policy (OALP): The HELP introduced the OALP in 2017 to further encourage companies to seek permission for exploration of any block at any time by submitting an expression of interest. Previously, there were formal bidding rounds led by the GoI and E&P activities were limited to blocks approved by it.
- National Data Repository: In support of the OALP, the government launched the National Data Repository in June 2017. It is a comprehensive archive of geo-scientific data for E&P activities. By allowing companies to access the data through an e-platform and consult relevant information, the government helped the interested parties in making bidding decisions.
- Discovered Small Field Policy: Launched in 2016 with an objective to tap into un-monetized small oil/gas discoveries in India, Discovered Small Field provides an easy and low-risk investment option for interested parties to encourage E&P activities

The HELP marked an important transition from regulation to liberalization of India's E&P sector; it is a very significant upstream reform of the fiscal regime. Despite this positive progress, India's growing oil demand is unlikely to be met by new production alone given the country's limited resource base.

## Key Challenges

- Declining domestic crude production: Most of the producing fields (in Cambay, Assam-Arakan and Mumbai Offshore) are maturing or have already matured. Due to inadequate new oil and gas discoveries and subsequent development, India is witnessing a decline in crude production.
- Large crude import bills: In 2018-19, India imported more than 80% of its crude consumption and spent in excess of \$110 billion.
- Inadequate transmission & distribution infrastructure: India needs to invest heavily in midstream and downstream sector to overcome infrastructure constraints in LNG, gas pipelines and CGD.
- Technology constraints: The country needs investment in exploring and developing Category-2 and Category-3 basins. However, Indian operators do not have the requisite technology and experience in this area.
- Low share of MNCs: Despite being one of the largest consumers of energy, India has a low share of MNCs in the domestic market.
- Environmentally friendly fuels: India continues to rely heavily on coal and petroleum products to meet its energy needs.